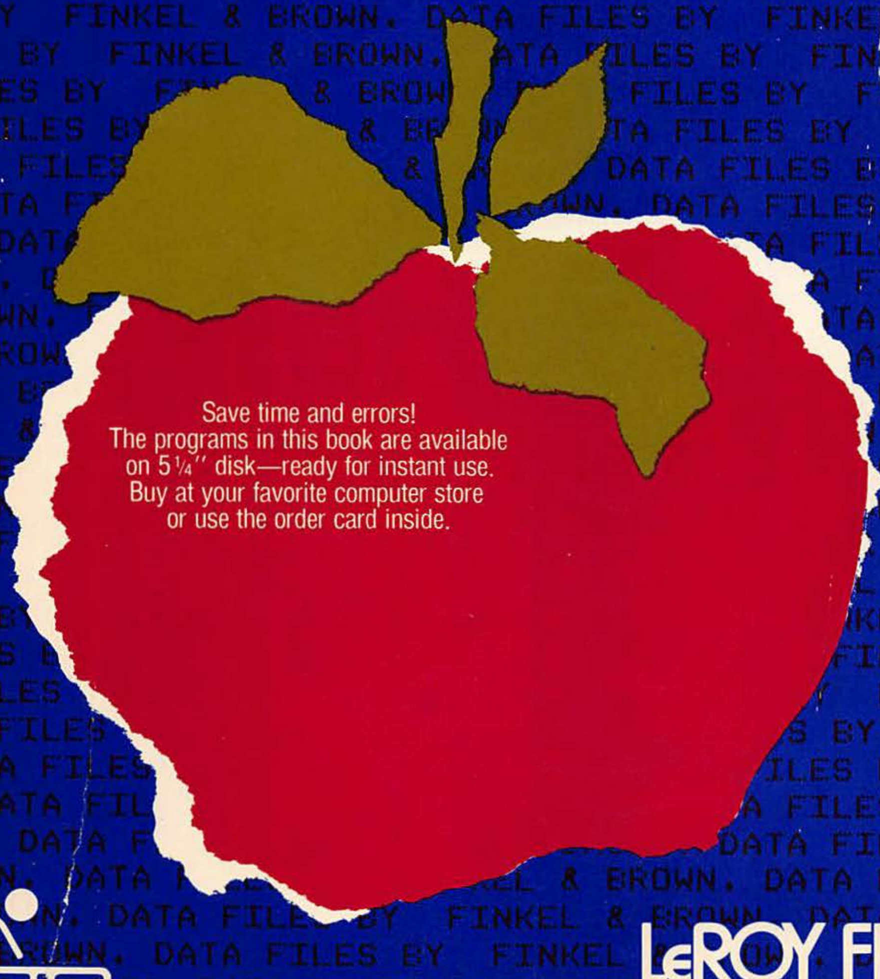
APPLE® BASIC: DATA FILE PROGRAMMING

A SELF-TEACHING GUIDE



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1807 175 YEARS OF PUBLISHING 1982

John Wiley & Sons, Inc.

New York • Chichester • Brisbane • Toronto • Singapore

Publisher: Judy V. Wilson
Editor: Dianne Littwin
Composition and Make-up: Trotta Composition

Library of Congress Cataloging in Publication Data

Finkel, LeRoy.
Apple BASIC, data file programming.

(Wiley self-teaching guides)
Includes index.
1. Basic (Computer-program language) 2. Apple computer–Programming. I. Brown, Jerald, 1940- II. Title. III. Series: Self-teaching guide.
QA76.73.B3F52 001.64'24 81-13100
ISBN 0-471-09157-X

Printed in the United States of America

82 83 10 9 8 7 6 5

How To Use This Book

When you use the self-instruction format in this book, you will be actively involved in learning data file programming in APPLESOFT* BASIC. Most of the material is presented in sections called frames, each of which teaches you something new or provides practice. Each frame also gives you questions to answer or asks you to write a program or program segment.

You will learn best if you actually write out the answers and try the programs on your APPLE II computer (with at least one disk drive). The questions are carefully designed to call your attention to important points in the examples and explanations and to help apply what is being explained or demonstrated.

Each chapter begins with a list of objectives – what you will be able to do after completing that chapter. At the end of each chapter is a self-test to provide valuable practice.

The self-test can be used as a review of the material covered in the chapter. You can test yourself immediately after reading the chapter. Or you can read a chapter, take a break, and save the self-test as a review before you begin the next chapter. At the end of the book is a final self-test to assess your overall understanding of data file programming.

This book is designed to be used with an APPLE computer close at hand. What you learn will be theoretical only until you actually sit down at a computer and apply your knowledge "hands-on." We strongly recommend that you and this book get together with a computer! Learning data file programming in BASIC will be easier and clearer if you have regular access to a computer so you can try the examples and exercises, make your own modifications, and invent programs for your own purposes. You are now ready to teach yourself to use data files in BASIC.

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Preface

This text will teach you to program data files in APPLESOFT BASIC. As a prerequisite to its use, you should have already completed an introductory course or book in BASIC programming and be able to read program listings and write simple programs: This is not a book for the absolute novice in BASIC. You should already be comfortable writing your own programs that use statements including string variables, string functions, and arrays. We do start the book with a review of statements that you already know, though we cover them in more depth and show you new ways to use them.

The book is designed for use by readers who have little or no experience using data files in BASIC (or elsewhere, for that matter). We take you slowly and carefully through experiences that "teach by doing." You will be asked to complete many programs and program segments. By doing so, you will learn the essentials and a lot more. If you already have data file experience, you can use this book to learn about data files in more depth.

The particular data files explained in this text are for APPLESOFT BASIC. Data files in other versions of BASIC will be similar, but not identical, to those taught in this book.* You will find this book most useful when used in conjunction with the reference manual for your computer system.

Data files are used to store quantities of information that you may want to use now and later; for example, mailing addresses, numeric or statistical information, or tax and bookkeeping data. The examples presented in this book will help you use files for home applications, for home business applications, and for your small business or profession. When you have completed this book, you will be able to write your own programs, modify programs purchased from commercial sources, and adapt programs using data files that you find in magazines and other sources.

*For programming data files in TRS-80 BASIC, MICROSOFT BASIC-80, and Northstar BASIC, read our other book, *Data File Programming in BASIC* by Finkel and Brown (John Wiley & Sons, Inc., N.Y., 1981). For programming data files on the IBM PC, read *IBM PC: Data File Programming* by Brown and Finkel (John Wiley & Sons, Inc., N.Y., 1983).

Contents

CHAPTER ONE

Writing BASIC Programs for Clarity, Readability, and Logic

Objectives: When you have completed this chapter you will be able to:

1. describe how a program can be written using a top-to-bottom format.
2. write an introductory module using REMARK statements.
3. describe seven rules to write programs that save memory space.

INTRODUCTION

This text will teach you to use data files in APPLESOFT BASIC. You should have already completed an introductory course or book in BASIC programming, and be able to read program listings and write simple programs. This is not a book for the absolute novice in BASIC, but is for those who have never used data files in BASIC (or elsewhere, for that matter). The particular data files explained in this text are for the APPLE II computer and the BASIC languages found on it.

Data files in other versions of BASIC and for other computers will be similar, but not identical, to those in this book. (If you are using a computer other than the APPLE II, you may want to read *Data Files Programming in BASIC*, or *IBM PC: Data File Programming*, available at your local computer store or bookstore.) You will find this text most useful when used in conjunction with the APPLE II reference manuals and the Disk Operating System (DOS) Manual: It is not a substitute for your careful reading of the APPLE II DOS Manual, though the workings of sequential and random access files are explained here in far more depth and with more examples.

Since it is assumed you have some knowledge of programming in BASIC and have practiced by writing small programs, the next step is for you to begin thinking about program organization and clarity. Because data file programs can become fairly large and complex, the inevitable debugging process – making the program actually work – can be proportionately complex. Therefore, this chapter is important to you because it provides some program organization methods to help make your future programming easier.

THE BASIC LANGUAGE

The computer language called BASIC was developed at Dartmouth College in the early 1960s. It was intended for use by people with little or no previous computer experience who were not necessarily adept at mathematics. The original language syntax included only those functions that a beginner would need. As other colleges, computer manufacturers, and institutions began to adopt BASIC, they added embellishments to meet their own needs. Soon BASIC grew in syntax to what various sources called Extended BASIC, Expanded BASIC, SUPERBASIC, XBASIC, BASIC PLUS, and so on. Finally, in 1978 an industry standard was developed for BASIC, but that standard was for only a "minimal BASIC," as defined by the American National Standards Institute (ANSI). Despite the ANSI standard, today we have a plethora of different BASIC languages, most of which "look alike," but each with its own special characteristics and quirks.

In the microcomputer field, the most widely used versions of BASIC were developed by the Microsoft Company and are generally referred to as MICROSOFT BASICs. These BASICs are available on a variety of microcomputers but, unfortunately, the language is implemented differently on each computer system. The APPLE version of MICROSOFT BASIC is called APPLESOFT.

The programs and runs shown in this text were actually performed on an APPLE II and an APPLE II PLUS computer using Disk Operating System (DOS) 3.3. (They will work in DOS 3.2, as well.) We wrote all of our programs using APPLESOFT BASIC. To use the programs in INTEGER BASIC, you will have to make the usual APPLESOFT to INTEGER modifications described in your reference manual. The file commands described in this text may be used in APPLESOFT or INTEGER BASIC. For INTEGER BASIC you may have to modify the file input and output statements, as described in your DOS Manual.

Where possible, we use BASIC language features that are common to all versions of BASIC, regardless of manufacturer. We do not attempt to show off all of the bells and whistles found in APPLESOFT BASIC, but rather to present easy-to-understand programs that will be readily adaptable to a variety of computers.

THE BASIC LANGUAGE YOU SHOULD USE

Conservative Programming

Since you will now be writing longer and more complex programs, *you should adopt conservative programming techniques so that errors will be easier to isolate and locate.* (Yes, you will still make errors. We all do!) This means that you should NOT use all the fanciest features available in APPLESOFT BASIC until you have tested the features to be sure they work the way you think they work. Even then, you still might decide against using the fancy features, many of which relate to printing or graphic output and do not work the same on other computers. Some are special functions that simply do not exist on other computers. Leave them out of your programs unless you feel you must include them. *The more conservative your programming techniques, the less chance there is of running into a software "glitch."*

This chapter discusses a program format that, in itself, is a conservative programming technique.

One reason for conservative programming is that your programs will be more portable or transportable to other computers. "Why should I care about portability?" you ask. Perhaps the most important reason is that you will want to trade programs with friends. But do all of your friends have a computer IDENTICAL to yours? Unless they do, they will probably be unable to use your programs without modifying them. Conservative programming techniques will minimize the number of changes required.

Portability is also important for your own convenience. The computer you use or own today may not be the one you will use one year from now; you may replace or enhance your system. In order to use today's programs on tomorrow's computer be conservative in your programming.

> Use conservative programming to:
>
> - Isolate and locate errors more easily.
> - Avoid software "glitch."
> - Enhance portability.

WRITING READABLE PROGRAMS

Look at the sample programs throughout this book and you will see that they are easy to read and understand because the programs and the individual statements are written in simple, straight-line BASIC code without fancy methodology or language syntax. It is as if the statements are written with the READER rather than the computer in mind.

Writing readable BASIC programs requires thinking ahead, planning your program in a logical flow, and using a few special formats that make the program listing easier to the eye. If you plan to program for a living, you may find yourself bound by your employer's programming style. However, if you program for pleasure, adding readable style to your programs will make them that much easier to debug or change later, not to mention the pride inherent in trading a clean, readable program to someone else.

A readable programming style provides its own documentation. Such self-documentation is not only pleasing to the eye, it provides the reader/user with sufficient information to understand exactly how the program works. This style is not as precise as "structured programming," though we have borrowed features usually promoted by structured programming enthusiasts. *Our format organizes programs in MODULES, each module containing one major function or program activity.* We also include techniques long accepted as good programming, but for some reason forgotten in recent years. Most of our suggestions do NOT save memory space or speed up the program run. Rather, readability is our primary concern, at the expense of memory space. Later in this chapter, we will present some procedures to shorten and speed up your programs. Modular style programs will usually be better running programs and will effectively communicate your thought processes to a reader.

THE TOP-TO-BOTTOM ORGANIZATION

When planning your program, think in terms of major program functions. These might include some or all of the functions from this list:

DATA ENTRY DATA ANALYSIS COMPUTATION FILE UPDATE EDITING REPORT GENERATION

Using our modular process, divide your program into modules, each containing one of these functions. Your program should flow from module one to module two and continue to the next higher numbered module. *This "top-to-bottom organization" makes your program easy to follow.* Program modules might be broken up into smaller "blocks," each containing one procedure or computation. The size or scope of a program block within a module is determined by the programmer and the task to be accomplished. Block style will vary from person to person, and perhaps from program to program.

USE A MODULAR FORMAT AND TOP-TO-BOTTOM APPROACH

REMARK Statements

Separate program modules and blocks from each other using REMARK statements or nearly blank program lines. In general, programs designed for readability make liberal use of REMARK statements, but don't be overzealous. A nearly blank program line can be created by typing a line number followed by a colon (150:). A line number followed by REM (150 REM) can also be used.

```
100  REM     DATA ENTRY MODULE
110  REM  **** READ DATA FROM DATA STATEMENTS 9000-9090
120
130  REM
200  REM     COMPUTATION MODULE
210  REM ARK
```

(Note: Your Apple computer will split the word REMARK into two words, as shown in line 210. Because this looks awkward, we encourage use of the word REM in place of the complete word.)

Begin each program module, block, or subroutine with an explanatory REM statement (line 100 and 110) and end it with a nearly blank line (line 120) or blank REM statement (line 130) indicating the end of the section.

Consistency in your use of REMs enhances readability. Use either REM or the nearly blank line with a colon, but be consistent. Some writers use the asterisks (****) shown in line 110 to set off REM statements containing actual remarks from blank REM statements; others use spaces four to six places after the REM before they add a comment (line 200). Both formats effectively separate REM statements from BASIC code.

You can place remarks on the same line as BASIC code using multiple statement lines, but be sure your REM is the LAST statement on the line. Such "on-line" remarks can be used to explain what a particular statement is doing. A common practice is to leave considerable space between an on-line remark and the BASIC code, as shown below.

```
220  LET C(X) = C(X) + U: REM ***COUNT UNITS IN C ARRAY
240  LET T(X) = T(X) + C(X): REM ***INCREASE TOTALS ARRAY
```

Using REMs to explain what the program is doing is desirable, but don't overuse it. (LET C = A + B does not require a REM or explanation!) REM should add information, not merely state an obvious step.

Like everything else said in these first chapters, there will be exceptions to what we say here. Keep in mind that we are trying to get you to think through your programming techniques and formats a little more than you are probably accustomed to doing. Thus, our suggested "rules" are just that – suggestions to which there will be exceptions.

GOTO STATEMENTS

Perhaps the most controversial statement in the BASIC language is the unconditional GOTO statement. Its use and abuse causes more controversy than any other statement. Purists say you would NEVER use an unconditional GOTO statement such as GOTO 100. A more realistic approach suggests that all GOTOs and GOSUBs go DOWN the page to a line number larger than the line number where the GOTO or GOSUB appears. This is consistent with the "top-to-bottom" program organization. This same approach–down the page–also applies to using IF. . .THEN statements (there will be obvious exceptions to this rule).

```
140  GOTO 210
150  IF X < Y THEN 800
160  GOSUB 8000
```

A final suggestion: A GOTO, GOSUB, or IF. . .THEN should not go to a statement containing *only* a REM. If you or the next user of your program run short of memory space you will delete extra REM statements. This, in turn, requires you to change all of your GOTO line numbers, so plan ahead first. Some BASICs do not even allow a program to branch to a statement starting with REM.

Bad	Good
`150 GOTO 300`	`150 GOTO 300`
`300 REM DATA ENTRY` `310 INPUT "ENTER NAME:";N$`	`299 REM DATA ENTRY` `300 INPUT "ENTER NAME:";N$`

A FORMAT FOR THE INTRODUCTORY MODULE

The first module of BASIC code (lines 100 through 199 or 1000 through 1999) should contain a brief description of the program, user instructions when needed, a list of all variables used, and the initialization of constants, variables, and arrays.

The very first program statement should be a REM statement containing the program name. Carefully choose a name that tells the reader what the program does, not just a randomly selected name. After the program's name comes the author's or programmer's name and the date. For the benefit of someone else who may like to use your program, include a REM describing the computer system and/or software system used when writing the program. Whenever the program is altered or updated, the opening remarks should reflect the change.

```
100  REM    PAYROLL SUBSYSTEM
110  REM    COPYRIGHT CONSUMER PROGRAMMING CORP. 9/82
120  REM
130  REM    HP 2000 BASIC
140  REM    MODIFIED FOR APPLESOFT BASIC BY J. BROWN
150  REM    ON APPLE II, 48K
```

Follow these remarks with a brief explanation of what the program does, contained either in REM statements or in PRINT statements. Next add user instructions. For some programs you might offer the user the choice of having instructions printed or not. If instructions are long, place the request for instructions in the introductory module and the actual printed instructions in a subroutine toward the end of your program. That way, the long instructions will not be listed each time you LIST your program.

```
170  REM    THIS PROGRAM WILL COMPUTE PAY AND PRODUCE PRINTED PAYROLL
180  REM    REGISTER USING DATA ENTERED BY OPERATOR
190  REM
200  INPUT "DO YOU NEED INSTRUCTIONS?";R$
210  IF R$ = "YES" THEN  GOSUB 800
220  REM
```

Follow the description/instructions with a series of statements to identify the variables, string variables, arrays, constants, and files used in the program. Again, these statements communicate information to a READER, making it that much easier for you or someone else to modify the program later. We usually complete this section AFTER we have completed the program so we don't forget to include anything.

Assign a variable name to all "constants" used. Even though a constant will not change during the run of the program, a constant may change values between runs. By assigning it a variable name, you make it that much easier to change the value;

that is, by merely changing one statement in the program. It is a good idea to jot down notes while writing the program so important details do not slip your mind or escape notice. When the program has been written and tested (debugged), go back through it, bring your notes up-to-date, and polish the descriptions in the REMs.

```
220  REM   VARIABLES USED
230  REM      G=GROSS PAY
240  REM      N=NET PAY
250  REM      T1=FEDERAL INCOME TAX
260  REM      T2=STATE INCOME TAX
270  REM      F=SOC.SEC.TAX
280  REM      D=DISABILITY (SDI) TAX
290  REM      X,Y,Z=FOR-NEXT LOOP CONTROL VARIABLE
300  REM      H(X)=HOURS ARRAY
310  REM      N$=EMPLOYEE NAME (20 CHAR)
320  REM      PN$=EMPLOYEE NO. (5 CHAR)
330  REM
340  REM   CONSTANTS
350  LET FR = .0613: REM    SOC.SEC. RATE
360  LET DR = .01: REM    SDI RATE
370  REM
380  REM     FILES USED
390  REM       ITM=FEDL. TAX MASTER FILE
400  REM       STM=STATE TAX MASTER FILE
410  REM
```

(Notice the method used to indicate string length in lines 310 and 320.)
(Notice the use of on-line remarks in lines 350 and 360.)

The final part of the introductory module is the initialization section. In this section, dimension the size of all single and double arrays and all string arrays, even though DIMENSION is not required by your computer. This is valuable information for a reader. Any variables that need to be initialized to zero should be done here for clear communication, even though your computer initializes all variables to zero automatically. This section also includes any user-defined functions *before* they are used in the program.

```
410  REM    INITIALIZE
420  :
430  DIM H(7),R(10,13),N$(30)
440  :
450  REM
```

THE MODULES THAT FOLLOW THE INTRODUCTION

The remainder of your program consists of major function modules and subroutines (and DATA statements, when they are used). Remember to separate each module from others by a blank line REM statement and a remark identifying the module. These modules can be further divided into user-defined program blocks, each separated by a blank line REM statement.

A typical second module would be for data entry. Data can be operator-entered from the keyboard or entered directly from DATA statements, a file, or some other device. Chapter 3 discusses in detail how to write data entry routines with extensive error-checking procedures to ensure the accuracy and integrity of each data item entering the computer.

For now, we suggest that you write data entry routines so that even a completely inexperienced operator would have no trouble entering data to your program. This means the operator should ALWAYS be prompted as to what to enter and provided with an example when necessary.

```
240 INPUT "ENTER TODAY'S DATE (MM/DD/YY)";D$
```

If data are entered from DATA statements, place the DATA statements near the end of your program (some suggest even past the END statement) using REM statements to clearly identify the type of data and the order of placement of items within the DATA statements.

```
9400  REM   DATA FOR CORRECT ANSWER ARRAY IN QUESTION NUMBER ORDER.
9410  REM   10 ANSWERS, MULT.CHOICE 1-5
9420  :
9430  DATA  4,5,1,3,2,1,1,4,4,5
9440  :
9450  REM   RESPONDENTS ANSWERS TO QUIZ
9460  REM   DATA STATEMENT FORMAT:
9470  REM   RESP. ID # FOLLOWED BY 10 RESPONSES TO QUIZ QUESTIONS
9480  :
9490  DATA  17642, 4,5,1,3,2,2,1,4,4,4
9500  DATA  98126, 3,5,2,3,2,1,5,4,5,2
9560  :
```

You can think of DATA statements as comprising a separate program module. The "inbetween" program modules might do computations, data handling, file reading and writing, and report writing. Modular programming style dictates that all printing and report generation, except error messages, be done in one program module labeled as such. This limits the use of PRINT statements to one easy-to-find location within your program. (There might be more than one print module.) This makes it that much easier for you to make subsequent changes on reports when paper forms change or new reports are designed. In the print module your program should NOT perform any computations except trivial ones. Make important computations BEFORE the program executes the print module(s). This may require greater use of variables and/or arrays to "hold" data pending report printing, but your programs will be much cleaner and easier to debug, since everything will be easy to find in its own "right" place.

SUBROUTINES

Program control flows smoothly from one module to the next. A well-designed module has *one* entry point at its beginning and *one* exit point at its end. The exception to this is a mid-module exit to a subroutine:

```
290 :
300  REM    COMPUTATION MODULE
310 :
320  LET T = (V * X) / Q
330  LET T9 = T9 + T
340  GOSUB 800
350 :
360  REM    REPORT PRINTING MODULE
370 :
```

A subroutine exit from a module always RETURNs to the next statement in the module. The use of subroutines is desirable provided you don't overdo it. Some program stylists recommend that the entire main program consist of nothing but GOSUB statements "calling up" a series of subroutines located later in the program. Such a technique is probably guilty of overkill. Strive for a happy medium between the two extremes of no subroutines and nothing but subroutines.

Technically, you need use a subroutine only to avoid duplicating the same program statements in two or more places in your program. A subroutine should be called from MORE than one place in your program. Otherwise, why use a formal subroutine? Program stylists now agree that subroutines enhance readability and clarity and can be used at the convenience of the programmer (you!). However, again the caution – don't overdo it. Use subroutines to enhance the flow and readability of your program. Stylists also agree that subroutines should be clearly identified using REM statements and set off from other program sections with blank REM statements. Program stylists disagree, however, on where to place the subroutines. There are two schools of thought. Placement of subroutines can be either immediately past the end of the module that calls the subroutine or in one common module toward the end of the program.

EITHER

```
300  REM     COMPUTATION MODULE
310  :
320  :
330  GOSUB 410
340  GOSUB 460
     :
     :
     :
400  REM     NUMBER CONVERSION SUBROUTINE
410  :
     :
     :
450  REM     COMPUTATION SUBROUTINE
460  :
     :
```

OR

```
330  GOSUB 810
340  GOSUB 910
     :
     :
     :
800  REM     NUMBER CONVERSION SUBROUTINE
810  :
     :
     :
900  REM     COMPUTATION SUBROUTINE
910  :
     :
     :
```

JUST FOR LOOKS

You can do a host of things to your programs to enhance looks and clarity. These techniques are generally called "prettyprinting." Your Apple computer automatically performs many "prettyprinting" activities. All statement lines are evenly spaced. Extra spaces are added to BASIC statements to enhance readability of your program, even if you type the statements with no spaces at all. In fact, extra spaces that you typed accidentally—or on purpose—may be deleted automatically by your Apple computer.

Spacing

One way to make your programs look nice is to use line numbers of equal length throughout the program. If your program is small, use line numbers 100 through 999. If long, start the program at 1000 and continue to 9999. When your program is listed, it will be aligned neatly. It also improves the appearance if the entire program is incremented by steps of ten. Without a resequence command this is virtually impossible to do. A partial solution is to enter statements in sequence increments of ten when you first enter your program. When you have completed the program, even with changes, MOST of the program will still be in increments of ten. Learn how to use the RENUMBER program that is provided on your Apple System Master diskette. The RENUMBER INSTRUCTION PROGRAM will teach you how to renumber programs and program parts in "prettyprinting."

Other Techniques To Enhance Looks and Readability

You can do still more to make your program clearer to you and another reader. These few ideas are the "finishing touches."

Using the LET statement, even when unnecessary, enhances readability. The absence of LET can be confusing, especially in a multiple-statement line.

CONFUSING

```
260 X = Y:C = X * Y: IF X = N THEN X = C
```

BETTER

```
140  LET X = 0:Y = 0:C = 0
```

BEST

```
260  LET X = Y: LET C = X * Y: IF N = X THEN  LET X = C
```

Arrange BASIC statements so that they read smoothly from left to right, just as the readers' eyes flow across the paper. This includes placing A before B and 1 before 2. Some stylists recommend that in IF. . .THEN statements, you place the least varying variable last, as shown in lines 270 and 300 below.

```
150   READ A,B,C
       :
       :
       :
260   FOR X = 1 TO 8
270   IF M(X) <  > N THEN 290
280   LET M(X) = N
290   NEXT X
300   IF D$ = "STOP" THEN 999
```

If your typed statement is long, it is probably confusing, especially if it is a mathematical equation. Break it into two or more pieces so it is easy to read. Read the statements aloud to test their readability.

CONFUSING

```
250  LET T = (N * 3.75) + ((N - 40) * 3.25) + ((N - 60) / 3) / ((D * N) * A)
```

CLEARER

```
250  LET T = (N * 3.75) + ((N - 40) * 3.25)
260  LET T = T + ((N - 60) / 3) / ((D * N) * A)
```

UNDOING IT ALL TO SAVE SPACE AND SPEED UP RUN TIME

After reading all these rules and ways to enhance readability, you are probably wondering how you will remember them all. Chances are you won't, but we hope we have at least sensitized you to the need for writing clear, readable programs. You will adopt your own typing style based on some of these techniques, plus others that you devise for convenience.

Nearly every technique illustrated in this chapter uses what some would consider to be unnecessary memory space. You may in fact find that your computer memory is filled before you have completely entered your program. When this happens, either rethink your entire problem-solving technique or look for ways to save memory space by making changes to your program. A well-written, readable program takes up more memory space than a poorly written, less readable program. Thus, to save memory space, you may have to undo some of the things you did to enhance readability.

To save large numbers of memory "bytes:"

1. Use multiple statements per line.
2. Delete all REM statements beginning with the introductory module.

For further space saving:

1. Use one-letter variable names.
2. Delete unnecessary parentheses.
3. Reuse variables when possible (normally a terrible technique).
4. Dimension arrays sparingly.
5. Use GOTO, not GOSUB, for a routine accessed from only one place in a program.

If you are concerned about the speed of your program run, you can use some techniques to shave microseconds, even seconds, off the run time. Some of these overlap with the space-saving techniques.

1. Delete all REMs and/or move the introductory module to the end.
2. Use multi-statement lines.
3. Use variables rather than constants (as recommended earlier).
4. Define the most commonly used variables first.
5. Place subroutines before the main program.
6. Use FOR NEXT loops whenever possible.
7. Remove extra parentheses.
8. Limit the use of GOSUBs.

Remember, these techniques may speed up your run, but they are generally considered to be bad programming techniques and contrary to nearly everything said in this chapter.

To save space and lessen distraction we have not followed ALL the rules suggested in this chapter in the rest of this book. However, you will still find our programs easy to read and self-documenting.

CHAPTER 1 SELF-TEST

1. Will a useful program written in BASIC on one computer system also RUN on a different brand of computer that uses BASIC? Why or why not?

____

____

____

2. How can you be most certain that a program you write will also run on another person's computer?

____

____

____

3. What is meant by the portability of a computer program?

____

____

____

4. Name at least three types of information to include in REM statements in a program's introductory module.

5. Describe the "top-to-bottom format" for organizing programs.

6. When branching statements such as GOTO and GOSUB are used, what statements should not be branched to and why?

7. Define "initializing."

8. What is the most important reason for designating a segment of a program as a subroutine accessed by GOSUB?

9. When writing a self-documenting, easy to read program, what sacrifices are made?

10. In a multiple statement line with three statements, the first being a REM statement, how many statements will be executed?

Answer Key

1. The program might not run on a different brand of computer, because different computers use different versions of BASIC.

2. Use conservative programming techniques and the least fancy statements in your version of BASIC.

3. Portability means that the program is likely to run on many computers with few or no modifications.

4. Variables used and what they stand for, files used, descriptive name for program, description of program if necessary, author of program, last revision of program, version of BASIC and/or system used. (any three answers)

5. To the extent possible, the program is written so that it begins execution at the smallest line number and procedes toward the largest, with a minimum of confusing branching within the program.

6. REM statements, in case they are removed from a program to save computer memory space.

7. The first time in a program that value(s) are assigned to variables or elements in an array (often means assignment of zeros); DIMENSIONING where needed.

8. The segment would otherwise have to be repeated because it is used more than once in executing the program.

9. Amount of memory used and possibly speed of program execution.

10. None. The computer goes on to the next line numbered statement if it sees that the first statement in the line is a REM.

CHAPTER TWO

An Important Review of BASIC Statements

Objectives: To review important aspects of BASIC. When you finish this chapter, you will be able to write BASIC statements using: LET, READ, DATA, INPUT, IF. . .THEN, FOR NEXT. GOSUB, RETURN, ON. . .GOTO, LEN, ASC, MID$, LEFT$, RIGHT$, and ONERR. .GOTO.

INTRODUCTION

We assume you have used BASIC to write programs and that you can read and understand a listing of a BASIC program (are you BASICly literate?); this information serves as a review. Many of the programming techniques in this and the next chapter will be used over and over again in programming data files. Even masters at programming in BASIC should give the material a quick run through. This is important information and skill to have under your belt so that you can give your fullest attention to learning file-handling BASIC statements and techniques in Chapter 4.

VARIABLE NAMES

In early versions of BASIC, the names you could choose for a variable were limited to one letter, or one letter and one number only. A, A1, Z7, ZØ, B$, and B1$ were all acceptable variable names: while AA, A25, SALARY, or NAME$ were unacceptable to the computer. In contrast, APPLESOFT BASIC and other new dialects of BASIC permit the use of multi-letter variable names. The unacceptable variable names mentiones above are all acceptable in APPLESOFT BASIC, as are NETPAY, GUESS, OLDNAME$, and many others you may think of. The temptation to use long variable names may be overwhelming, but beware! APPLESOFT *BASIC recognizes and identifies the variable using only the first two letters of the variable name.* Thus, the variables SALES and SALARY are not really two variables, but rather *one* – SA. PAYMENT and PAYROLL are also really the same variable – PA – in APPLESOFT BASIC. Be extremely cautious selecting variable names to avoid unusual errors that are hard to detect. Also note that longer variable names take up more computer memory space, which may become a problem as the programs you write become longer and more complex.

Another limitation when using long variable names is that you cannot use a combination of letters that are also used for a BASIC statement, command, or function. A Reserved Word List in your reference manual tells you which words cannot be a part of a long variable name. Examples are:

FOR, DATA, NOT, LIST, PRINT, DIM, IF, THEN

Use of simple variable names (A, T1, Y$) precludes having to debug a program when the problem is a reserved word accidentally used (embedded) in a long variable name. Notice in our examples, that even with simple variables we have selected names that are more likely to be remembered and make sense to someone reading the program. We encourage you to do the same. Use T for total, T9 for grand total, S for salary, N$ for name, etc.

The letters O and I are poor variable names since they are easily confused with the number Ø (zero), the number 1 (one), or the lower case letter l (el). Some experienced programmers reserve a few variables and use them the same way in all programs they write. X, Y, and Z are popular as control variables in FOR NEXT loops. K and C are popular for counting in statements like LET C = C + 1.

Variables, also called variable names or labels, identify for the computer a particular place in its memory where information is stored. The information may be numeric (a value) or alphanumeric (a string, discussed more fully later). A value or string is first stored by an assignment statement (LET, READ, INPUT), and subsequent references to the variable tell the computer to use the value or string assigned to (and identified by) that variable. Assignment statements are included in this review of BASIC.

(a) Give two reasons for using simple variable names such as A, X3, and Y$.

____

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____

____

____

____

____

____

(a) 1. Conserves computer memory space.
2. No reserved words are accidentally embedded in the variable.
3. Portability of programs between different versions of BASIC.
(any two answers)

String Variables

The rules for constructing names for string variables are the same as for numeric variables, except that a string variable always has a dollar sign ($) as its last character. A is a numeric variable, whereas A$ is a string variable. A string is one or more letters, symbols, or numbers that can be used as information in a BASIC program. Strings are stored in the computer's memory with an assignment statement such as LET B$ = "EXAMPLE OF A STRING." The string variable B$ acts as a label in the computer's memory for the place where the string assigned to B$ is stored. A reference to B$ elsewhere in the program automatically tells the computer to use the string assigned to B$. The string assigned to a string variable is often referred to as the "value" of the string variable.

String variables act much like numeric variables and can generally be manipulated just like numeric variables. The crucial difference is that you cannot use string variables in arithmetic expressions and calculations, even if numeric information is assigned to the string variable. For example, LET F$ = "8.99" does not let you use F$ in numeric calculations, even though the string is comprised of numbers.

String variables and the strings assigned to them take up space in your computer's memory. You can visualize this as a box or compartment that contains alphanumeric information identified by a string variable. For example, the assignment statement LET N$ = "ALPHA PRODUCTS COMPANY" can be thought of as creating a storage compartment in the computer's memory like this:

N$	ALPHA PRODUCTS COMPANY

the string variable — the string

Remember that a string assigned to a string variable in this way has the string enclosed in **quotation marks.** Only the information between the quotation marks comprises the string; the quotes themselves are not part of the string.

Many, if not most, business and personal applications of data files make much greater use of alphanumeric data (strings) than numeric data (numbers or values), so we are taking this opportunity to reinforce and extend your understanding of the use of string variables. Notice the word "alphanumeric." This term comes from the data processing industry and refers to data that may consist of alphabetic characters, numeric characters, and/or special characters. For example, the product identification number FC1372 appearing in a catalog is alphanumeric data consisting of two alphabetic characters followed by four numeric characters. An address or hyphenated phone number is also alphanumeric data. To use and store such information in BASIC, assign it to a string variable (LET P$ = "FC1372") because a simple numeric variable would not accept the two alphabetic characters. If an identification number is mostly numeric, but includes a hyphen, asterisk, or even a space (e.g., 84992*, where the "*" denotes a special location, price, etc.), then it too requires the use of a string variable.

One string variable can have from zero to 255 characters, including all spaces, punctuation, and special characters. A string with no characters (zero characters) is called a *null string* or empty string. An assignment statement for a null string would be: `10 LET Z$ = ""`. (There is no space between the two sets of quotation marks.)

There is a crucial difference between the *maximum* length of a string (255 characters) and its *actual* length. The actual length is the number of alphanumeric characters presently assigned to the string variable and stored in the computer's memory. Remember, spaces count as characters. Consider the lengths of the following strings assigned to string variables.

N$	ALPHA PRODUCTS

Actual length: Fourteen characters

C$	MENLO PARK, CA. 94025

Actual length: Twenty-one characters (includes comma, period, and spaces)

Now you do this one:

A$	161 DAWN ST. SUITE 3

(a) What is the maximum length for a string assigned to A$?

____

(b) What is the actual length of the string shown as assigned to A$ above?

____

— — — — — — — — — — — — — — —

(a) 255 characters
(b) Twenty characters

Since APPLE SOFT BASIC automatically assumes that a string variable can be assigned a string with up to 255 characters, there is no need to DIMENSION string variables. However, we recommend that you show a person using your program what the string size (maximum *actual* size) is for all string variables listed in the program. Do this by including REM statements in the introductory module, as shown:

```
140  REM    STRING VARIABLES
150  REM      N$=CUSTOMER NAME(20)
160  REM      A$=CUST.STREET ADDRESS(25)
170  REM      C$=CUST.CITY(15),STATE(2),ZIP(5)
180  REM      C$ HAS 26 CHAR. TOTAL INCLUDING SPACES
190  :
```

(a) How many characters are contained in a null string assigned to a string variable?

____

(b) In the actual length of a string, how many characters does a space use?

____

(a) zero (none)
(b) one

As noted earlier, you can *assign a string to a string variable using the LET statement.* Remember to place the string inside quotation marks, or the computer will reject the statement; it will tell you that an error has been made. Example:

```
240  LET N$ = "TYPE A POSITIVE"
```

Almost all versions of BASIC allow omitting the word LET from an assignment statement. For this reason, LET statements are sometimes called *direct assignment statements* to distinguish them from INPUT and READ assignment statements. A variable (numeric or string) followed by an equal sign (=) implies LET to BASIC; thus, the "implied LET" direct assignment statement can save a bit of typing and a little memory space. We generally include LET for clarity in reading a program listing. This statement:

```
240 N$ = "TYPE A POSITIVE"
```

means the same in BASIC as the example before this paragraph.

READ-DATA ASSIGNMENT STATEMENTS

DATA statements are like data files in that they hold data to be assigned to variables and are then used in a program. The difference is that a DATA statement holds data that can be used only by the program in which the DATA statement appears, whereas a data file can be created and the data used by a variety of different programs, since it is separate from the program itself. This will be explained in greater detail later.

The READ statement, which must have one or more DATA statements in the same program to READ from, is an assignment statement. One or more data items from a DATA statement are assigned to one or more variables by a READ statement.

```
10  READ A
20  DATA  15, 76.5, 1892, -999
```

The statement READ A assigns a numeric value from the DATA statement to variable A.

```
10  READ A,B
20  DATA  15, 76.5, 1892, -999
```

The statement READ A, B assigns two consecutive values from the DATA statement; the first to variable A, the second tó B.

A program can also use the READ and DATA statements to assign strings to string variables. A DATA statement can contain strings as data items, and these strings are assigned to string variables by a READ statement using the same procedure as for reading numeric values.

```
220  READ A$,B$,C$
      :
      :
910  DATA  BLUE, GREEN, GOLD
```

In APPLESOFT BASIC, the individual string items in the DATA statement do not have to be enclosed in quotation marks *unless* the string data idem includes a comma, semicolon, or one or more leading spaces (blank spaces that are to be included and considered part of the string). In the latter cases, enclose the string data item in quotation marks, just as for a LET direct assignment statement. Any trailing spaces left between a string data item and the comma separating it from the next item in the same data statement are accepted as part of the string and duly assigned to the string variable. Note that the actual length of such a data item includes these trailing spaces, even though they seem invisible.

In the following example, quotation marks are necessary around each data item because a comma is part of the string data items themselves.

```
220  READ N$
      :
      :
910  DATA  "BROWN, JERALD R.", "FINKEL, LEROY P."
```

Try this test program to see how the "trailing space" rule works on your APPLE.

```
220  READ N$,A$
230  PRINT N$;A$
910  DATA  TEST     ,     ITEMS


]RUN
TEST    ITEMS
```

There should be only three spaces between the words TEST and ITEMS because the leading spaces before items are not included, while the trailing spaces after TEST and before the comma are included. Now change line 910 as shown below and RUN the program segment again.

```
910  DATA  "TEST    ","    ITEMS"
```

(a) How many spaces should now appear between the strings when the program is RUN? ____________________

(a) six spaces

The computer uses an internal "pointer" system to keep track of items in a DATA statement that are "used up" or already assigned to variables in a program RUN. When executing READ-DATA statements, each time a data item is read and assigned to a variable the internal pointer advances one position in the DATA statement to the next data item. If the pointer is pointed at alphanumeric data (a string) and the READ statement is looking for numeric information to assign to a numeric variable, the program will terminate in an error condition. For example:

```
210  READ A
910  DATA  ALPHA,NUMERIC
```

An error condition would result from executing this program segment because the statement READ A is "looking" for numeric data to assign to the numeric variable A, but the pointer is pointing at alphanumeric information.

What will happen if this program is RUN?

```
210  READ A$,B$
220  PRINT A$;B$
910  DATA  17926, NUMERIC
```

(a) Will the program RUN without an error condition? ____________

(b) What will be assigned to A$ and why? ____________________

____

(a) Yes
(b) A$ = 17926, since a number can be assigned as a string to a string variable (but not vice versa)

UNDERSTANDING INPUT, AN IMPORTANT ASSIGNMENT STATEMENT

You can enter numeric or alphanumeric information to be assigned to a numeric variable or a string variable using the INPUT statement. When using INPUT statements, make certain that the data entry person using your program at a computer terminal knows exactly what kind of information to enter for assignment to a variable by the INPUT statement. To do so, *you* must fully understand how INPUT works in APPLESOFT.

The INPUT statement should always include a prompting string (a message that appears on the printer or display screen) to tell the user exactly what sort of information is to be entered. A typical format for an INPUT statement is:

```
160  INPUT "ENTER YOUR NAME, FIRST NAME THEN LAST:";N$
```

An INPUT statement without a prompting message (the part enclosed by quotes) causes the computer to print or display a question mark; the computer then waits for a response from the keyboard. There is nothing more frustrating to a computer user than an INPUT question mark with no hint as to what sort of response is requested. *Always use a prompting string in an INPUT statement.* If necessary, use PRINT statements preceding the INPUT statement to explain to the user what information to enter.

Another source of user frustration is the funny responses the computer can make when incorrect data are entered. Consider the following example:

```
360  INPUT "ENTER PRODUCT NUMBER AND QUANTITY:";N,Q
```

```
]RUN
ENTER PRODUCT NUMBER AND QUANTITY:137
??
```

The user entered the number 137 after the prompting message and then pressed the RETURN key. The computer responded with a double question mark (??), indicating that more data were expected. Notice that the INPUT statement had two variables to assign values to but only one value (137) was entered. An inexperienced user would not know that.

RUN the same program segment again and enter three items of data.

```
]RUN
ENTER PRODUCT NUMBER AND QUANTITY:137,12,164
?EXTRA IGNORED
```

This general error message doesn't provide any help to the user since it doesn't pinpoint the problem. To make matters worse, the computer may accept incorrect data and assign it to the INPUT variables! Consider this example!

```
110  INPUT "ENTER TWO VALUES:";A,B
120  PRINT A,B

]RUN
ENTER TWO VALUES:3
??
?REENTER
ENTER TWO VALUES:
?REENTER
ENTER TWO VALUES:
```

USER ENTERS ONE VALUE ONLY AND PRESSES RETURN.
USER ENTERS NO VALUE AND PRESSES RETURN.
IT'S BACK LOOKING FOR A VALUE FOR 'A' AGAIN!

The same error conditions and input problems can occur in string data with an additional peculiarity. Consider the following program segment:

```
180  INPUT "ENTER CUSTOMER NUMBER AND NAME:";C,N$
190  PRINT C,N$

]RUN
ENTER CUSTOMER NUMBER AND NAME:13726
??
13726
```

Here the user entered the customer number (13726) and pressed RETURN, and the number was duly assigned to variable C. But when the ?? appeared, indicating that the computer expected yet another entry, the user pressed the RETURN key again without making another entry. While the computer wanted a second entry to assign to N$, it accepted "nothing" as an entry; that is, it accepted a null string and assigned it to N$. If we changed the INPUT variables to C$ and N$ (instead of C and N$), the computer would accept null strings for assignment to both string variables. In that case, the computer interprets two presses on the RETURN key as meaning that it should assign null strings to both variables.

Our insistence on the importance of understanding INPUT should now be hitting home. So what do you do for the accidental null string entry and the other eccentricities of the INPUT statement.

Two programming techniques can help eliminate errors. First, ask the user to enter only *one* value or string per INPUT statement, period! This makes data entry (and data checking, as we will discuss in the next chapter) nice and clean. For example:

```
RUN
ENTER CUSTOMER NUMBER:137
ENTER CUSTOMER NAME:BISHOP BROTHERS
ENTER PRODUCT NUMBER:18625
ENTER QUANTITY ORDERED:106
```

Second, to have *all* input entries, whether string or numeric, assigned to string variables. This eliminates error messages for numeric variables that cannot accept alphanumeric information for assignment. In the next chapter you will learn to test for null strings (no entry made) and appropriately advise the user with explicit messages as to the proper entry to be made. Numbers (numeric values) assigned to string variables can be converted from strings to numeric values for arithmetic operations using the VAL function. If Q$ = 106 (a string), then VAL(Q$) converts 106 to a numeric value that can be assigned to a numeric variable and/or used directly as a numeric value in a BASIC expression. VAL is discussed in the next chapter.

(a) Write an INPUT statement that will result in the following RUN:

```
RUN
ENTER YOUR HOME ADDRESS:
```

____

____

____

- - - - - - - - - - - - - - - -

(a) `100 INPUT "ENTER YOUR HOME ADDRESS:";A$` (Your line number and string variable may be different.)

CONCATENATION

Strings can be joined to form longer strings; a process called *concatenation*. Strings are concatenated in BASIC using the plus (+) sign. The process, however, is one of joining, not of arithmetic addition. For example, the strings assigned to F$ and L$ can be concatenated and the new, longer string assigned to another variable N$ in an assignment statement like this:

```
110 LET N$ = F$ + L$
```

Strings assigned to variables can be concatenated with string constants, like this:

```
120 LET G$ = N$ + "CUSTOMER"
```

or

```
150  LET N$ = F$ + " " + L$
```

The statement above concatenates the strings associated with F$ and L$ and assigns them to N$, but it also places a space in the new N$ string between the parts of N$ that were assigned to F$ and L$. Look at the following program and show what will be printed when it is RUN.

(a)
```
10  LET F$ = "JANET"
20  LET L$ = "BARRINGTON"
30  LET N$ = F$ + " " + L$
40  PRINT N$

RUN
```

____

(a)
```
JANET BARRINGTON
```

IF. . .THEN STATEMENTS

The IF. . .THEN statement in BASIC gives the language real power. Its syntax varies from one BASIC system to another. Some BASICs permit only a GOTO statement to follow an IF. . .THEN expression.

```
140  IF X < Y THEN  GOTO 800
```

However, the GOTO can be, and usually is, omitted. The simplest form of IF. . .THEN is a COMPARISON between two numeric values or expressions. IF the comparison is true, THEN (GOTO) a given line number and continue executing the program with the statement at that line number. Since GOTO is usually omitted, just the line number follows THEN. The possible comparisons are:

=	equals
<	less than
>	greater than
< =	less than or equal to
> =	greater than or equal to
< >	not equal to

APPLESOFT BASIC also includes in the IF. . .THEN family of statements:

IF. . .THEN LET. . .	(Follow rules for regular LET statements. LET can be omitted.)
IF. . .THEN GOSUB. . .	(Line number follows GOSUB.)
IF. . .THEN RETURN. . .	(Unusual, but possible.)
IF. . .THEN PRINT. . .	(Follow all the rules for regular PRINT statements.)
IF. . .THEN INPUT. . .	
IF. . .THEN READ. . .	(These two are possible, but are not recommended because of confusion and debugging complications.)
IF. . .THEN STOP. . .	
IF. . .THEN END. . .	
IF. . .THEN IF...THEN...	(Possible, but confusing and unnecessary.)

(a) What statement is implied after the THEN in the simplest form of the IF. . .THEN statement? ______________

(b) List at least five BASIC statements that can be part of an IF. . .THEN statement and that will be executed if the condition (comparison) is true.

____

____

____

____

____

____

- - - - - - - - - - - - - - - - -

(a) GOTO
(b) PRINT, GOTO (assuming a line number appears after THEN),
LET (direct assignment statement, with the option of omitting the word LET),
READ, INPUT, another IF. . .THEN statement (not recommended),
GOSUB, RETURN (any 5 answers)

IF. . .AND. . .THEN. . . and IF. . .OR. . .THEN. . . are called the logical AND and logical OR. They allow you to put more than one comparison in a single IF. . .THEN statement. The comparisons on both sides of an AND must be true for the entire IF. . .THEN comparison to be true. Only one comparison on either side of an OR must be true for the comparison to be true. You can use more than one AND and more than one OR between IF and THEN, and you may use both AND and OR in the same IF. . .THEN statement, which allows three or more comparisons in one IF. . .THEN statement! Be certain you understand how to use the logical AND and OR to produce the results you want. We find they are useful for certain checks on user INPUT entries. If an INPUT value should be between five and twenty, then the following statement would check that the value was within these parameters.

```
150  IF F < 5 OR F > 20 THEN  PRINT "ENTRY IS INCORRECT"
```

Alternately, the following line would check for "within bounds" parameters for the value assigned to F, instead of "out of bounds" values.

```
150  IF F >  = 5 AND F <  = 20 THEN  PRINT "ENTRY IS WITHIN BOUNDS"
```

Note: Be very careful to have your logic straight or such comparison statements will not do what you want. For some, flow charts help visualize the alternatives so you can properly construct your comparison statements. Thoroughly testing programs and program segments for every conceivable mistake that you could enter is a must.

(a) Write two IF. . .THEN statements, one using a logical AND and another using a logical OR. The statement should test to see if the value assigned to variable Y is greater than, but not equal to, zero, and less than, but not equal to, one. When the comparison is true, one statement should print the message BETWEEN ZERO AND ONE, and the other should print NOT BETWEEN ZERO AND ONE.

____

____

____

- - - - - - - - - - - - - - - -

(a)
```
60  IF Y > 0 AND Y < 1 THEN  PRINT "BETWEEN ZERO AND 1"
70  IF Y <  = 0 OR Y >  = 1 THEN  PRINT "NOT BETWEEN ZERO AND 1"
```

Having seen how more than one comparison can be made within a single IF. . .THEN statement, now consider the other end of the comparison statement and how to have more than one instruction executed in the case of a true IF. . .THEN comparison.

APPLESOFT BASIC permits you to do nearly anything after an IF. . .THEN expression, frequently encouraging you to place multiple statements on one line.

```
150   IF X < Y THEN  PRINT "TOO LOW": LET C = C + 1: GOTO 10
160   IF X > Y THEN  LET C = C + 1: LET G = 0: GOTO 10
```

When you use this APPLESOFT BASIC feature, keep in mind that you may be hindering the portability of your program. If this doesn't concern you, forget it! We do urge you to complete your entire "activity" on one line after an IF. . .THEN statement, otherwise the program is extremely awkward to follow. If you cannot complete your activity on one line, then GOTO a section where all of the activity can be done together. Follow the acceptable example:

BAD

```
150   IF X < Y THEN  LET X = X + D: LET Y = Y / N: GOTO 200
160   IF X > Y THEN  LET X = X - D:Y = Y / N: GOTO 10
 .
 .
 .
200   LET C = C + 1: PRINT "TOO LOW": GOTO 10
```

ACCEPTABLE

```
150   IF X < Y THEN 200
160   IF X > Y THEN 250
 .
 .
 .
200   LET X = X + D
210   LET Y = Y / N
220   LET C = C + 1              . . . or all on one line
230   PRINT "TOO LOW"
240   GOTO 10
```

Most of us who program for fun ignore what is going on inside the computer because we don't have to pay attention. However, on occasion, little "bugs," inconsistencies, and our own ignorance can cause some interesting (and frustrating) problems. BASIC software sometimes does funny things, barely detectable because the problem exists at the seventh or eighth decimal location, which may be invisible to the BASIC user. We once spent hours trying to fix a "money changing" program that kept giving us 4.9999 pennies change instead of a nickel. (This points out a very important lesson: Your BASIC language interpreter does not always do things with the accuracy and consistency you might expect. Therefore, when you are comparing numeric values, especially numbers that have been computed by your computer, try to compare using less than (<), greater than (>), or not equal (<>).

GOOD

```
IF X<1125.75 THEN...
IF X>1125.75 THEN...
IF X <> 1125.75 THEN.....
```

NOT WISE

```
IF X = 1125.75 THEN....
```

(a) Why should you avoid IF. . .THEN comparisons for equality?

____

____

____

- - - - - - - - - - - - - - -

(a) Internal round-off errors may produce very slightly inaccurate values in calculations. Therefore, a comparison for equality might fail (be false) where you would expect the comparison to be true.

IF. . .THEN String Comparisons and the ASCII Code

So far the only comparisons used in IF. . .THEN examples have been between two numeric expressions or values. Comparing *strings* in IF. . .THEN statements begins to get a little tricky. However, comparisons for equality or inequality are fairly straightforward. Examine these statements:

```
220   INPUT "ENTER YOUR LEGAL NAME:";N$
230   IF N$ = "STOP" THEN 999
```

Notice that in line 230 a string variable (N$) is compared with a string constant ("STOP"). A string constant in a comparison must be enclosed in quotation marks. In order for a comparison for equality between two strings to be true, each and every character in the two strings must be identical (upper and lower case are different), and the length of the strings and any leading or trailing spaces must be the same. Any difference *whatsoever* will make the equality comparison false.

In line 230 above, the string assigned to a string variable was compared to a string constant. Likewise, the contents of two string variables can be compared.

```
310   INPUT "ENTER OLD TITLE:";T$
320   IF T$ <  > D$ THEN  PRINT "WRONG TITLE. TRY ANOTHER."
```

The difficulty in string comparisons comes with the "less than" or "greater than" comparisons. These have application in sorting strings, alphabetizing data, or inserting new information into an alphabetically organized data file. In IF. . .THEN comparisons, BASIC compares the two strings one character at a time, from left to right.

Rather than comparing within the construct of a twenty-six-character alphabet, *BASIC uses a standard code that represents every possible signal a terminal keyboard can send to the computer (and vice versa).* Each key and each permitted combination of keys, such as the shift or CONTROL key along with another key, sends a unique electronic *code* pattern to the computer. *These patterns are represented by* *the decimal numbers 0 through 127 in the ASCII Code chart.* Mercifully, here is one instance of standardization throughout the computer industry. ASCII stands for American Standard Code for Information Interchange. The ASCII code's 128-character set includes the upper and lower case letters of the alphabet, numbers, punctuation, and other special characters and special function keys. The ASCII code also includes 128 other special codes that are numbered 129 through 255, that do not concern us. Refer to the ASCII chart in the Appendix for your understanding of the following.

Notice that the numbers 0 through 9 have ASCII codes of 48 to 57. The alphabet has ASCII codes of 65 to 90 for upper case letters; lower case starts at 96. Therefore, the lower case equivalent of an upper case letter is the upper case letter's ASCII code number plus 31.

$$A = 65, \text{ so } a = 65 + 31 = 96$$

This fact will be of use later.

What actually happens in an IF. . .THEN string comparison? BASIC compares the ASCII code number for each character in the two strings, comparing just *one* character at a time. As soon as an inequality exists between characters, the string with the character that has the lower ASCII code number will be considered "less than" the other string. BASIC *does not* add up the ASCII code values for the two strings being compared to determine "less than" or "greater than." The following chart shows the results of comparing a series of strings assigned to A$ and B$.

A$	B$		
ABC	ABD	A$ IS LESS THAN B$	
MN!	MNO	A$ IS LESS THAN B$	
STOP	STO	B$ IS LESS THAN A$	(A$ is greater than B$)
123A	123a	A$ IS LESS THAN B$	

In the comparison process, if one string ends before the other and no other difference has been found, then the shorter string is said to be "less than" the longer one. One result is that a null string is always "less than" a non-null string, since the ASCII code for null is zero. Here are some more examples of string comparisons:

A$	B$		
SMITH	SMITHE	A$ IS LESS THAN B$	
ALCOTJONES	ALCOT	A$ IS GREATER THAN B$	(B$ is less than A$)
JOHNSEN	JOHNSON	A$ IS LESS THAN B$	
KELLOG	KELLOGG	A$ IS LESS THAN B$	
EQ-8	EQ 8	B$ IS LESS THAN A$	

Now it's your turn to familiarize yourself with ASCII code comparisons. Fill in the blanks with the appropriate string variable. Of course you can refer to the Appendix!

	C$	D$		
(a)	JACOB	JACOBS	______ is greater than ______	
(b)	LOREN	LORAN	______ is less than ______	
(c)	SMITH-HILL	SMITH HILL	______ is less than ______	
(d)	ABLE12	ABLE-12	______ is less than ______	
(e)	Theater	THEATER	______ is less than ______	
(f)	95.2	95-2	______ is less than ______	

(a)	D$,C$	D$ has more characters, others being equal
(b)	D$.C$	Letter A is less than letter E
(c)	D$,C$	A space is less than a hyphen
(d)	D$,C$	A hyphen is less than the number 1
(e)	D$,C$	Uppercase letters are less than lower case letters
(f)	D$, C$	A hyphen is less than a decimal point

Two string functions are used in conjunction with the ASCII code. The ASC ( ) function gives the ASCII code number for the first character of the string contained in the parentheses or for the first character of the string assigned to the string variable contained in the parentheses. The ASCII number produced by ASC ( ) may be assigned to a variable, displayed by a PRINT statement, used in arithmetic expressions, and used as a value in an IF. . .THEN comparison. The following examples illustrate these points.

```
LET X = ASC(A$)
LET X = ASC("ANTWERP")
PRINT ASC(A$)
IF ASC(N$) = 0 THEN...
```

Give the ASCII number or value that will be printed for each of these program segments. Refer to the ASCII chart in the appendix.

(a)
```
LET D$ = "DOLLAR"
PRINT  ASC (D$)
RUN
```
______

(b)
```
PRINT  ASC ("YES")
RUN
```
______

(c)
```
10  LET F$ = "FRANK"
20  LET L$ = "JONES"
30  LET N$ = L$ + ", " + F$
40  PRINT  ASC (F$)
50  PRINT  ASC (L$)
60  PRINT  ASC (N$)

RUN
```

____

____

____

(d)
```
10  PRINT  ASC (" ")
RUN
```

____

- - - - - - - - - - - - - - - -

(a) 68
(b) 89
(c) 70
74
74
(d) 32

Describe the string that must be assigned to A$ in order for the following IF. . .THEN comparisons to be true.

(a) IF ASC(A$) = 53 THEN 510 ____________________

(b) IF ASC(A$) <> 48 THEN 810 ____________________

(c) IF ASC(A$) = Ø THEN 950 ____________________

- - - - - - - - - - - - - - - -

(a) First character in A$ is 5
(b) First character in A$ is not zero
(c) A$ must be a null string

The opposite of the ASC( ) function is the CHR$( ) function. An ASCII number is placed in the parentheses: It causes the computer to send that ASCII code signal to the terminal, which can cause the printing of an alphanumeric character. CHR$( ) is also used to send special control signals to the CRT screen or printer (ASCII numbers 0 through 31) or in a PRINT statement to print characters corresponding to the ASCII number in the CHR$( ) parentheses.

```
840  PRINT  CHR$ (69); CHR$ (78); CHR$ (68)
```

(a) By running this program or by reference to the ASCII chart, what will this program line print? ____________

- - - - - - - - - - - - - - -

(a) END

CHR$(7) sounds the beeper on the APPLE keyboard. CHR$(34) produces quotation marks in situations where they would not otherwise be printed around a string. Remember these possibilities. Check the ASCII codes, especially 0 through 31, in your APPLESOFT reference manual. There may be some interesting capabilities to explore.

When a program user has limited options for a response to input statements, it is necessary to check the input for the options available. For example, it is often useful to have the computer user answer yes or no, or to select from a specific list of options for the response to an input statement. Examine the following program segment:

```
330   INPUT "DO YOU WISH TO CONTINUE DATA ENTRY (Y OR N)?";R$
340   IF R$ <  > "Y" AND R$ <  > "N" THEN  PRINT  CHR$ (7);"PLEASE TYPE 'Y'
      FOR YES OR 'N' FOR NO.": GOTO 330
350   IF R$ = "Y" THEN 450
```

If line 340 were omitted and the user typed YES instead of Y, the program would not operate as the programmer intended. Suppose a program displays the following "menu" or list of possible responses!

```
ENTER 'I' TO INSERT DATA
ENTER 'C' TO CHANGE DATA
ENTER 'D' TO DELETE DATA
ENTER 'N' FOR NO CHANGE OF DATA
YOUR CHOICE:
```

The selection of each option directs the computer to branch to a different section of the remaining program to accomplish this activity.

```
210  INPUT "YOUR CHOICE:";R$
220  IF R$ = "I" THEN 510
230  IF R$ = "C" THEN 610
240  IF R$ = "D" THEN 710
250  IF R$ = "N" THEN 150
```

If the user entered a response other than I, C, D, or N, this program would not detect the error. If the user pressed RETURN with no response, the computer would not catch the error either.

(a) Now write a statement for line 215 that ensures that the response entered was among the list of options on the menu, and, if not, informs the user of the options available and branches back to the INPUT statement.

215

____

____

____

- - - - - - - - - - - - - - -

(a)
```
215   IF R$ < > "I" AND R$ < > "C" AND R$ < > "D" AND R$ < > "N" THEN
      PRINT "PLEASE TYPE ONLY THE LETTER I, C, D, OR N.": GOTO 210
```

THE LEN FUNCTION

Recall that while the maximum length of a string that can be assigned to a string variable is 255 characters, the *actual* length of the string is the number of characters *currently* assigned to a string variable. BASIC provides a function to "count" and report the actual length of a string, or of a string assigned to a particular variable; a function appropriately called the LEN (for LENgth) function. LEN can be used in a print statement to print the number of characters in the string in question. Since the execution of LEN results in a numeric value, it can be assigned as a value to a numeric variable, used as a value in an IF. . .THEN comparison, or used in calculations.

For example:

```
10  LET G$ = "WHAT A GAS"
20  PRINT  LEN (G$)

]RUN
10


100  PRINT  LEN ("NORTHERN MUSIC")

]RUN
14


10  LET H$ = "1582 ANCHORAGE DRIVE"
20  LET A =  LEN (H$)
30  PRINT A

]RUN
20


150  LET R$ = "YES"
160  IF  LEN (R$) = 3 THEN  PRINT "GO ON TO THE NEXT QUESTION."

]RUN
GO ON TO THE NEXT QUESTION
```

```
10  LET M$ = "AMERICAN"
20  LET N$ = "FOREIGN"
30  PRINT  LEN (M$) +  LEN (N$)
RUN

15
```

Show the results of executing each of the following program segments:

(a)
```
10  LET C$ = " "
20  PRINT  LEN (C$)

RUN
```

____

(b)
```
10  LET F$ = "FRANK"
20  LET L$ = "JONES"
30  LET N$ = L$ + ", " + F$
40  PRINT N$
50  PRINT  LEN (N$)

RUN
```

____

____

— — — — — — — — — — — — — — —

(a) 1
(b) JONES, FRANK
12

SUBSTRING FUNCTIONS: VERSATILE TOOLS TO MANIPULATE STRING DATA

Three APPLESOFT BASIC string functions (MID$, RIGHT$, LEFT$) allow you to manipulate the parts of a string called substrings. The MID$ function is by far the most useful substring manipulating function. It allows you to *select* substrings from within a larger string. The MID$ selection function has the following forms:

(1) `MID$("CHARGE IT", 1,6)`

(2) `MID$(T$, 3, 15)`

(3) `MID$(D$, 10)`

(4) `MID$(W$, A, C*D)`

In example (1), the MID$ function selects characters 1 through 6 inclusive as the substring within the string constant CHARGE IT, with the substring starting at character position 1 (the C) and including six characters total, making the substring

CHARGE. Example (2) assumes that a string has been assigned to T$, and the substring comprises fifteen characters of the T$ string, starting with the third character in the string and continuing on to the 15th character after the third one. In example (3), the "last character position" notation (the last value inside the MID$ parentheses) has been omitted, which tells the computer that the substring will start at character position 10, and will include all the rest of the string to the right of the character at position 10. Example (4) shows that the starting position for the substring, as well as the number of characters to be included in the substring, can be represented by variables or expressions that evaluate to a numeric value. Of course, these variables must have been previously assigned values, just as the string variable must have previously been assigned a string. So in general, the MID$ function has the form

MID$ (string variable or constant, substring starting position, how many characters in the substring from the start position)

Note that the three parameters in the MID$ function are separated by commas. The first is usually a string variable to which a string has previously been assigned. The second parameter is the starting position for the substring. The third parameter *does not* tell the last character position number in the substring, but rather tells how many characters to include in the substring – a point that sometimes confuses people.

Notice the use of the MID$ selection function in PRINT statements in the program below. Remember, it allows you to select and print any part or substring of the string assigned to the string variable in the MID$ parentheses. The other two values or parameters inside the parentheses still indicate where the substring to be printed starts and how many characters it includes.

```
150  LET N$ = "FOGHORNE WHILDEFLOWER"
160  PRINT  MID$ (N$,1,8)
170  PRINT  MID$ (N$,10,12)
180  PRINT N$

]RUN
FOGHORNE
WHILDEFLOWER
FOGHORNE WHILDEFLOWER
```

Notice the use of MID$ as a *selection* function in lines 160 and 170 above. This same selection function can be used to assign a substring from a string assigned to a string variable, without changing the original string from which the substring was selected. Notice in the program segment below that a substring from an existing string can be assigned to a new variable without changing the string from which it was selected. F$ (for first name) and L$ (for last name) are selected from the entire name (N$) without changing N$.

```
150  LET N$ = "FOGHORNE WHILDEFLOWER"
160  LET F$ =  MID$ (N$,1,8)
170  LET L$ =  MID$ (N$,10,12)
180  PRINT N$
190  PRINT "FIRST NAME IS ";F$
200  PRINT "LAST NAME IS ";L$
```

(a) Show the RUN for the program segment above.

____

____

____

____

(b) Which character in N$ is not selected for inclusion in either F$ or L$?

____

— — — — — — — — — — — — — — —

(a) RUN
FOGHORNE WHILDFLOWER
FIRST NAME IS FOGHORNE
LAST NAME IS WHILDEFLOWER

(b) The space at character position 9 of N$

The LEFT$ and RIGHT$ string functions are not as versatile as MID$ and are not used as much in our programming. They both work the same way, however, as shown in these program segments:

`160 PRINT LEFT$ (A$,8)`	means print the left-most eight characters of A$ (the first eight characters in the string assigned to A$)
`170 LET R = 12` `180 LET B$ = RIGHT$ (A$,R)`	means assign to B$ the twelve right-most characters of A$ (the last twelve characters in the string assigned to A$)

These examples demonstrate the substring selection capabilities of LEFT$ and RIGHT$. They are strictly *selection* functions, selecting one or more characters from one end or the other of an existing string to treat as a substring.

We often use LEFT$ for convenience to check for a user's YES or NO response to an INPUT prompting question. Using an IF. . .THEN statement, we have the computer look at the first character of the response string to determine whether or not the answer was YES, as shown in the following program segment:

```
240  INPUT "DO YOU NEED INSTRUCTIONS (YES OR NO)?",R$
250  IF  LEFT$ (R$,1) = "Y" THEN 600
```

(a) What responses could a user make to the INPUT prompt above in order for the IF. . .THEN comparison to be true?

____

\- - - - - - - - - - - - - - - -

(a) Could type YES or Y or any string that started with the letter Y

We have found less use for the RIGHT$ function than for MID$ or for LEFT$, but here is an example. Remember, the numeric value inside the RIGHT$ function's parentheses means to start counting the characters for the substring at the right-most end of the string from which the substring is being selected, counting toward the beginning of the string.

```
240  INPUT "WHICH HIGH SCHOOL CLASS DID YOU GRADUATE FROM?";Y$
250  PRINT "YOU GRADUATED IN 19"; RIGHT$ (Y$,2)
```

Assume that several people responded to the INPUT prompting question when the above program segment was RUN. Show what the computer will print for each user's response.

(a) User responds: CLASS OF 1938

Line 250 prints: ____________________

(b) User responds: CLASS OF '64

Line 250 prints: ____________________

(c) User responds: 1958

Line 250 prints: ____________________

(d) User responds: FORTY EIGHT

Line 250 prints: ____________________

\- - - - - - - - - - - - - - - -

(a) YOU GRADUATED IN 1938
(b) YOU GRADUATED IN 1964
(c) YOU GRADUATED IN 1958
(d) YOU GRADUATED IN 19HT

MULTI-BRANCHING WITH ON. . .GOTO

The ON. . .GOTO statement allows the computer to branch to a number of different statements throughout a program. The format for the statement is a list of line numbers:

```
10   ON X GOTO 310,450,660,660,660,720,830,910
```

Note: X = any variable or expression from which a value will result.

If the value of X is 1 when the ON. . .GOTO statement is encountered and executed, the computer branches (goes to) the first line number in the list of line numbers (in our example, line 310). If the value of X is 2, the second line number in the list is branched to. As many line numbers can follow GOTO as will fit in a statement line. Notice also in our example that if X = 3, 4, or 5, the same line number (660) will be branched to.

If the value of X is a zero, a negative number, or larger than the number of line numbers in the list, then the ON. . .GOTO statement will be skipped without execution and the next statement executed.

Here is a method to arrive at an ON. . .GOTO value in a menu-section situation. In the following program segment, the ASC( ) function is used to convert a letter entered by the user to an ASCII value that is used to determine the value for an ON. . .GOTO statement. The ON. . .GOTO is a multi-branching instruction. In line 260, if the value of R is 1, then the program goes to the first line number given after GOTO. If R = 2, then the program branches to the second line number given, and so on. The value of R must be greater than 1 and no higher than the number of line numbers that follow GOTO.

```
200 :
210 :
220 :
230  INPUT "ENTER YOUR CHOICE, A-E:";R$
240  LET R =  ASC (R$) - 64
250  IF R < 1 OR R > 5 THEN 270
260  ON R GOTO 300,400,500,600,700
270  PRINT "ENTRY ERROR. PLEASE REENTER AS REQUESTED": GOTO 230
280 :
290 :
```

(a) In the program above, why is line 250 included?

____

____

- - - - - - - - - - - - - - - -

(a) If R evaluates to less than 1 due to a data entry error or larger than 5, an error would occur; so the checking is done by line 250.

FOR NEXT STATEMENTS

It is preferable to use a FOR NEXT loop when you have a controlled, repeating sequence of instructions.

PREFERRED

```
100   FOR X = 1 TO N
110   PRINT X,X ^ 2
120   NEXT X
```

UNDESIRABLE

```
100   LET X = 1
110   PRINT X,X ^ 2
120   LET X = X + 1
130   IF X > N THEN 200
140   GOTO 110
```

As you can see, the FOR NEXT loop is more space-efficient (it could even have been done in one line), looks better, and is easier to read.

A general rule when using FOR NEXT loops is: DO NOT EXIT from the middle of a FOR NEXT loop, except to GOSUB to a subroutine. Leaving the controlled loop makes the program difficult to read and hard to understand. Further, internally your computer wants to complete the entire FOR NEXT sequence. If you exit prematurely, there is no certainty that your computer will behave "normally" the next time it encounters the loop variable (X in the example above). This uncertainty can cause some very serious program errors that are extremely hard to detect. An exit to a subroutine is acceptable because a subroutine will RETURN the program to the *inside* of the FOR NEXT loop to continue in sequence, as if there was no exit at all.

NEVER

```
100   FOR X = 1 TO N
110   IF A(X) = B(X) THEN 200
120   NEXT X
```

NOT DESIREABLE

```
100   FOR X = 1 TO N
110   IF A(X) = B(X) THEN 130
120   NEXT X
130   LET S = S + 1
140   GOTO 120
```

PREFERRED

```
100   FOR X = 1 TO N
110   IF A(X) <  > B(X) THEN 130
120   LET S = S + 1
130   NEXT X
```

You can usually write your program to include everything you need to do *inside* the loop, rather than leaving the loop. (There will be exceptions.)

(a) Write a program segment using nested FOR NEXT loops that will print the word HELLO three times, but will print the word GOODBY four times after each appearance of the word HELLO.

(a)
```
10 FOR X = 1 TO 3
20 PRINT "HELLO"
30 FOR Y = 1 TO 4
40 PRINT "GOODBY"
50 NEXT Y
60 NEXT X
```

MULTIPLE-STATEMENT LINES

Many language features in APPLESOFT BASIC are *not* available on other computer systems. Some of these features speed up the program's run time, others save memory space, and some do both. Some features enhance program readability while others confuse the reader. A popular feature is the ability to place multiple BASIC statements on one line separated by a colon, as we showed earlier in discussing IF. . .THEN.

```
140 FOR X = 1 TO 10: PRINT X,X ^ 2: NEXT X
```

or

```
200 IF X = Y THEN  PRINT "YOU WON!": GOTO 10
210 PRINT "SORRY, WRONG NUMBER": GOTO 60
```

A few cautions and suggestions are applicable as you use multiple-statement lines:

1. Multiple-statement lines are often hard to read and sometimes hard to understand. If you later change a program, readability may be a problem. It is more clear to use one statement to a line.
2. If you must use multiple-statement lines, carry out a complete procedure or action on *one* line, whenever possible. Carryover to other lines makes reading more difficult and less clear.
3. Finding program errors buried in multiple-statement lines is difficult.
4. Understand completely how IF. . .THEN statements work in a multiple-statement line. In line 200 above, if X *does* equal Y, then "You won" will be printed and the program will branch to line 10. If the X=Y condition is false, line 210 will be executed next. Some people incorrectly presume that GOTO 10 will be executed whether the condition is true or false.
5. REM statements must be the *last* statement on a multiple-statement line. Any executable statement after a remark will *not* be executed.

Special consideration of the GOSUB statement in multiple-statement lines is warranted. Remember that each GOSUB statement must have a corresponding RETURN statement that appears as the last statement in the subroutine which the GOSUB branches to.

Say, a GOSUB is executed when an IF. . .THEN condition is true. After com-

pleting the subroutine, the computer must always be instructed to RETURN. The statement it returns to will be:
(1) the next statement after GOSUB if it is a multiple-statement line, or
(2) the next lined numbered statement in normal line number order.

(a) Assume that the comparison in line 120 below is true and the GOSUB statement is executed. Which statement will be executed next after the RETURN from subroutine execution?

```
120  IF X = 2 THEN  GOSUB 510: GOTO 360
130  PRINT "X IS LESS THAN TWO."
```

— — — — — — — — — — — — — — — —

(a) GOTO 360

TRAPPING ERRORS WITH ONERR GOTO

APPLESOFT BASIC has the ability to detect errors while your program is executing. If you wish, you can have the program stop execution altogether and print an error message. Or you can "trap" the error using the ONERR GOTO statement and then determine if you want the program to continue, terminate, or print a message to the program user.

The main reason for using the ONERR trap procedure is to avoid having your program terminate unexpectedly in the middle of execution. This is especially important when using data files in your programs. If you do not use the error trapping procedure, any programming or data entry errors will cause your program to terminate with an error message. And most error messages do not do an adequate job of explaining what is wrong to a naive computer user.

ONERR GOTO works much like an IF. . .THEN statement; if there is an error, THEN GOTO the statement number indicated.

```
10  ONERR  GOTO 300
```

If there is no error, then continue program operation.

The ONERR statement sets what we call a "flag." ANY error that occurs after the ONERR statement has been executed will cause the statement to execute. In that regard it is unlike an IF. . .THEN statement. You need execute the ONERR statement only once and the flag is "set" for the rest of the program or until the flag is "unset," or reset with another ONERR statement that may direct the computer to a different line number than the first ONERR.

To "unset" the ONERR flag, use the statement POKE 216, 0. Alternatively, a second ONERR statement executed after the first one in a program will cancel the first one.

Here is an example of the use of ONERR. The program reads information from DATA statements into an array. We do not know exactly how much data is contained in the DATA statements; less than fifty items is assumed. When we run "out of data" (an error condition), we wish to continue operation of the program at line 200, where the array information will then be used in some way.

```
100  REM     ONERR DEMO PROGRAM
110  :
120  DIM A(50)
130  LET K = 1
140  :
150  ONERR  GOTO 200
160  READ A(K)
170  LET K = K + 1
180  GOTO 160
190  :
200  POKE 216,0: REM     RESET ERROR TRAP
210  REM     PROGRAM CONTINUES
```

Notice that the ONERR statement is only executed once (line 150). That sets the flag until the flag is "unset" or reset at line 200. As the program continues at line 200, you may have wanted to set another error trap to send the program to line 300 if an error occurs.

(a) Write the statement that will set another error trap in line 200 to send the program to line 300.

200 ____

(a) 200 ONERR GOTO 300

A NOTE ON POKE AND PEEK

The BASIC statements PEEK and POKE provide the BASIC user with a way to get "inside" of the computer and observe or change the machine language codes.

You are aware that all data, even BASIC programs, are translated in the computer into a binary code. This code is called "machine langauge." The PEEK statement will show you the numeric machine language code-value at a particular memory location. These locations are numbered. For example, the following program segment "looks at" the numeric code found at memory location 222, assigns it to the variable A, and then displays it on the screen.

```
10  LET A =  PEEK (222)
20  PRINT A
```

The POKE statement, on the other hand, allows you to change the numeric machine langauge code found at a particular memory location. You need not learn machine language to use PEEK and POKE to accomplish specific jobs when you are provided with the necessary machine language code and/or memory location. Here is an example of a POKE statement.

```
50  POKE 216,0
```

This statement tells the computer to place a zero value at memory location 216. A zero at this memory location turns off, or cancels, a previous ONERR instruction. This is discussed further in the next section.

USING ONERR

You can use ONERR to trap bad data in data entry routines (discussed in more detail in Chapter 3). If a user responds with alphabetic information when numeric data is requested, that is a trapable error. Look these program segments over carefully.

```
100  REM     DATA ENTRY ERROR TRAP
110  :
120  ONERR   GOTO 200
130  INPUT "ENTER YOUR COMPLETE NAME:";N$
140  INPUT "ENTER YOUR AGE IN YEARS:";A
150  :
160  REM     PROGRAM CONTINUES
     :
     :
     :
200  PRINT "YOU HAVE MADE A DATA ENTRY ERROR. PLEASE TRY AGAIN."
210  RESUME
220  :
```

If the user makes a trapable error, the message at line 200 is printed. The RESUME statement in line 210 sends the computer back to the line in which the error was originally made (where the error was trapped). We do not normally encourage the use of the RESUME statement, however, as you will see in Chapter 3.

Each normal error message has a numeric error code. The code for "out of data" is 42. For "bad response to INPUT statement," the code is 254. Other error codes are in your reference manual and DOS manual. We will point out particular error codes as we use them. The numeric code for a particular error encountered by the ONERR error trap is saved in the computer memory in location 222. To see the error code, or to check to see if it is the one you expected, use PEEK(222) in a BASIC statement. For instance, in line 200 we might have said:

```
200  IF  PEEK (222) = 254 THEN  PRINT "YOU HAVE MADE A DATA ENTRY ERROR.
     PLEASE TRY AGAIN.": RESUME
205  PRINT "UNUSUAL ERROR CONDITION. PLEASE REENTER."
```

Now line 200 checks to be sure that it is a data entry error before the message is printed. If it is not a data entry error, the message in line 205 is displayed to caution the operator of an unusual error.

(a) Rewrite the error trapping routine for the first example to trap for bad data (alphabetic information) and for out of data. Print an appropriate message if the data are bad, then continue to the next data item.

(a)
```
100  REM    SECOND ONERR DEMO PROGRAM
110  :
120  DIM A(50)
130  LET K = 1
140  :
150  ONERR  GOTO 200
160  READ A(K)
170  LET K = K + 1
180  GOTO 160
190  :
200  IF  PEEK (222) = 254 THEN  PRINT "BAD DATA ITEM REJECTED.": GOTO 160
205  IF  PEEK (222) = 42 THEN 220
210  PRINT "UNUSUAL ERROR CONDITION": STOP
220  REM    PROGRAM CONTINUES
```

CHAPTER 2 SELF-TEST

1. Why do the authors recommend using "greater than" and "less than" comparisons in IF. . .THEN numeric comparisons, rather than comparisons for equality?

2. When must quotation marks be placed around string data items in a DATA statement?

3. How can a null string be assigned to an INPUT string variable?

4. Show the results of a RUN of the following program:

```
10  LET A$ = "ALFRED"
20  LET B$ = "CONTRACT"
30  LET C$ = "32C"
40  PRINT  ASC (A$), ASC (B$), ASC (C$)
RUN
```

5. Describe the string that must have been assigned to D$ for each of these comparisons to be true:

(a) `10 IF ASC (D$) < 48 OR ASC (D$) > 57 THEN 660`

(b) `30 IF ASC (D$) > 64 AND ASC (D$) < 91 THEN GOSUB 1520`

(a)

(b)

6. What value will the LEN function show for a string to which fifteen spaces have been assigned?

7. Write a statement to check that the user response to an INPUT is among the options requested. The INPUT prompt asks: DO YOU WANT INSTRUCTIONS (YES OR NO):

8. Give an example of a simple numeric variable and a simple string variable.

9. Give a reason for avoiding multiple-statements in one program line.

10. Examine the following statement:

```
120 IF X > 10 THEN GOSUB 810 : GOTO 110
```

After executing the subroutine starting at like 810, to which statement will the computer return?

11. If a variable name has more than two alphanumeric characters, how many of those characters does the computer use to identify the value assigned to that variable?

Answer Key

1. Round-off error in the computer's computational process may introduce tiny errors that make expected values slightly more or less. Therefore, an equality comparison may fail where you would expect it to succeed.

2. When the string data item includes a comma as part of the string or leading spaces are to be included as part of the string.

3. By pressing the ENTER key without entering anything else from the keyboard.

4. 65   67   57

5. (a) First character of D$ must *not* be a number (Ø to 9).
   (b) First character of D$ must be a capital letter (A to Z).

6. 15 (Spaces count as characters in a string.)

7.
```
220  IF R$ < > "YES" AND R$ < > "NO" THEN  PRINT "PLEASE TYPE 'YES' OR
     'NO'": GOTO 310
```

8. Numeric variable: A (or any letter of the alphabet); string variable: A$ or any letter of the alphabet followed by a dollar sign.

9. May make it harder to read the program; may make errors in programming harder to detect. (either answer)

10. GOTO 110

11. Only the first two characters.

CHAPTER THREE

Building Data Entry and Error Checking Routines

Objectives: When you finish this chapter, you will be able to write statements in a data entry program module to check the following aspects of data items:

- Proper length
- Non-response (null strings)
- Type of data (numeric or alphanumeric)
- Inadvertant inclusion of wrong characters
- Parameters for numeric data

In addition, you will be able to write data entry modules that:

- Have clearly stated prompts
- Use reasonable data fields
- Concatenate data items into a single field
- Check and "pad" entries, as necessary, for proper field length
- Remove excess spaces from data taken from data fields
- Replace data items contained in a data field
- Provide complete explanations of a data entry error to the user

INTRODUCTION

If you are wondering when you are going to get into data files themselves, be patient. Experience has shown that you need a good background in some special techniques associated with data file programming which use BASIC statements you already know. This will make it much easier and faster to learn the new BASIC statements and functions specifically applied to data file handling. You shouldn't have to struggle to understand a new use for a familiar BASIC statement while trying to absorb the data file statements and techniques, so please don't gloss over this material.

Concern for data entry procedures was introduced in the section on INPUT in the previous chapter. For our purposes *data* are defined as any information that is or will be stored in a data file on disk. Common examples of data include mailing, subscription, or billing lists; inventories of retail merchandise; accounting information; files of books, recordings, journal articles, or notes for a book; statistical information. *Data entry* includes the process of getting such information into the computer so that it can be stored in a data file. *Data files* usually contain large amounts of data, which, to be useful, must be accurate, valid, and error-free in content and format. The accuracy and usefulness of your program output depends entirely on the accuracy of the data in these files. Furthermore, inaccurate or invalid data in a data file (or any place in a program) can cause your program to interrupt, halt, or abort in an error condition in the middle of its run. If your program terminates unexpectedly, there may be no telling what is happening inside the computer. Printed reports can be only partially completed, entered data can be lost or destroyed, data in the files can be half processed; the list goes on.

The result of an unexpected program interruption can be catastrophic, though it may not always be so. It is almost impossible to predict exactly what will happen. Therefore, always do everything you can in your programming to avoid errors that can precipitate program interruptions.

Unfortunately most errors occur at data entry time. That is why we emphasize the use of data entry checking procedures in this chapter – procedures to guarantee that data are entered as clean, valid, and accurate in content and format as your ingenuity and knowledge of programming techniques can make it. Throughout the remainder of this book "error-traps" and places where programming errors are likely to occur are illustrated.

This chapter focuses on constructing the data entry module of a program. This is where, usually with INPUT statements, the computer user is instructed to type in information that is going to be placed in a new data file, or to tell the computer to locate information in an already existing data file. After each response to an INPUT statement we will use one or more statements to check the response for possible errors. These error-checking statements comprise the largest part of a data entry program module.

DATA FIELD LENGTH

Many data entry problems are avoided by establishing a certain amount of space; a certain number of character positions into which a given element of data or data item is placed. Establish strings, or defined substring positions within one string, where data must be located (data fields). *A data field can be thought of as a string that contains more than one data item. These data items always fit between two defined character positions within the string.* A simple example would be one string variable to which both a customer's first and last names are assigned like this:

```
N$ = "VIVIAN VANCE"
```

The first name field is a six-character field in N$, occupying the first six character positions of that string (1 through 6). The separator field is a one-character field, located at character position 7.

The last name field has (a) ________ characters and occupies character positions (b) ________________ in the string assigned to (c) ________________ .

(a) five
(b) 8 to 12
(c) N$

Below is a graphic look at the fields in N$ with a slash (/) marking the field designation:

```
N$ = _ _ _ _ _ _ / _ / _ _ _ _ _
          ↑          ↑        ↑
     first name      |    last name
                 separating
                   space
```

This particular data field works for the name in the example. However, the goal is to establish *reasonable* data fields. In this case, a reasonable data field should hold ANY first or last name that might be assigned to N$. Certainly, many names contain more than six letters for the first name and five letters for the last. On one hand, you want to provide reasonably sized fields for the data. On the other hand, much storage space will be wasted if you try to cover all possibilities. There really may be someone named *John Jacobjingleheimerschmidt,* but reserving twenty-four character positions for a last name data field would waste storage space; if 95 percent of the last names in a data file has twelve letters or less, then half or more of the last name data field goes unused 95 percent of the time. In a file of 1,000, 10,000, or 100,000 names, such as a mailing list, this can amount to a vast amount of unused string and disk storage space.

Data field lengths must be adequate and reasonable. If all the catalog numbers in an inventory data file are five characters, then obviously a five-character data field is sufficient.

To review, use a slash(/) to mark off the fields in a twenty-six character string assigned to A$, where the data fields hold the city, state, and zip code (the last line in a mailing address). Place a number in each field indicating which of the following data items are to occupy that field.

1. City name (fifteen characters maximum)
2. Two separator spaces
3. State code (standard two-letter postal abbreviation)
4. Two separator spaces
5. Zip code (five characters)

(a) A$ = _

\- - - - - - - - - - - - - - - -

(a) A$ = ________①________/②__/③__/④__/⑤_____

Next, consider the following data entry module to enter the city, state, and zip code. These data are to be placed into the data fields you just defined above.

```
100  INPUT "ENTER NAME OF CITY:";C$
110  INPUT "ENTER STATE CODE:";S$
120  INPUT "ENTER ZIP CODE:";Z$
130  LET A$ = C$ + " " + S$ + "   " + Z$
140  PRINT A$
```

Notice the concatenating statement in line 130 – an attempt to get the data items into data fields. But these two RUNs demonstrate a serious problem that relates to the length of the city name.

(a)
```
]RUN
ENTER NAME OF CITY:IOWA CITY
ENTER STATE CODE:IA
ENTER ZIP CODE:52240
IOWA CITY IA   52240
```

(b)
```
]RUN
ENTER NAME OF CITY:SOUTH SAN FRANCISCO
ENTER STATE CODE:CA
ENTER ZIP CODE:94080
SOUTH SAN FRANCISCO CA   94080
```

Fill in the spaces to show the results of line 130 in the program for each of the sample RUNs:

(a) A$ = ________________/__/__/__/_____

(b) A$ = ________________/__/__/__/_____

\- - - - - - - - - - - - - - - -

(a) A$ = IOWA_CITY__IA__/52/24/0_/_____

(b) A$ = SOUTH_SAN_FRANC/IS/CO/__/CA__94080

The fact that all cities don't have fifteen letters means that simple concatenation of this data does not place it into the defined character positions for the data fields.

Checking Data Entries for Acceptable Length

One programming technique to check data entries for acceptable length uses the LEN function in an IF . . . THEN comparison. If the data requested always have a defined number of characters, then an important check for mistakes in data entry would be to see whether the entry has the exact length it should. A U.S. zip code always has five characters, so a check for that data item would look like line 170:

```
160  INPUT "ENTER ZIP CODE:";Z$
170  IF  LEN (Z$) <  > 5 THEN  PRINT "REENTER AS 5 DIGIT CODE": PRINT :
     GOTO 160

]RUN
ENTER ZIP CODE:9543
REENTER AS 5 DIGIT CODE

ENTER ZIP CODE:954316
REENTER AS 5 DIGIT CODE

ENTER ZIP CODE:
REENTER AS 5 DIGIT CODE
```

If the entry for the zip code does not have exactly five characters, then a mistake has been made, the user is so advised, and the computer repeats the prompting message and waits for another entry. With new zip code formats, a bit of reprogramming will be necessary.

Now you write a statement to check for proper length of the entry for the INPUT statement below:

(a) `140  INPUT "ENTER STATE CODE:";S$`

150 ______________________________

(a)
```
150  IF  LEN (S$) <  > 2 THEN  PRINT "REENTER AS STANDARD 2-LETTER CODE.":
     PRINT : GOTO 140
```

How can you check something like a city name, which is allowed fifteen characters or less? The city name could have less than fifteen characters, exactly fifteen, or more than fifteen. If it has more, you must advise the user that a shorter entry is needed and allow the user to reenter the data item with an intelligent abbreviation.

```
120  INPUT "ENTER CITY NAME:";C$
130  IF  LEN (C$) > 15 THEN  PRINT "REENTER USING 15 CHARACTERS OR LESS.":
     PRINT : GOTO 120

]RUN
ENTER CITY NAME:SOUTH SAN FRANCISCO
REENTER USING 15 CHARACTERS OR LESS.

ENTER CITY NAME:
```

Write a statement (similar to line 130 above) to check the entry for the INPUT statement below, where the data field for the entry is twenty characters maximum;

(a) `310  INPUT "ENTER STREET ADDRESS:";S$`

320 ______________________________

- - - - - - - - - - - - - - - -

(a)
```
320   IF  LEN (S$) > 20 THEN  PRINT "REENTER USING 20 CHARACTERS OR LESS.":
      PRINT : GOTO 310
```

"Padding" Entries With Spaces to Correct Field Lengths

You are probably wondering how to *increase* the length of an entry that has fewer characters than its data field. The solution involves automating the addition of spaces to "pad" the short entry (say, a short city name) with trailing spaces, so that the resulting city name *string,* which includes the padding spaces, exactly fits the data field. Remember, spaces occupy character positions and count as characters in the length of the string. Line 140 shows how to pad with spaces:

```
120   INPUT "ENTER CITY NAME:";C$
130   IF  LEN (C$) > 15 THEN  PRINT "REENTER USING 15 CHARACTERS OR LESS.":
      PRINT : GOTO 120
140   IF  LEN (C$) < 15 THEN  LET C$ = C$ + " ": GOTO 140
```

In line 140, if the city name entered and assigned to C$ has less than fifteen characters, then a space is concatenated on to the end of the string. The new string assigned to C$ is the old string plus a space. The statement "goes back to itself" (GOTO 140) and keeps adding another space to the end of the C$ string until the string contains exactly fifteen characters, including the spaces. Clever?

Now you write a statement to pad an entry with spaces if it has less than the eight characters required to fit in its data field.

(a)
```
120   INPUT "ENTER YOUR FIRST NAME:";F$
130   IF  LEN (F$) > 8 THEN  PRINT "SHORTEN ENTRY TO 8 CHARACTERS OR LESS.":
      PRINT : GOTO 120

140 ______________________________________________
```

- - - - - - - - - - - - - - - -

(a)
```
140   IF  LEN (F$) < 8 THEN  LET F$ = F$ + " ": GOTO 140
```

Now apply the techniques you have been using in a data entry module.

(a) Write a program routine to request that a user enter an alphanumeric product identification code with three characters, plus a product description with up to twenty characters maximum, followed by a two-character code identifying the person making the entries, using their first and last name initials. Once these three data items have been entered and tested, combine the data into one string of twenty-five characters assigned to a single string variable.

(a)
```
100  REM     DATA ENTRY MODULE
110  :
120  INPUT "ENTER A THREE CHARACTER CODE:";C$
130  IF  LEN (C$) <  > 3 THEN  PRINT "ENTRY MUST BE 3 CHARACTERS. PLEASE
     REENTER.": PRINT : GOTO 120
140  INPUT "ENTER DESCRIPTION:";D$
150  IF  LEN (D$) > 20 THEN  PRINT "ENTRY TOO LONG. PLEASE REENTER USING
     20 CHARACTERS OR LESS.": PRINT : GOTO 140
160  IF  LEN (D$) < 20 THEN  LET D$ = D$ + " ": GOTO 160
170  INPUT "ENTER YOUR TWO INITIALS:";N$
180  IF  LEN (N$) <  > 2 THEN  PRINT "PLEASE USE THE FIRST LETTERS OF YOUR
     FIRST AND LAST NAME ONLY.": PRINT : GOTO 170
190  LET R$ = C$ + D$ + N$
200  REM  FOR DEMONSTRATION PURPOSES ONLY WE DISPLAY R$
210  PRINT : PRINT R$
```

What's the advantage in setting up data fields in a single string and putting more than one data item into it? The reasons will become clear in later chapters. For now, the answer has to do with how data files can store information using some automated data entry procedures and equipment and with the ease with which BASIC allows the manipulation of substrings using MID$ for particular applications.

Examine the program below and answer the questions that follow it.

```
100  REM     EXAMPLE DATA ENTRY MODULE
110  :
120  INPUT "ENTER CITY NAME:";T$
130  IF  LEN (T$) > 15 THEN  PRINT "REENTER USING 15 CHARACTERS OR LESS.":
     PRINT : GOTO 120
140  IF  LEN (T$) < 15 THEN  LET T$ = T$ + " ": GOTO 140
150  INPUT "ENTER STATE CODE:";S$
160  IF  LEN (S$) <  > 2 THEN  PRINT "PLEASE REENTER AS 2 CHARACTERS.":
     PRINT : GOTO 150
170  INPUT "ENTER ZIP CODE:";Z$
180  IF  LEN (Z$) <  > 5 THEN  PRINT "REENTER AS A 5 DIGIT CODE": PRINT :
     GOTO 170
190  LET C$ = T$ + " " + S$ + "  " + Z$
200  :
210  REM     FOR DEMONSTRATION PURPOSES ETC.
220  PRINT : PRINT C$
```

(a) What is the purpose of line 130?

____

____

____

____

(b) What does T$ = T$ + " " in line 140 do?

____

____

____

____

(c) In line 190, what is the purpose of " " in the concatenation?

____

____

____

- - - - - - - - - - - - - - -

(a) Tests to be sure user has not entered more than the acceptable number of characters (fifteen) for the city name field

(b) Fills in, adds on, or concatenates spaces from the last character of the T$ string up to and including character field position 15. Changes T$ to a fifteen-character string if there were fewer than fifteen characters in the string entered for T$.

(c) Places spaces in the C$ string, one between the fields for city and state and two between state code and zip code.

Stripping the Padding Spaces From Substrings in Fields

You know how to pad a string with extra spaces to arrive at the proper field length for that data item. Now let's explore a way to eliminate the extra blank spaces when you extract data packed into a string. In the example where we wanted to change a person's last name, it was necessary to pad names with spaces to the proper field length so that corrections could be made, if necessary, and so the first and last names could be found separately. But for name printing purposes, you want to eliminate all the extra blank spaces. The method shown below uses the MID$ function. In our example, N$ really consists of eight characters, one space separating the two fields, twelve characters for L$, and one final space. If the name concatenated into N$ is Jenny Smiles, then:

N$ = "JENNY SMILES "

This includes the field-separating space at character position 9. The string N$ has this format:

```
--------/-/------------/-/
    ↑      ↑       ↑        ↑
first name space last name space
```

The procedure used in the following example is called "parsing." It means searching through the string variable, one character at a time, until you find the character(s) you are seeking. We use a FOR NEXT loop to help us "parse" the string variable N$ to find the first space in the first name field and first space in the last name field. If no padding spaces were used, the spaces at the end of each field are found. The example program below shows how to use first and last names separately, without extra spaces, in a computer-printed "thank you" letter.

```
100  REM     PARSING DEMO PROGRAM
110  :
120  REM     VARIABLES USED
130  REM       F$=FIRST NAME
140  REM       L$=LAST NAME
150  REM       N$=CONCATENATED NAMES
160  REM         S AND S1=CHARACTER POSITION OF SPACE
170  REM       X=FOR-NEXT LOOP CONTROL VARIABLE
180  :
190  REM     DATA ENTRY MODULE
200  :
210  INPUT "ENTER FIRST NAME:";F$
220  IF  LEN (F$) > 8 THEN  PRINT "NAME TOO LONG. REENTER USING 8
     CHARACTERS OR LESS.": PRINT : GOTO 210
230  IF  LEN (F$) < 8 THEN  LET F$ = F$ + " ": GOTO 230
240  INPUT "ENTER LAST NAME:";L$
250  IF  LEN (L$) > 12 THEN  PRINT "NAME TOO LONG. REENTER USING 12
     CHARACTERS OR LESS.": PRINT : GOTO 240
260  IF  LEN (L$) < 12 THEN  LET L$ = L$ + " ": GOTO 260
270  :
280  REM     CONCATENATES ENTIRE NAME INTO N$
290  :
300  LET N$ = F$ + " " + L$ + " "
310  :
320  REM    PARSING ROUTINE TO DETECT FIRST SPACE IN FIELD
330  :
340  FOR X = 1 TO 9
350  IF  MID$ (N$,X,1) = " " THEN  LET S = X: GOTO 380: REM
     S=CHAR.POSITION OF FIRST SPACE FOUND IN FIRST NAME FIELD
360  NEXT X
370  :
380  FOR X = 10 TO 23
390  IF  MID$ (N$,X,1) = " " THEN  LET S1 = X: GOTO 440: REM   S1 IS FIRST
     SPACE FOUND IN LAST NAME FIELD
400  NEXT X
410  :
420  REM     LETTER PRINT ROUTINE
430  :
440  PRINT : PRINT : PRINT
450  PRINT "DEAR "; MID$ (N$,1,S - 1);",": REM   PRINTS FIRST NAME IN SALUTATION
460  PRINT "IT SURE WAS GOOD TO SEE YOU AND MRS. "; MID$ (N$,10,S1 - 10);"
     AT THE GET TOGETHER THE OTHER EVENING."
```

```
]RUN
ENTER FIRST NAME:DANIEL
ENTER LAST NAME:ROBERTS


DEAR DANIEL,
IT SURE WAS GOOD TO SEE YOU AND MRS. ROBERTS AT THE GET TOGETHER THE OTHER
     EVENING.
```

NOTE: Lines 350 and 390 are one of those exceptions when the program leaves or exits a FOR NEXT loop without necessarily completing all of the loops.

(a) In lines 350 and 390, what does the MID$ function search for?

____

(b) What value is assigned to S and S1 in the same lines?

____

(c) In line 450, why does S appear in the MID$ function?

____

____

(d) In line 460, why is 10 subtracted from S1 in the MID$ function?

____

____

(a) Looks for the first space in each name field
(b) Character position number of first space in each field
(c) Counts the number of characters in the first name field, with the space at the end subtracted from the character count
(d) Subtracts the characters in the first name field (B), the space at character position nine (1), and the first space in the last name field (1) from the MID$ character count.

CHECKING ENTRIES FOR NULL STRINGS

One idiosyncracy of the INPUT statement already pointed out is that if the user merely presses the RETURN key when the computer is waiting for a response to an INPUT statement, a null string is assigned to the string variable. If the computer then encounters a checking statement that pads the entry with spaces to the proper field length, the entire entry would end up as a string of spaces and be duly included in the data field for that entry. So checking data entries for null string assignments is a must and should be part of your data entry program modules.

You can use two different techniques to test whether a string variable has been assigned a null value. They work equally well.

```
IF A$ = "" THEN...
```

or

```
IF LEN(A$) = 0 THEN...
```

The decision the programmer must make (and it will vary with each situation) is what to do after the THEN when the IF. . .THEN condition is true and a null assignment has been mistakenly made. Whatever you do, do *not* have the computer merely repeat the INPUT prompt, as in the "what-not-to-do" example below.

```
170  INPUT "ENTER CUSTOMER NUMBER:";C$
180  IF  LEN (C$) = 0 THEN 170

]RUN
ENTER CUSTOMER NUMBER:
ENTER CUSTOMER NUMBER:
ENTER CUSTOMER NUMBER:
ENTER CUSTOMER NUMBER:
```

A user who persists in not entering the customer number gets no information as to what is wrong. Always provide a helpful error message, perhaps even a beep, bell, or other sound if available on the terminal, so the user knows something is amiss with the present response or entry.

```
170  INPUT "ENTER CUSTOMER NUMBER:";C$
180  IF  LEN (C$) = 0 THEN  GOSUB 1010
     :
     :
     :
1010  PRINT "PLEASE, WE MUST HAVE THE CUSTOMER NUMBER TO CONTINUE."
1020 :
```

```
]RUN
ENTER CUSTOMER NUMBER:
PLEASE, WE MUST HAVE THE CUSTOMER NUMBER TO CONTINUE.
```

With this information in mind, write the data entry routine that will produce the prompts shown below. Test each data item for null response immediately after it is entered with a message to the user that if reentry is made then all data entered are assigned to string variables.

(a)
```
ENTER CUSTOMER NUMBER:
ENTER CUSTOMER NAME:
ENTER PRODUCT NUMBER:
ENTER QUANTITY ORDERED:
```

(a)
```
210 :
220   INPUT "ENTER CUSTOMER NUMBER:";C$
230   IF  LEN (C$) = 0 THEN  PRINT "ENTRY ERROR. PLEASE REENTER.": PRINT :
      GOTO 220
240   INPUT "ENTER CUSTOMER NAME:";N$
250   IF  LEN (N$) = 0 THEN  PRINT "PLEASE RESPOND AS REQUESTED.": PRINT :
      GOTO 240
260   INPUT "ENTER PRODUCT NUMBER:";P$
270   IF  LEN (P$) = 0 THEN  PRINT "WE CANNOT CONTIUE WITHOUT THIS DATA.":
      PRINT : GOTO 260
280   INPUT "ENTER QUANTITY:";Q$
290   IF  LEN (Q$) = 0 THEN  PRINT "PLEASE ENTER THE CORRECT VALUE.": PRINT :
      GOTO 280
```

(or some similar messages)

Depending upon the program user's sophistication, even more detailed error messages for problems like the null string entry and others may be necessary. Our examples have given minimum messages to keep the examples short, uncluttered, and easy to understand, but they may not be adequate to ensure a proper response. Return to this example.

```
170   INPUT "ENTER CUSTOMER NUMBER:";C$
180   IF  LEN (C$) = 0 THEN  GOSUB 1010: PRINT : GOTO 170
 :
 :
 :
1010  PRINT "YOU APPARENTLY PRESSED THE 'RETURN' KEY WITHOUT MAKING AN
      ENTRY."
1020  PRINT "WE NEED A CUSTOMER NUMBER WITH THIS FORMAT: A-121."
1030  RETURN
```

Another example:

```
230   INPUT "ENTER COMPANY NAME:";C$
240   IF  LEN (C$) > 12 THEN  GOSUB 1010: PRINT : GOTO 230
 :
 :
 :
1010  PRINT : PRINT : PRINT "YOU ENTERED: ";C$
1020  PRINT "PLEASE ABBREVIATE THE COMPANY NAME TO 12 CHARACTERS OR LESS."
1030  PRINT "EXAMPLE: ALPHA PRODUCTS COMPANY COULD BE SHORTENED TO 'ALPHA
      PRO CO'"
1040  RETURN
```

Subroutines need to be protected from the main program that calls or branches to them. Depending on how a program is constructed, a subroutine could be encountered and executed as if it were part of the main program, especially if the subroutine section is one of the program's last modules. *Use a STOP or END statement between the main program and the module(s) containing the subroutines.* This protects the first subroutine in the subroutine module from being executed in normal line number order. If the first subroutine is executed, the computer will stop executing the program and give an error message when it encounters a RETURN statement for which the program has no matching GOSUB statement that sent it to the subroutine.

(a) Write an error message subroutine accessed by a GOSUB statement executed after a true IF. . .THEN comparison; one that displays an INPUT entry and describes how to comply with the limit of twenty characters (because of data field length) for entries to the following statement:

```
320  INPUT "ENTER PRODUCT DESCRIPTION:";P$
```

Sample entry to above statement:

```
RUN
ENTER PRODUCT DESCRIPTION:LEFT HANDED MONKEY WRENCH
```

(a) Your solution should be similar to this:

```
330  IF  LEN (P$) > 20 THEN  GOSUB 1120: PRINT : GOTO 320
     :
     :
     :
1110  STOP
1120  PRINT : PRINT : PRINT "YOU ENTERED >> ";P$;" << FOR PRODUCT
      DESCRIPTION."
1130  PRINT "PLEASE REENTER, BUT SHORTEN YOUR ENTRY BY USING ABBREVIATIONS"
1140  PRINT "SO THAT THE PRODUCT DESCRIPTION IS 20 CHARACTERS OR LESS IN
      LENGTH."
1150  PRINT "INCLUDING THE SPACES AND PUNCTUATION."
1160  RETURN
```

REPLACEMENT OF DATA ITEMS CONTAINED IN A DATA FIELD

You may encounter problems when you attempt to change a data item in a data field. The most practical solution is *always use data fields of predefined lengths for each data item in a string.* That way any changes or replacements with MID$ will be complete, rather than partial, as happened above.

Now design program modules to accomplish assignment and extraction of data in fields within strings, using first and last names as examples.

Step 1. Define the field for the first name to have eight characters and that for the last name, twelve characters, with a space after each name field.

Step 2. Create the data entry routine.

```
100  INPUT "ENTER FIRST NAME:";F$
110  IF  LEN (F$) = 0 THEN  PRINT : PRINT "PLEASE, WE MUST HAVE THE NAME.":
     PRINT : GOTO 100
120  IF  LEN (F$) > 8 THEN  PRINT : PRINT "FIRST NAME TOO LARGE. 8 CHAR.
     MAX.": PRINT : GOTO 100
130  IF  LEN (F$) < 8 THEN  LET F$ = F$ + " ": GOTO 130
140  INPUT "ENTER LAST NAME:";L$
150  IF  LEN (L$) = 0 THEN  PRINT : PRINT "PLEASE, WE MUST HAVE THE LAST
     NAME.": PRINT : GOTO 140
160  IF  LEN (L$) > 12 THEN  PRINT : PRINT "LAST NAME TOO LONG. 12
     CHAR.MAX.": PRINT : GOTO 140
170  IF  LEN (L$) < 12 THEN  LET L$ = L$ + " ": GOTO 170
180 :
190  REM    CONCATENATED NAMES
200 :
210  LET N$ = F$ + " " + L$ + " "
220  PRINT : PRINT N$: PRINT
230 :
```

Step 3. Replacement routine for last name field.

```
240  REM  NEW LAST NAME TO REPLACE OLD LAST NAME
250 :
260  INPUT "ENTER NEW LAST NAME:";L1$
270  IF  LEN (L1$) = 0 THEN  PRINT : PRINT "PLEASE, WE MUST HAVE A LAST
     NAME.": PRINT : GOTO 260
280  IF  LEN (L1$) > 12 THEN  PRINT : PRINT "LAST NAME TOO LONG. 12
     CHAR.MAX.": PRINT : GOTO 260
290  IF  LEN (L1$) < 12 THEN  LET L1$ = L1$ + " ": GOTO 290
300  LET N$ =  MID$ (N$,1,9) + L1$ + " "
310 :
```

Step 4. Name printing routines.

```
320  REM    NAME PRINTING ROUTINE
330 :
340  REM    TO PRINT FIRST NAME ONLY
350 :
360  PRINT : PRINT  MID$ (N$,1,8)
370 :
380  REM    TO PRINT LAST NAME ONLY
390 :
400  PRINT : PRINT  MID$ (N$,10,12)
410 :
420  REM    TO PRINT COMPLETE NAME
430 :
440  PRINT : PRINT N$
```

Check your understanding of the routines above by answering the following questions.

(a) In line 170, what is the purpose of L$ = L$ + " "?

____

____

(b) What does line 210 do? ______________________________

____

____

(c) In line 300, what does the MID$ function do? ______________________

____

____

____

____

____

(d) If F$ = "VAL" and L$ = "JEANS", how will N$ appear when printed or displayed by line 220? ______________________

- - - - - - - - - - - - - - -

(a) Fills in unused character positions with blanks to the correct field length (same technique used in lines 160 and 420)
(b) Packs first and last names into N$
(c) Concatenates the first nine characters of original N$ with the new last name (F1$), creating a new N$ assignment
(d) VAL JEANS
(All "padding" spaces are included when N$ is printed.)

THE VAL FUNCTION IN DATA ENTRY CHECKS

If the product number and quantity ordered in a program must be numeric quantities, VAL( ) can easily convert these numbers stored as strings to numeric values.

```
330  LET A$ = "128.95"
340  PRINT  VAL (A$)
350  LET A =  VAL (A$)
360  PRINT A

]RUN
128.95
128.95
```

In the conversion, either a leading space is added for the implied plus sign, or a minus sign is provided if the quantities were negative.

But the VAL( ) function does not completely solve the problem of converting string numbers to numeric values. For example, alphabetic information included in a string you wish to convert to a numeric value presents a very real problem that can range from accidentally using the letter O (oh) for a zero, to a quantity that includes the units that measure that quantity (12 quarts). Therefore, always test to be sure that if numeric values are needed, that is what was entered.

Following are some sample values run on our APPLE II.

```
100  REM     VAL FUNCTION TEST#1
110 :
120  LET A$ = "ABC"
130  PRINT A$, VAL (A$)
140 :
150  REM.    TEST#2-NULL STRING
160 :
170  LET A$ = ""
180  PRINT A$, VAL (A$)
190 :
200  REM     TEST#3
210 :
220  LET A$ = "123ABC"
230  PRINT A$, VAL (A$)
240 :
250  REM     TEST#4
260  LET A$ = "ABC123"
270  PRINT A$, VAL (A$)
```

The RUN:

```
]RUN
ABC              0
                 0
123ABC           123
ABC123           0
```

Notice in the RUN above that alphabetic characters result in a value of Ø, as do a null string and the mixed alphanumeric data where the alpha information *precedes* the numeric (ABC123). Notice also that the mixed data 123ABC results in a value of 123. The APPLESOFT BASIC's VAL function disregards the alphabet information that *follows* numeric information in the same string. This is convenient if you wish to enter the quantity and the units, such as 14 gallons, but inconvenient if you wish to check for the validity of the data entered. Here, you want to ascertain that the data entered are numeric, so when the VAL function entry test is used you get valid numeric values. At this point, for mixed numbers and letters, assume that the user did enter the correct value.

The test to validate numeric information would be:

```
100  IF  VAL (A$) = 0 THEN  PRINT "ENTER NUMERIC VALUES ONLY."
```

Note that the entry passes the test if only the first character entered is numeric.

(a) Now do some programming. For the data entry problem on page 60, you wrote a program to produce a data entry sequence with null string checks added. Now add data checks that ensure that the product number and quantity ordered are numeric values. Also include a data check to be certain that the product number is a four-digit number.

____

____

____

(a)
```
210 :
220   INPUT "ENTER CUSTOMER NUMBER:";C$
230   IF  LEN (C$) = 0 THEN  PRINT "ENTRY ERROR. PLEASE REENTER.": PRINT :
      GOTO 220
240   INPUT "ENTER CUSTOMER NAME:";N$
250   IF  LEN (N$) = 0 THEN  PRINT "PLEASE RESPOND AS REQUESTED.": PRINT :
      GOTO 240
260   INPUT "ENTER PRODUCT NUMBER:";P$
270   IF  LEN (P$) = 0 THEN  PRINT "WE CANNOT CONTINUE WITHOUT THIS DATA.":
      PRINT : GOTO 260
272   IF  VAL (P$) = 0 THEN  PRINT : PRINT "PLEASE ENTER NUMBERS ONLY.":
      PRINT : GOTO 260
274   IF  LEN (P$) <  > 4 THEN  PRINT : PRINT "THIS ENTRY MUST BE A 4-DIGIT
      NUMBER, SO REENTER.": PRINT : GOTO 260
280   INPUT "ENTER QUANTITY:";Q$
290   IF  LEN (Q$) = 0 THEN  PRINT "PLEASE ENTER THE CORRECT VALUE.":
      PRINT : GOTO 280
295   IF  VAL (Q$) = 0 THEN  PRINT : PRINT "ENTER NUMBERS ONLY, PLEASE.":
      PRINT : GOTO 280
```

USING STR$ TO CONVERT VALUES TO STRINGS

The STR$( ) function serves the opposite purpose of the VAL( ) function. It converts numeric values into strings. This allows you to manipulate numbers with string functions. You can use it to convert numeric values to strings assigned to variables, in concatenating several small strings into a string variable, as done earlier in this chapter. For example, you may have combined product number, product description, and quantity in inventory into one long string. You may then need the quantity in inventory for an accounting procedure or another calculation. Such operations require a *numeric* value. You would convert the string to a numeric value by using the VAL( ) of the entry string. When the quantity is stored, you can convert back to a string by taking the STR$( ) of the numeric value to place it into the P$ string.

P$	17633	BOOK TITLE	144

```
P$ = P$ + STR$(Q)
```

or

```
Q$ = STR$(Q)
P$ = P$ + Q$
```

When the computer converts a numeric value to a string with STR$( ), a minus sign is included in the string if the value is negative.

Try this demonstration program:

```
140  LET X = 847.25
150  LET X$ =  STR$ (X)
160  PRINT "X =";X
170  PRINT "X$ =";X$


]RUN
X =847.25
X$ =847.25
```

In the example above, the LEN(X$) is six – five numeric characters and the decimal point. (Remember, blank spaces, decimal points, and other punctuation marks are characters.) If you fail to provide enough string length or field space, you will inadvertently lose significant digits or characters due to computer truncation. A six-digit number with a decimal point does *not* fir in a six-character field.

How many characters will the following data items have if they are converted from values to strings with the STR$ function?

(a) 171.83 __________

(b) 2001 __________

(c) –999 __________

- - - - - - - - - - - - - - - -

(a) 6
(b) 4
(c) 4

CHECKING FOR ILLEGAL CHARACTERS

Using the ASC function in a data entry checking statement is a powerful tool to determine whether illegal or unlikely characters have been included in an INPUT string. Checking is done by a combination of the ASC function, the MID$ function, an IF. . .THEN statement, and a FOR NEXT loop. First the length of the entry is determined by the LEN function, which is used as the upper limit of the FOR control variable, like this:

```
350  INPUT "ENTER 6 CHARACTER CATALOG CODE:";C$
360  FOR X = 1 TO  LEN (C$)
```

Then the MID$ function, using the FOR control variable (value of X for any iteration) to determine which character to examine, selects each character in the string for comparison to an ASCII number, like this:

```
370  IF  ASC ( MID$ (C$,X,1)) = 32 THEN  PRINT "REENTER BUT DO NOT INCLUDE
     SPACES.": PRINT : GOTO 350
380  NEXT X
```

(Note: Here is one of those exceptions when the computer leaves or exits a FOR NEXT loop before completing all iterations of the loop.)

Notice that any character that can be entered as part of a string can be checked to see that legal characters that should be there are included, or that illegal characters are not included. Notice, too, that the error message could be located in a subroutine outside of the FOR NEXT loop. In addition, you can use the logical AND and OR to check for more than one character or group of characters in the same IF. . .THEN statement.

What if a user made the following response to line 350 in the example above? Answer the questions based on this response and this program segment:

```
]RUN
ENTER 6 CHARACTER CATALOG CODE:A - 1341
REENTER BUT DO NOT INCLUDE SPACES.

ENTER 6 CHARACTER CATALOG CODE:A-1341
```

(a) What is the length of the substring selected by the MID$ function in line 370?

____

(b) What ASCII value is compared to 32 the first time through the FOR NEXT loop? ____________

(c) The second time through? ________________

(d) On which iteration of (time through) the FOR NEXT loop is the comparison in line 370 true? ________________________

(e) What value does the FOR statement control variable have as an upper limit for this user's response? ________________________________

- - - - - - - - - - - - - - - -

(a) 1
(b) 64 (for A)
(c) 32 (for a space)
(d) second iteration
(e) LEN(C$) = 8

(a) Write a data entry checking routine similar to the one before that prints an error message if an illegal character is encountered. Use more than one IF. . . THEN statement with the ASC function in the comparison, or a single IF. . . THEN statement that uses the logical AND and OR. The only *legal* characters for the entry are the digits Ø (zero) through 9 inclusive and the decimal point, such as would be entered for a dollar and cents entry without a dollar sign. Include a null entry test.

____

____

____

____

____

____

____

____

____

____

____

____

(a)
```
100  INPUT "ENTER A VALUE:";V$
110  IF  LEN (V$) = 0 THEN  PRINT : PRINT "PLEASE ENTER AS REQUESTED.":
     PRINT : GOTO 100
120  FOR X = 1 TO  LEN (V$)
130  IF  ASC ( MID$ (V$,X,1)) >  = 49 AND  ASC ( MID$ (V$,X,1)) <  = 57 OR
     ASC ( MID$(V$,X,1)) = 46 THEN 150
140  PRINT "INVALID ENTRY. ENTER NUMBERS AND DECIMAL PT. ONLY.": PRINT :
     GOTO 100
150  NEXT X
160  REM    PROGRAM CONTINUES
```

THE HOME INSTRUCTION

It is sometimes desireable to remove "clutter" from the screen, especially when asking the computer user for specific input, or after a data entry or data display operation is completed. Use APPLESOFT HOME instruction to accomplish this. HOME should generally be used just before a new display operation. (If HOME is placed in the program after a display or entry instruction, the screen may be cleared before the user has a chance to absorb the information). HOME may also be used in direct mode to clear a screen.

```
100  HOME
110  INPUT "ENTER A VALUE:";V$
120  HOME
130  IF  LEN (V$) = 0 THEN  PRINT : PRINT "PLEASE ENTER AS REQUESTED.":
     HOME : PRINT : GOTO 110
140  HOME
150  FOR X = 1 TO  LEN (V$)
160  IF  ASC ( MID$ (V$,X,1)) >  = 49 AND  ASC ( MID$ (V$,X,1)) <  = 57 OR
     ASC ( MID$(V$,X,1)) = 46 THEN 190
170  HOME : PRINT "INVALID ENTRY. ENTER NUMBERS AND DECIMAL PT. ONLY.":
     PRINT : HOME : GOTO 110
180  HOME
190  NEXT X
200  REM    PROGRAM CONTINUES
```

(a) The HOME instruction appears five times in this segment. Which ones should be removed so that adequate information is displayed for the user.? ____________

(a) All except line 100.

A DISCUSSION OF DATA ENTRY AND CHECKING PROCEDURES

This chapter has included recommendations, hints, and techniques for dealing with and checking data. This section describes and summarizes procedures used to check and validate all data entries.

There are two schools of thought regarding at what point incoming data should be checked for errors. One states that since the data entry operator's time is costly, the operator should merely enter data using the fastest possible procedures, with no checks for accuracy at the time data are entered. This position requires that more time be spent training the data-entry operator in fast, accurate computer entry techniques. Then, later, another program does the error checking on the data at fast computer speeds. Whenever a data error is encountered, the computer "kicks out" or rejects the entire data entry transaction for that set of data and prints the rejected information in a special report. The rejected data set is then reprocessed or reentered by the data-entry staff. This procedure works well if the number of rejects is low.

In contrast, we prefer the second approach – checking data on the way in. As each item is entered, it is error-checked immediately. If an error is detected, the computer operator is advised to reenter the data. One advantage is that the person making the entry error is responsible for correcting it. This method also gives management a better measure of an operator's work flow since only accurate, accepted information is completed during a work day. In the alternate method, data entry rates may seem high, but so may be the reject rate, and special procedures are need to verify who is making the entry errors. A less subtle technique is to signal an entry error with a terminal beeper or bell. Each time faulty data are detected, the sound signals the operator (and the manager, if present) that an error was made and draws attention to the "culprit." But these are concerns in a business environment. The immediate error check is more in keeping with the small business or personal nature of most programming applications presented here. And since all the error checking routines follow the data entry immediately, you can easily read the program to see what kinds of error checks are being made.

Two general data entry techniques are universally accepted. One uses a graphic reproduction on the video screen of the paper form from which data are entered. It makes sense to reproduce that form on the screen and have the computer prompt the operator to "fill in the blanks" just as they appear on the paper form or data source sheet.

A second generally accepted technique is one that repeats back to the operator one or more sets of data entered. The operator is then given the chance to reenter any incorrect items, even after the entry checking has been performed by the computer. This is the "last chance" to pick up spelling errors, number transpositions, typographical errors, and anything else for which entry error checks cannot be designed into the program itself. An example of such a post-data entry display appears below:

```
THANK YOU. HERE IS THE DATA YOU ENTERED.

          CUST. #         PROD. #          QUANTITY

1 - 98213           17892             18
2 - 98213           24618             12
3 - 98213           81811             144

ARE THERE ANY CHANGES (YES OR NO)? YES
ENTER THE NUMBER OF THE LINE IN WHICH A CHANGE IS NECESSARY:
```

Before a summary report such as the one above is displayed, clear the screen of previously displayed information. If fact, clearing the screen before each new entry or after the entry of a data set is important in the entire concept of avoiding errors. If the graphic display of a data source form is used, then the screen should be cleared and the form redisplayed with the just-entered data. The operator can then double check with the option to make any corrections directly on the new form.

Many error-checking procedures depend on personal preference or company policy. Either way, plan ahead. Look carefully at the complete problem or job for which you are using your computer. In what form and format should the data be entered? Are there subtle limits or tests that you can apply to data to detect operator errors? For instance, if you are entering addresses with zip codes and a large percentage of your business is in California, then you know that most zip codes should start with the number 9. It would be appropriate to test whether the entered zip code value begins with a 9, and if not, to inform the operator of a *possible* error.

```
140  INPUT "ENTER ZIP CODE:";Z$
150  IF  LEN (Z$) <  > 5 THEN  PRINT : PRINT "ZIP CODE MUST BE EXACTLY 5
     DIGITS. PLEASE REENTER.": PRINT : GOTO 140
160  IF  LEFT$ (Z$,1) = "9" THEN 210
170  PRINT : PRINT "THE ZIP CODE YOU ENTERED, ";Z$;" IS NOT FOR CALIFORNIA."
180  INPUT "IS IT CORRECT ANYWAY?";R$
190  IF  LEFT$ (R$,1) <  > "Y" AND  LEFT$ (R$,1) <  > "N" THEN  PRINT :
     PRINT "ENTER 'Y' FOR YES OR 'N' FOR NO.": PRINT : GOTO 170
200  IF  LEFT$ (R$,1) <  > "Y" THEN  PRINT "PLEASE REENTER.": PRINT :
     GOTO 140
210  REM    PROGRAM CONTINUES
```

We also strongly recommend consistency in your data entry formats, especially for such things as data field lengths. Don't confuse yourself or others who use your programs. If you write several programs that use personal names, use the same size delimiters or data fields. This also allows you to have compatible data files for various uses. The same goes for address sizes and formats, product descriptions, and other alphanumeric data. Remember, your company may have already made the decision for you, so be sure you know the policies!

For numeric values, quantities, and entries involving monetary values, you may have to dig a little to discover the limits for which the data should be tested. Company policy, common sense, and actual experience may give you the logical limits for a "not less than" or "not to exceed" data entry check. And you can always use the operator override procedure for possibly erroneous data, as shown below:

```
330  INPUT "ENTER QUANTITY ORDERED:";Q$
340  IF  VAL (Q$) <  = 98 THEN 400
350  PRINT : PRINT "THE QUANTITY ENTERED EXCEEDS ORDER LIMIT OF 98 UNITS.
     PLEASE REENTER.": PRINT : GOTO 330
360 :
370 :
380  REM     ANOTHER PROCEDURE
390 :
400  INPUT "ENTER PRICE QUOTED:";P$
410  IF  VAL (P$) <  = 75.00 THEN 460
420  PRINT : PRINT "THE PRICE QUOTED EXCEEDS NORMAL LIMITS OF $75.00."
430  INPUT "IS IT CORRECT ANYWAY?";R$
440  IF  LEFT$ (R$,1) <  > "Y" AND  LEFT$ (R$,1) <  > "N" THEN  PRINT :
     PRINT "PLEASE ENTER 'Y' OR 'N'.": PRINT : GOTO 420
450  IF  LEFT$ (R$,1) <  > "Y" THEN  PRINT : PRINT "PLEASE REENTER.":
     PRINT : GOTO 400
460  REM     PROGRAM CONTINUES
```

Let's review the general data entry error-checking procedures for alphabetic and numeric information.

1. Enter all data into string variables after a clearly stated prompt request from the computer.
2. Enter only one data item per prompt.
3. If you are going to pack a number of data items (a data set) into one string, enter the data into separate string variables and then concatenate after all checking has been accomplished. Do *not* enter data directly into a substring position.
4. Checking should include a test for non response (a null string) of the type IF LEN(R$) = Ø. . .
5. When an error is discovered, include a message not only to tell the operator that an error was made, but also to describe as completely as possible what the error was. Do not merely request a reentry.
6. Check alphabetic data for field length using the LEN function.
7. It may be necessary to pad the entry with spaces to the proper field length, especially for alphabetic data.
8. Thoroughly test numeric data (which we recommend be entered into a string variable) in this order:
   (a) for non-response (a null string)
   (b) for excess string length, if applicable
   (c) for the inadvertent inclusion of alphabetic characters in numeric values, using VAL or ASC
   (d) for any company policy tests or size limit
   (e) if the datum is an integer value, test the value to see if it is an integer with a statement like IF X <> INT(X). . . .
   (f) for negative values if they are not acceptable.

If this sounds like a lot of work, remember that your otherwise excellent program must have valid and accurate data to do its job. Don't skimp. Be complete. For example, the capability of the IF. . .THEN statement to PRINT a message may lull you into trying to oversimplify an error message in order to fit it into the same programming line as the IF. . .THEN statement. Don't fall into this trap. Use GOSUBs and provide complete, clear messages to the operator.

You may want to place all error tests and messages into subroutines. This gives your program neatness and clarity. Various entries may be put to the same tests, allowing the check statements to work for various entries if variables and other factors are compatable.

Be alert to other occasions throughout your programs where data errors may occur. While we encourage sensitivity to errors at data entry time, always check for data errors later in your program, especially if the data are subject to various manipulations after the entry routines. Watch for strange results from functions such as VAL. Get to know the version of BASIC you are using inside and out by thoroughly exploring the reactions of statements and functions in various circumstances. The error conditions you encounter will depend largely on your programming skills and the kinds of applications you program. Be alert to the errors that occur and include tests for them. Don't get psychologically locked in to your first, second, or third version of a program or programming technique.

Finally, be aware that many programmers test their programs with only sensible data, neglecting the ridiculous mistakes that can, and without a doubt will, be made. When you think you have covered every possibility, let a child with no computer experience try it out. If the program survives, you've checked it all out!

CHAPTER 3 SELF-TEST

1. Write an IF. . .THEN comparison that will be true if:
   (a) the entry has exactly seven characters.
   (b) the entry does not have exactly seven characters.
   (c) the first character in any entry is not a number.
   (d) the first character in an entry is a number other than zero.
   (e) the entry is not a null string.

   (a) ______________________________

   (b) ______________________________

   (c) ______________________________

   (d) ______________________________

   (e) ______________________________

2. Write a statement line that checks to see if an entry has less than twelve characters, and if so, pads the entry with spaces so that the resulting string has exactly twelve characters.

   ____

   ____

3. Write a data entry checking routine that checks to see that no numbers have been included in a string entry. Write an accompanying subroutine, to be called when a number is found, that tells the user what was entered, and to reenter without including numbers in the entry.

4. You now have the background to write a data entry module for most kinds of data to be later placed into a data file (covered in the next chapter). Write the data entry module and complete it with data entry error checks, as described below:

(a) Write a data entry routine that prompts the use to enter:
   (1) a five-character alphanumeric product code (must always have five characters)
   (2) a product name with a twelve-character maximum length
   (3) the quantity ordered into a three-digit field with a limit of 288 per order
   (4) the price, into a five-digit field, with no price exceeding $99.99

(b) Pack the information entered into one long string (M$) with the following fields:

```
M$ = _ _ _ _ _ / _ _ _ _ _ _ _ _ _ _ _ _ / _ _ _ / _ _ _ _ _
         C$                N$                Q$      P$
```

Note: Do not include slashes in the data field string.

(c) Print parts of M$ in a "report" with the format shown below:

```
JPRICE: 1.25
QUANTITY: 24
PROD. CODE: 11234
```

Refer back through this chapter for ideas, and try debugging your solution program before looking at our way of doing it. Our solutions are not the only ones possible. The real test is whether the program works, and how foolproof it is.

Answer Key

1. (a) `IF LEN (A$) = 7 THEN .....`

   (b) `IF LEN (A$) < > 7 THEN .....`

   (c) `IF ASC (A$) < 48 AND ASC (A$) > 57 THEN .....`

   (d) `IF VAL (A$) < > 0 THEN .....`

   (e) `IF LEN (A$) < > 0 THEN .....`

2. `120 IF LEN (A$) < 12 THEN LET A$ = A$ + " ": GOTO 120`

   (Your string variable and line number may be different, of course.)

3.
```
100  REM    SOLUTION, CH3, PROB3, SELF-TEST
110  :
300  INPUT "ENTER YOUR NAME:";A$
310  IF LEN (A$) = 0 THEN PRINT : PRINT "NO ENTRY MADE. PLEASE TRY
     AGAIN.": PRINT : GOTO 300
320  FOR X = 1 TO LEN (A$)
330  IF ASC ( MID$ (A$,X,1)) > 47 AND ASC ( MID$ (A$,X,1)) < 58 THEN
     GOSUB 1100: PRINT : GOTO 300
340  NEXT X
     :
     :
     :
1090  STOP
1100  PRINT : PRINT "YOU ENTERED: ";A$
1110  PRINT "PLEASE REENTER, BUT DO NOT INCLUDE ANY NUMBERS.": PRINT
1120  RETURN
```

4.
```
100  REM   SOLUTION, CH3, PROB4 SELF-TEST
110  :
120  REM    VARIABLE LIST
130  REM      C$=PRODUCT CODE(5 CHAR.)
140  REM      N$=PRODUCT NAME(12 CHAR.MAX.)
150  REM      Q$=QUANTITY ORDERED(3 CHAR.MAX.)
160  REM      P$=PRICE(5 CHAR.MAX.)
170  REM      M$=CONCATENATED DATASET(25 CHAR.)
180  :
190  REM   DATA ENTRY MODULE
200  :
210  INPUT "ENTER PRODUCT CODE:";C$
220  IF  LEN (C$) <  > 5 THEN  PRINT : PRINT "CODE MUST BE 5 CHARACTERS
     EXACTLY. PLEASE REENTER.": PRINT : GOTO 210
230  INPUT "ENTER PRODUCT NAME:";N$
235  IF  LEN (N$) = 0 THEN  PRINT : PRINT "NO ENTRY MADE. PLEASE ENTER AS
     REQUESTED.": PRINT : GOTO 230
240  IF  LEN (N$) > 12 THEN  PRINT : PRINT "ENTRY TOO LONG. PLEASE REDUCE
     TO 12 CHARACTERS MAX.": PRINT : GOTO 230
250  IF  LEN (N$) < 12 THEN  LET N$ = N$ + " ": GOTO 250
260  INPUT "ENTER QUANTITY ORDERED:";Q$
263  IF  LEN (Q$) = 0 THEN  PRINT : PRINT "PLEASE ENTER AS REQUESTED.":
     PRINT : GOTO 260
265  IF  VAL (Q$) = 0 THEN  PRINT : PRINT "ENTRY ERROR. NUMBERS ONLY,
     PLEASE.": PRINT : GOTO 260
270  IF  LEN (Q$) > 3 THEN  PRINT : PRINT "TOO MANY DIGITS.  3 MAX.":
     PRINT : GOTO 260
280  IF  LEN (Q$) < 3 THEN  LET Q$ = Q$ + " ": GOTO 280
290  IF  VAL (Q$) > 288 THEN  PRINT : PRINT "ORDER EXCEEDS LIMIT OF 288
     UNITS. PLEASE REENTER.": PRINT : GOTO 260
300  INPUT "ENTER UNIT PRICE:";P$
305  IF  LEN (P$) = 0 THEN  PRINT : PRINT "NO ENTRY MADE. PLEASE ENTER AS
     REQUESTED.": PRINT : GOTO 300
310  IF  VAL (P$) > 99.99 THEN  PRINT : PRINT "PRICE ERROR. MAXIMUM PRICE
     MUST BE LESS THAN 100.": PRINT : GOTO 300
320  IF  LEN (P$) < 5 THEN  LET P$ = P$ + " ": GOTO 320
330  :
340  REM    CONCATENATE DATA
350  :
360  LET M$ = C$ + N$ + Q$ + P$
370  :
380  REM   DISPLAY DATA
390  :
400  HOME
460  PRINT "PRICE: "; RIGHT$ (M$,5)
470  PRINT "QUANTITY: "; MID$ (M$,18,3)
480  PRINT "PROD. CODE: "; LEFT$ (M$,5)
490  :
```

CHAPTER FOUR

Creating and Reading Back Sequential Data Files

Objectives: When you complete this chapter, you will be able to store and retrieve numeric and/or alphanumeric data in sequential disk data files, using the following BASIC data file statements in their special formats: OPEN, CLOSE, DELETE, READ and INPUT, and WRITE and PRINT.

INTRODUCTION

A data file is stored alphanumeric information that is separate and distinct from any particular BASIC program. It is located (recorded) on either a magnetic disk, diskette, or cassette tape. This chapter discusses using sequential (also called serial) data files on disks and diskettes.

In your previous BASIC programming experiences you probably hand-entered all data needed by your programs using INPUT statements. You did this each time you ran your programs. Or, if you had larger amounts of data, you might have entered the data with DATA statements and used the READ statement to access and manipulate the data. In either case, the data were program-dependent; that is, they were part of that one program and not usable by other programs.

A data file is *program-independent*. It is *separate* from any one program and can be accessed and used by many different programs. In most cases, you will use only one program to load a data file with information. But once your data file is loaded (entered and recorded) on a disk, you can read the information from that file using many different programs, each performing a different activity with that file's data.

For example, perhaps you have computerized your personal telephone and address directory using data files stored on a disk. You may need just one program to originally load information into that file and add names to it. (This chapter will show you how.) Another program allows you to select phone numbers from the file using NAME as the selection criterion. You can use still another program to change addresses or phone numbers for entries previously made in the file. Another program could print gummed mailing labels in zip code order using the same data file. You could design yet another program to print names and phone numbers by phone number area code. The possibilities go on and on. Notice that one data file can be accessed by many different computer programs. The data file is located separately on the disk in a defined place. Each program mentioned above copies the information from the disk into the electronic memory of the computer as it is needed by that particular program. Alternatively, the program could transfer information from the computer's memory to be recorded onto the disk.

If you already use your disk to SAVE and/or LOAD BASIC programs, then you have some experience with disk files. When you SAVE a BASIC program, it is recorded on this disk in a file. Such files containing BASIC programs are called *program files.* In contrast, the files discussed in this chapter contain data and are therefore called *data files* or text files. *Program files and data files* are different and are used differently. A BASIC program file contains a copy of a BASIC program that you can LOAD, RUN, LIST, and SAVE. A data file contains information only. You access this information using a BASIC program that includes special BASIC statements that access data files; that is, transfer all or part of the data from the magnetic recording on the disk into the computer's electronic memory so the program can use it. You *cannot* LOAD, RUN, LIST, or SAVE a data file. You can access the information only by using a BASIC program.

You can tell what type of files is contained on your diskette by listing a CATALOG on your screen or printer. Type the word CATALOG and press RETURN. Here is a CATALOG of one of our diskette contents:

```
*A 002 HELLO
*I 002 APPLESOFT
*B 027 MUFFIN
 A 013 RENUMBER
*T 023 QUIZ
 T 015 APPLE CHAPTERS
```

The column to the far left with the letter A, I, B, or T indicates whether the file is an Applesoft BASIC program file, Integer BASIC program file, Binary program file, or Text (or data) file. The asterisk (*) indicates whether or not the file is "locked," If it is, you cannot accidentally erase that file. See the APPLE II DOS Manual for the locking procedures.

The numeric entry in the second column indicates how many "sectors" of disk space are taken by the file, and, of course, the file name. A file name can be from one to thirty characters in length. The only "rule" is that the file name must begin with a letter. "Sectors" are explained in next section.

(a) Describe in general-terms how you can access data in a data file.

____

____

\- - - - - - - - - - - - - - -

(a) Using a BASIC program that includes special file accessing BASIC statements.

DATA STORAGE ON DISKS

A magnetic disk (or diskette) has limited data storage capacity that varies from one computer to another, from one size disk to another, and from one recording system to another. For our APPLE II computer using version 3.3 DOS with sixteen-sector diskettes, the user storage capacity of the diskette is nearly 127,000 bytes of information. (The term "byte" will be explained shortly.) Using the 3.2 DOS, with diskettes of only thirteen sectors, the storage capacity is slightly over 103,000 bytes of information.

A disk refers to several styles of magnetic storage. Floppy disks are made of a flexible, magnetic-coated plastic, and come in two sizes – 8-inch and 5¼-inch. The smaller is often called a diskette. Hard disks are also available for microcomputers. Although more expensive, they have larger data storage capacities. Fortunately, these physical variations do not affect the BASIC statements used to store and access data files.

Other variations occur in the way data are recorded on disks. A disk can be recorded on one or both sides and in more or less space, depending on the disk drive system. A double-density system records twice as much data in the same space as a single-density system. A quad-density system is double-density recording on a system that can record both sides of a disk without "turning it over." Again, such variations do not affect the BASIC statements used to store and access data files.

Let's take a closer look at the single-density, 5-¼ inch diskette that is used by the standard disk drive available with your APPLE computer. The disk is divided into thirty-five concentric circles called tracks. Each track, in turn, is divided into thirteen or sixteen sectors, depending on whether you use DOS 3.2 or 3.3 Each sector has the capacity to store 256 bytes of information. The DOS uses three complete tracks. Therefore, the DOS 3.3 diskette has a user capacity of 496 sectors, while the DOS 3.2 user has only 403 sectors of storage capacity.

What is this thing called a byte? A *byte* is computer jargon for both a unit of computer memory and a unit of disk storage. Each byte has an electronic pattern that corresponds to one alphanumeric character of information. One letter of the alphabet, one special character, or one numeric character entered as a string (such as LET B$ = "3") takes up one byte of storage space. A twenty-character name takes twenty bytes of disk storage space. The general rule for storing strings in data files is that the amount of storage needed for each string is equal to the actual length of the string plus one byte for "overhead."

(a) How many bytes of disk storage are required by the string assigned to N$?

```
N$ = "BASIC DATA FILES ARE FUN"
```

(a) Twenty-four, plus one for "overhead" (Spaces also take one byte.)

Keeping track of disk storage requirements for alphanumeric data in strings is easy, since one character equals one byte. Numeric values not entered as strings work in much the same way. Each character in the number, the sign (if negative), and the decimal point all take one byte, plus one byte for "overhead." The trick is knowing in advance about how large each number will be so that you can approximate how much storage space will be needed for numeric entries. With string entries you can limit the size of the data field, as we showed you in Chapter 3. You cannot, however, limit the size of a numeric entry. Therefore, you must plan ahead and estimate the space requirements for your numeric file entries. The examples below give the space requirements for each entry.

234	= 3 characters +1 = 4 bytes
–127.5	= 6 characters +1 = 7 bytes
12.509	= 6 characters +1 = 7 bytes
.0002	= 5 characters +1 = 6 bytes

For a personal telephone and address directory application, let's see how much disk storage space is required for each person on file. Each data item has a defined field length.

Name	20 characters	
Address (street)	25	
City	10	
State	2	
Zip code	5	
Phone (xxx-xxx-xxxx)	12	
Age	2	(Entered as an integer number)
Birthdate (xx/xx/xx)	8	
Subtotal	84	
Overhead	7	
Total	91	

(a) How many bytes would be required to store the zip code as numeric value instead of a string? ______________________

(b) Why was a twelve-character string rather than a numeric value used for the phone number? ______________________

____

(c) How many sectors would 150 entries in the address and phone directory take up in storage? ____________________

____

(d) What is the maximum number of people you could file in your directory on one disk with a capacity of 103,000 bytes? ____________________

____

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(a) 5, plus 1 "overhead"
(b) Could not have included hyphens, which make number easier to read
(c) 92 times 150 = 13,800 bytes. 13,800 divided by 256 = 53.9, or 54 sectors (Note that if you placed all eight data items into one long string, you could save seven bytes of overhead, leaving eighty-five bytes per entry for a total of fifty sectors. This technique can save bytes per entry and, therefore, valuable storage space.)
(d) 103,000 divided by 92 = 1119

The eight items in each entry in the personal directory are called a *dataset.* A dataset consists of all data that are included in one complete transaction or entry into a data file. Grouping information by dataset and then accessing or otherwise manipulating the dataset as a group of data items makes programming and reading programs much easier.

Sequential data files can be visualized as one long, continuous stream of information, with datasets recorded one after the other. Imagine datasets recorded continuously on a magnetic tape cassette (a single, long ribbon of tape) and you have a fairly accurate image of how a sequential file looks in theory. That is how you as a file user should think of it. The truth is, a file can be partially located on one track or one sector, and partially on another, depending on the computer system and how the file was filled. Fortunately, the physical location of the file on a disk is "invisible" to the user. All you need remember is the long, continuous stream of information.

SEQUENTIAL VS RANDOM ACCESS DATA FILES

Data filing systems can use sequential data files or random access data files. The latter are explained fully in Chapters 6 and 7. Sequential data files use disk storage space more efficiently than random access data files. It will quickly become clear to you that a disk is easy to fill to capacity, despite the seemingly large number of bytes that can be stored on it. Thus, sequential files are *space-efficient.* However, it is somewhat difficult to change data stored in a sequential file. *Sequential files are designed for "permanent" information* that changes infrequently. You can change data in sequential files, but it is not as easy or efficient as in random access files, Thus, another criterion for choosing between sequential and random access data files is how often changes in data can be expected.

A third consideration is the time it takes to access information stored on a disk. When you have a large data file with loads of information, it takes more computer time to find or access a particular dataset at the end of a sequential file than it would in a random access file. To access the 450th data set in a sequential file of 475 data sets, the computer must sequentially search through 449 datasets before coming upon the 450th dataset. Using random access files, the computer can immediately access the 450th dataset without having to search through the other 449 datasets. Therefore access time is another factor in selection of sequential or random access data files.

(a) What are three factors to consider when choosing between sequential and random access data files? ______________________________

____

- - - - - - - - - - - - - - - -

(a) Storage space efficiency, changing data, and time for accessing data

INITIALIZING SEQUENTIAL DATA FILES

To prepare to use data files, you must first tell your APPLE how many different data files you plan to use at one time in your programs. When you first load the DOS, your APPLE assumes that you will use no more than three separate data files at one time and reserves enough buffer memory space for those three files. If you know that you will use more than three files at the same time in one BASIC program, then you must execute a MAXFILES command.

APPLE will allow up to sixteen files to be used at one time. The MAXFILES command tells the computer how many files you plan to use. To allocate space for eight files, use this format:

```
MAXFILES8
```

You should execute the MAXFILES command before you even load your BASIC program, since its execution will sometimes interfere with the internal pointers (explained later) set by your program. If you must execute a MAXFILES command as part of a program, make the MAXFILES command the first executable statement in your program.

The MAXFILES command actually sets aside 595 bytes of memory for each file that will be used. This space is called a buffer; it acts as a go-between for the computer and the disk data file (see Figure 1). Input information accessed from a disk file is first copied into the buffer, 256 bytes at a time. It is then available for manipulation by the program. Likewise, data to be output from the computer for recording onto the disk are first accumulated in the buffer. When the buffer is full, the information is copied from the buffer to the disk file. The buffer is a holding area for all data coming to or from a data file.

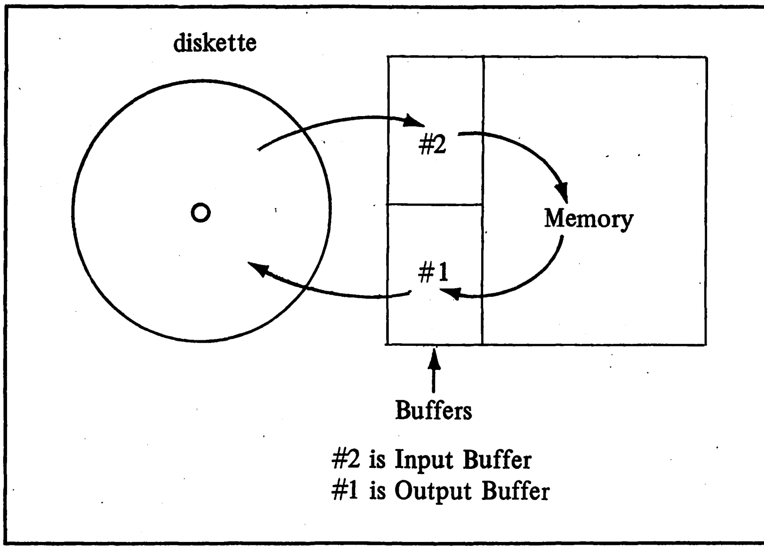

Figure 1: Data flow through buffers.

APPLESOFT BASIC statements that deal with data files fall into a special category of BASIC statements that require an unusual format to execute. These statements look like PRINT statements but are not really the same. The special format requires a PRINT followed by a CONTROL D character, followed by the executable statement:

```
100  PRINT "CONTROL D";MAXFILES5
```

While this looks easy, when you see a line such as 100 in a program listing, you will not see the CONTROL D. Control characters do not print in a program listing, so at some later time you may forget what you were trying to do. To establish a clean, readable procedure, we do the following in our programs:

1. Define the string variable D$ with the Control D character in the initialization routine at the beginning of each program, as shown below.

```
150  LET D$ =  CHR$ (4): REM    SET CONTROL D
```

2. Use D$ in all special file statements.

```
200  PRINT D$;"MAXFILES 5"
```

Notice the punctuation in line 200. A semicolon (;) follows the PRINT statement and the BASIC file statement is inside quotations marks.

Normally, the first statement in your program that relates directly to data files is the OPEN statement(s) that identify to the computer the names of the files that will be used in the program. The OPEN statement causes the computer to assign one of the buffers to the file named in the OPEN statement. A buffer is needed for each file that is open at the same time in the program. The buffer assignment is done automatically on execution of the OPEN statement; the user and programmer need do nothing. The OPEN statement searches the disk to see if the named file aready exists. If not, it readies the disk to accept a new file with the indicated home. The OPEN statement has the following form:

```
140  PRINT D$;"OPEN NAMES1"
```

This statement opens a sequential file with the name NAMES1 if none already exists, and assigns a buffer to it. Another example:

```
140  INPUT "ENTER FILE NAME:";F$
150  PRINT D$;"OPEN"F$
```

This shows that the file name can be assigned with a string variable. Line 150 opens the file designated by the user in F$.

Just as every file must be OPENed by the program, every OPEN file must be CLOSEd with a CLOSE statement before the program finishes execution. As soon as your program is through using a file, and always before the program terminates, include a CLOSE statement to close each of the files or to close all of them at once. This also completes any transaction inside the computer system that the buffer was involved in, as explained in more detail in the next section. Once a file has been closed and the buffer unassigned, the same buffer may be used again by the program if you open new files. Here are some examples of CLOSE statements:

```
800  PRINT D$;"CLOSE NAMES1"

810  PRINT D$;"CLOSE"F$

820  PRINT D$;"CLOSE"
```

The Buffer Problem

CLOSE is a vitally important statement and, in most cases, is used to maintain the integrity and accuracy of your data files. Recall that the buffer acts as a go-between for the computer and the disk system. When you *output* data from the computer to the disk file, the data go first to the buffer. Then, when the buffer is full (256 bytes), the data are output and recorded onto the disk. This is often referred to as *updating the disk file.*

What happens if the buffer is only partly full of data and there are no more data to finish filling it? You might expect the half-full buffer to simply transfer its contents to the disk for recording when the program finishes execution. But it won't do that. The data in the half-filled buffer will not necessarily be recorded into the file; your file, therefore, may not contain all the information you expected. One important purpose of the CLOSE statement is to force the buffer to transfer its contents to the data file even though the buffer is not full. As a rule of thumb, any program with an

OPEN statement should have a CLOSE statement that is always executed before the program terminates. If you get trapped with a program that aborts or terminates and the buffer still contains data, CLOSE can be executed in direct mode, forcing the buffer to transfer its contents to the disk file. However, to have to do so indicates poor programming technique and would be completely unacceptable in a work environment. Further instructions on writing your programs to always execute a CLOSE statement are given later in the chapter.

(a) What are two purposes of the CLOSE statement?

____

____

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(a) To unassign the buffer and to force the buffer to transfer its contents to the disk data file.

Our APPLE reference material states that the buffer will automatically "flush" (transfer its contents to the disk data file) under normal conditions if the program executes an OPEN to the same file, CLOSE or MAXIFILES, or if the user switches languages by typing INT or FP (for Integer Basic or Floating-Point Basic). Don't count on anything else to flush the buffer! To repeat: Always include a CLOSE statement that is executed before the program terminates, so that buffer-flushing is automatic. You should only force buffer-flushing under emergency conditions, and then you should use the CLOSE statement in direct mode.

The buffer-flushing problem – and it is a real problem – makes it imperative that you *never* remove a disk from the disk drive if the disk contains an open file. Be certain all files are closed before you remove the disk from the drive, or you may find yourself with data from a half-filled buffer placed in the wrong file on the wrong disk, which can create some nasty errors. Be cautious, and remember that data go first to the buffer. They then transfer to the disk file once the buffer is full. If the buffer is not full, force it to transfer the data to the disk file with the CLOSE statement.

(a) If you are outputting data in a program to a data file and the program accidentally terminates without executing a CLOSE statement, what should you do?

____

____

– – – – – – – – – – – – – – –

(a) Close the file with a CLOSE statement in direct mode.

WRITING DATA TO A SEQUENTIAL DATA FILE

You have learned to set up communication between your APPLE and the disk system with the OPEN and CLOSE statement. Now you will learn how to place data into a file; that is, actually record data onto the disk. APPLESOFT BASIC does this using a special WRITE statement followed by a PRINT statement. The procedure is a little tricky, mainly because you have to plan the sequence of operation in your program.

To write to a file, you must use a PRINT D$ statement with a WRITE statement to begin the WRITE operation.

```
360 PRINT D$; "WRITE DEMO1"
```

Once you start the WRITE operation, any normal PRINT statement that follows will cause data to be printed to the file, rather than printed to the screen or printer. You can see how this is done in the next program segment in lines 360 and 370. The PRINT statement, then, actually causes the data to be printed to the file (after going first to the buffer). The WRITE operation is terminated by a blank PRINT D$ statement, like this:

```
410 PRINT D$
```

An INPUT statement INPUT N$ by itself will also terminate the file WRITE operation. However, an INPUT with a prompt string (INPUT "ENTER NAME:"; N$) will place unwanted data in your file by printing the prompt string message (ENTER NAME:) to your file before terminating the write-to-file operation.

In our example, we want to enter data from the keyboard, and then write the data to the disk file. We then enter more data and write it to the file. We will continue this procedure until we "signal" the computer that no more data are forthcoming, then close the file. The program creates a data file containing the information found in a school transcript showing classes taken, grades received, and units of college credit for the course. The general programming steps are shown below.

1. OPEN the file.
2. Enter the data.
3. Tell the computer to start the WRITE procedure.
4. PRINT to the file.
5. Terminate the WRITE operation.
6. Return to step 2 above.
7. CLOSE the file.

Here is our program. Read it over carefully.

```
100  REM      FILE PRINT DEMO #1
110  :
120  REM      VARIABLES USED
130  REM       N$=COURSE NAME
140  REM       G$=COURSE GRADE
150  REM       N=NUMBER OF ACADEMIC UNITS
160  :
170  REM     FILES USED
180  REM       SEQUENTIAL FILE NAME: DEMO1
190  REM       DATASET FORMAT:N$,G$,N
200  :
210  REM     INITIALIZE
220  :
230  LET D$ =  CHR$ (4)
240  PRINT D$;"OPEN DEMO1"
250  :
260  REM    'BARE BONES' DATA ENTRY MODULE
270  :
280  PRINT "TYPE 'STOP' INSTEAD OF COURSE NAME TO END DATA ENTRY."
290  INPUT "ENTER COURSE NAME:";N$
300  IF N$ = "STOP" THEN 460
310  INPUT "ENTER COURSE GRADE:";G$
320  INPUT "ENTER NUMBER OF UNITS:";N
330  :
340  REM     START FILE WRITE OPERATION
350  :
360  PRINT D$;"WRITE DEMO1"
370  PRINT N$: PRINT G$: PRINT N
380  :
390  REM    TERMINATE WRITE OPERATION
400  :
410  PRINT D$
420  PRINT : GOTO 280
430  :
440  REM     CLOSE FILE
450  :
460  PRINT D$;"CLOSE DEMO1"
470  END
```

(a) What is the name of the file used in this program? ____________________

(b) Data entry takes place in what statements? ____________________

(c) What signal is used to tell the computer there are no more data forthcoming?

____

(d) What is the purpose of line 410?

____

____

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(a) DEMO1
(b) 290, 310, 320
(c) STOP
(d) It turns OFF the file write operation before you return for more data entry.

Line 360 tells the computer to begin the write-to-file operation, also referred to as print-to-file, copy-to-file, or record-to-file operations. The PRINT statements in line

370 actually cause the data to be printed to the file (buffer). You can only PRINT one data item to the file with each PRINT statement. You cannot easily use one statement to print all three items as you would likely do if you were using a PRINT statement to display data on the screen or printer. Rather than use three separate PRINT statements on three different lines, we have chosen to complete the file PRINTing on one multiple-statement line (see line 370). The three data items are called a dataset, PRINTed to the file by us on one line. This method creates one file PRINT statement in the program, making it easier to check the program for errors.

Before the program returns for more data entry, the WRITE operation must be terminated. The blank or empty PRINT D$ statement at line 410 terminates the WRITE. Notice that there is no punctuation following the D$. Strange happenings can occur in programs when you accidentally place a semicolon after the D$.

The final operation is the CLOSE routine at line 460.

(a) What causes the program to execute line 460?

____

____

– – – – – – – – – – – – – – – –

(a) The operator enters "STOP" as the course name: line 300 tests for "STOP" and branches to 460 to CLOSE the file.

There are other ways to use PRINT statements to print to a file. We mention them here in case you encounter them in programs written by other people. We do NOT recommend these procedures, primarily because it is too easy to make errors as you type the statements.

For *numeric data only*, you can use either of the PRINT statements shown below to print to a file. Notice that this procedure requires only one PRINT statement to print three data items.

```
100  PRINT A;",";B;",";C
110  PRINT A;";";B;";";C
```

(a) What is the difference between the two statements?

____

____

– – – – – – – – – – – – – – – –

(a) Line 100 uses commas (",") to separate the variables; line 110 uses semicolons (";").

Notice the use of semicolons and quotations. With all that typing, you are bound to make errors. We think the procedure described earlier is easier and clearer: use one PRINT statement for each numeric variable holding data for the file.

For *alphanumeric data,* you *must* use separate PRINT statements for each string variable, as described before:

```
130  PRINT A$: PRINT B$: PRINT C$
```

A possible problem arises when you want to write information that includes commas to your file.

```
210  LET B$ = "PUBLIC, JOHN Q."
```

You would expect that the file print sequence below would cause the complete name to be printed to the file:

```
220  PRINT D$;"WRITE FILENAME"
230  PRINT B$
```

But it doesn't: The quotation marks are essentially ignored. The computer accepts the word "Public" and rejects the words ""John Q.." The only item placed on your file is the word "Public." Replacing line 210 with this statement compounds the problem even more:

```
210  INPUT "ENTER NAME:";N$
```

When RUN, the operator responds with:

```
]RUN
ENTER NAME:"PUBLIC,JOHN Q."
```

Enclosing the name in quotes, you would expect the complete name to be written to the file. Again, the computer confounds us by accepting the word "PUBLIC," rejecting "JOHN Q.," printing the error message "EXTRA INPUT IGNORED," and placing both the word PUBLIC *and* the error message on your file! And you thought this was going to be easy!

As you might expect, there is a way to program the APPLE to accept alphabetic data that includes embedded commas. The solution is to "force" quotation marks on either side of the name string variable by using the CHR$() function. CHR$(34) is the ASCII code for the quote (") symbol. Here is a PRINT statement that will accept and print to the file any alphabetic information that includes commas:

```
230  PRINT  CHR$ (34);: PRINT N$;: PRINT  CHR$ (34)
```

Note carefully the format and the use of semicolons and colons. The typing alone in the statement above may cause you anxiety. However, you need to worry about forcing quotation marks only when your string includes commas. This should not happen often and with careful planning it may never be necessary.

As noted earlier, using files requires planning. Your plan should consider:

1. What to include in each dataset.
2. How large each data item or dataset will be.
3. Whether technical points, such as imbedded commas in strings, must be handled with special techniques.
4. How to test each data item in the dataset as completely as possible for accuracy and validity.

With these considerations in mind, here is a program to help you place a simple inventory from your home or business into a disk file. The introductory module and possible checks for data validity are included.

```
100  REM      INVENTORY FILE LOAD PROGRAM
110  :
120  REM      VARIABLES USED
130  REM        T$=DESCRIPTION(20 CHAR.MAX.)
140  REM        N = NUMBER OF ITEMS
150  REM        V = DOLLAR VALUE
160  REM        D$ = CONTROL D
170  REM        R$=USER RESPONSE
180  :
190  REM      FILES USED
200  REM        SEQUENTIAL FILE NAME: PROPERTY
210  REM        DATASET FORMAT: T$,N,V
220  :
230  REM      INITIALIZE
240  :
250  LET D$ =  CHR$ (4)
260  PRINT D$;"OPEN PROPERTY"
270  :
280  REM      DATA ENTRY ROUTINES
290  :
300  INPUT "ENTER ITEM DESCRIPTION:";T$
310  IF  LEN (T$) = 0 THEN  PRINT : PRINT "PLEASE ENTER AS REQUESTED.":
     PRINT : GOTO 300
320  IF  LEN (T$) > 20 THEN  PRINT : PRINT "PLEASE ABBREVIATE TO 20
     CHARACTERS OR LESS.": PRINT : GOTO 300
330  INPUT "HOW MANY ITEMS:";N
340  IF N <  >  INT (N) THEN  PRINT : PRINT "ENTER INTEGERS ONLY, PLEASE.":
     PRINT : GOTO 330
350  IF N <  = 0 THEN  PRINT : PRINT "THERE MUST BE SOME UNITS! PLEASE
     ENTER A QUANTITY." : PRINT : GOTO 330
360  INPUT "WHAT IS THE DOLLAR VALUE OF EACH:";V
370  IF V <  = 0 THEN  PRINT : GOTO 460
380  PRINT D$;"WRITE PROPERTY"
390  PRINT T$: PRINT N: PRINT V
400  PRINT D$
410  :
420  PRINT : GOTO 300
430  :
440  REM     ERROR MESSAGE MODULE
450  :
460  INPUT "DID YOU REALLY MEAN ZERO VALUE, YES OR NO:";R$
470  IF  LEFT$ (R$,1) <  > "Y" AND  LEFT$ (R$,1) <  > "N" THEN  PRINT :
     PRINT "PLEASE TYPE 'Y' FOR YES OR 'N' FOR NO.": PRINT : GOTO 460
480  IF  LEFT$ (R$,1) = "N" THEN  PRINT : PRINT "REENTER THE CORRECT
     VALUE.": PRINT : GOTO 360
490  GOTO 380
500  :
510  REM     FILE CLOSE ROUTINE
520  :
530  PRINT D$;"CLOSE PROPERTY"
540  :
550  END
```

(a) What is the purpose of the blank PRINT D$ statement in line 400?

(b) The above program has one small but important "bug." Find and describe the error.

(a) To turn OFF the WRITE operation so you can resume data entry
(b) The program never executes the file closing routine at line 530; the CLOSE statement is needed to assure flushing the last data items from the buffer to the file.

The problem of how to indicate to the program when to close the file is part of replanning. The program should include a way for the user to indicate to the computer that the user is done with the program for now, or that all data have been entered. Either of the two procedures shown below could be included in the previous program for this purpose. The choice is yours.

```
295  PRINT "TYPE 'STOP' IF NO MORE DATA. OTHERWISE,"
315  IF T$ = "STOP" THEN 530
```

or

```
405  INPUT "IS THERE MORE DATA TO ENTER (Y OR N)?";R$
406  IF  LEFT$ (R$,1) < > "Y" AND  LEFT$ (R$,1) < > "N" THEN  PRINT :
     PRINT "PLEASE TYPE 'Y' FOR YES OR 'N' FOR NO": PRINT : GOTO 405
407  IF  LEFT$ (R$,1) = "N" THEN 530
```

Now enter and RUN the program, creating a sequential data file named PROPERTY, which you will use later. This procedure works for terminating a program and closing files which contain discrete datasets, as have been described in the inventory program. But what about a variable length dataset – one with no predefined field lengths, such as a data file of recipes or a file of letters? How do you indicate to the program when one recipe or letter ends and another begins? And then, how can the computer "sense" the end of such data when inputting or reading back from the recorded data file?

One popular procedure is to place a flag or "dummy" character at the end of each dataset as a separator. The dummy character could be any character that would never be part of or found in the data. An asterisk (*) is often used as a dummy separator. Here is one way to insert such markers into the data file.

```
322  INPUT "IS THIS THE END OF ONE DATASET?";R$
323  REM   Y OR N DATA TEST GOES HERE
324  IF  LEFT$ (R$,1) = "Y" THEN  PRINT D$;"WRITE FILENAME": PRINT "*":
     PRINT D$: GOTO 410
```

A word of advice! When you write file programs (or any program for that matter) prepare some written documentation for yourself and other users. At least some description of the file layout is needed. Without written documentation, even you may have trouble seeing how the program works six months from now. A good procedure is to include such information in REM statements in the program itself as part of the introductory module.

(a) Why is it important to inform the computer that all data to be included in the data file have been entered?

(a) so that a CLOSE statement can be executed to flush an unfilled buffer

And a word of extreme caution: When you WRITE to a file after an OPEN statement, you destroy any previous data that may be in that file! If you reuse a file, and place data into it from the beginning, you destroy the previous information that was placed in the file – but not completely. What happens is that some of the new data overwrite the old data (old data are erased and new data are recorded on the same disk space), but some of the old data may still be in the file! That means that when you use the file, you may have some of the new data you want and some old data you thought were destroyed. There is a way out of this mess. Follow these steps when you first initialize your file and you can be sure you have completely destroyed all previous data. Remember though, reuse only data files in which the old data are no longer of use.

```
140  PRINT D$;"OPEN FILENAME"
150  PRINT D$;"DELETE FILENAME"
160  PRINT D$;"OPEN FILENAME"
```

You must first OPEN the file before you DELETE it. This is done because the DELETE instruction first looks for a data file with the specified file name. If there is no file by that name, the DELETE statement will cause an error message and your program will stop altogether. You can see that using the first OPEN statement prevents the potential error condition. The moral of this lesson is think twice before you begin to WRITE to a file. Make sure the file is either new or deleted before you start to write new data into it; otherwise, you may end up with a file that contains a lot of "garbage."

Now you create a data file using the inventory program shown above. The data file should include several datasets and a procedure to inform the computer that all data have been entered, so that the file can be properly closed. Do NOT include a routine that places a dummy separator between datasets. The file you create will be used in another program later in this chapter.

READING DATA FROM A FILE

Now that you can output data from the computer to the data file, let's examine how to input or read data back into the computer's memory from an existing disk file. To do this, the most important thing to know is how the data were placed in the file in the first place; that is, what order and format a dataset has in the file. After that, reading from a file is simple and straightforward, with none of the complications that can accompany writing to a file.

To read from a file, first OPEN the file as you did for the PRINT to file operation. You then use a PRINT D$ statement to begin the READ operation. Any INPUT statements that follow the READ statement will input data to the computer from the file. The READ operation is terminated by a blank PRINT D$ statement, as before.

```
120  PRINT D$;"OPEN FILENAME"
130  PRINT D$;"READ FILENAME"
140  INPUT A$,B,C$
150  PRINT D$
```

Notice the use of commas to separate the variables in line 140 above.

It is important that the variables in the INPUT statements be the correct variable type (string or numeric) to match the data that appear next in the file. If the INPUT statement "looks" for numeric data in the file to assign to a numeric variable (B), and the next file data item is alphanumeric, then your program may terminate in an error condition or, perhaps worse, it will continue with bad data. If the INPUT statement looks for string data and the next file item is numeric, the number will be accepted and assigned to the string variable.

Is that good or bad? While the problem of having an open file and the program stopping in an error condition is avoided and the new problem of having invalid data takes its place – and after all that error checking at data entry time to place accurate data into the file in the first place. To avoid such hassels, be sure you know how the data were initially placed into the file, whether numeric or string data; and if strings, how long. Your documentation should show the format of your dataset, at least in the section of the program showing the variables used.

Returning to the simple inventory file named PROPERTY described earlier in the chapter, recall that the alphanumeric description (T$), followed by number of units (N), followed by value (V) were placed in the file in that order. The variable names T$, N, and V were used in the program when the data were printed to the file. The variable names themselves are separate from the data items. Therefore, you can use any appropriate string or numeric variable name in the INPUT statement when data are read from the file, as long as they match the variable type in the file, numeric or string.

(a) Which of the following statements is appropriate to input data from the inventory data file named PROPERTY?

1) 270 INPUT A,B,C
2) 270 INPUT A$,B,C
3) 270 INPUT D1$,Q,D

(a) Statements 2 and 3 are both acceptable.

Below is the companion program to the property inventory file program, to read the PROPERTY file and print a simple screen report with the data. Enter and RUN the program. Make sure the disk containing the datafile called PROPERTY is in the disk drive.

REF-pg 92

```
100  REM      READ DATA FROM PROPERTY FILE
110  :
120  REM      VARIABLES USED
130  REM        T$=DESCRIPTION
140  REM        N=NUMBER OF ITEMS
150  REM        V=DOLLAR VALUE
160  REM        D$ = CONTROL D
170  :
180  REM      FILES USED
190  REM       SEQUENTIAL FILE NAME: PROPERTY
200  REM       DATASET FORMAT:T$,N,V
210  :
220  REM      INITIALIZE
230  :
240  LET D$ =  CHR$ (4)
250  PRINT D$;"OPEN PROPERTY"
260  :
270  REM      PRINT HEADINGS
280  :
290  PRINT : PRINT "DESCRIPTION"; TAB( 22);"QUANTITY"; TAB( 33);"VALUE":
     PRINT
300  :
310  REM      FILE READ ROUTINE/PRINT REPORT
320  :
330  PRINT D$;"READ PROPERTY"
340  INPUT T$,N,V
350  PRINT D$
360  PRINT T$, TAB( 22);N; TAB( 33);V
370  GOTO 330
380  :
390  REM      CLOSE FILE ROUTINE
400  :
410  PRINT D$;"CLOSE PROPERTY"
420  END
```

```
RUN
DESCRIPTION              QUANTITY    VALUE

FILES                    2           49
COMPUTERS                1           4500
CLASSES                  24          5
DISKS                    15          4.25
```

(a) What is the line number of the statement that begins the READ operation?

____

(b) What is the line number of the statement that terminates the READ operation?

____

(c) What is the purpose of line 360?

____

- - - - - - - - - - - - - - - -

(a) line 330
(b) line 350
(c) Displays the report on the screen

This RUN terminated in an error condition with the message END OF DATA. This was an aborted end to the program execution. What if you wanted to do more with the data and did not want the program to terminate when the end of the data file was reached? A technique exists that allows the program to read to the end of the file without the program stopping at that point. To understand the technique, you must know how the data file "pointer" works. What follows is not an exact explanation of how the APPLE works, but it serves to explain how to detect the end of the file. The procedures used do, indeed, work on the APPLE.

Just as with regular READ and DATA statements in BASIC, the data file uses a pointer to point "to" the next data item available in the buffer holding data from the disk file. When a file is opened, the pointer is positioned automatically at the beginning of the file and points to the first data item. Each execution of a file INPUT statement or a file PRINT statement pushes that pointer forward as many places as there are variables in the statement-variable list.

`10 PRINT A$` moves the pointer one position, to the place where the second data item may be recorded.

`20 INPUT N,N$` moves the pointer past data items 1 and 2 to item 3. The pointer is always looking at the position of the next available data ietm.

`30 INPUT W,X,Y,Z` moves the pointer four places, so the next data item read by an INPUT statement will be the fifth data item

When your program uses a PRINT statement to add data to a file, each PRINT statement moves the pointer and an end-of-file marker ahead one position. When all data have been entered, the end-of-file marker is located just past the last data item. The end-of-file marker is automatically put in place by the computer.

When you INPUT data from the file, the file pointer is always looking at the next data item available in the file (or in the buffer, to be more exact). An attempt to INPUT the end-of-file marker or anything beyond the last item of data results in an error condition that can be detected using the ONERR statement. The end-of-file error number is number five (5). Here are the statements needed to detect the end-of-file condition.

```
220  ONERR  GOTO 300
230  PRINT D$;"READ FILENAME"
240  INPUT A$,B
      :
      :
300  IF  PEEK (222) = 5 THEN  PRINT D$;"CLOSE": GOTO 800
```

Line 220 sets the error condition test. Notice that we placed it before the READ operation, since it does not have to be set more than once. One execution of line 220 sets the error condition trap, which continues in effect until the program stops execution or until another ONERR statement is executed during the program RUN. Line 300 tests to be sure that the error detected is the end-of-file condition. If it is, the file is closed.

You can modify the previous program so that it does not terminate with an END-OF-DATA error condition. Make these changes to your program.

```
325  ONERR  GOTO 410
      :
410  IF  PEEK (222) = 5 THEN 430
420  PRINT "UNUSUAL FILE ERROR. PROGRAM TERMINATED."
430  PRINT D$;"CLOSE PROPERTY"
440  END
```

An alternative modification would be as follows:

```
410  IF  PEEK (222) = 5 THEN  PRINT D$;"CLOSE PROPERTY": GOTO 440
```

With either "fix," the file will be properly closed.

A reminder: This is NOT a precise description of how the end-of-file mark works on the APPLE. However, while the explanation has been simplified, the procedures described to detect the end of a file do work correctly on your APPLE.

(a) In the program to read and display PROPERTY, with the end-of-data error trap included, under what conditions is line 420 executed?

____

____

\- - - - - - - - - - - - - - - -

(a) If the error detected by ONERR is not the out-of-data error

PERMANENTLY REMOVING FILES FROM DISKS

Situations will arise when you want to erase a data file from a disk. It may be a temporary file such as those created for demonstration programs in this book or a file that is of no further use to you for other reasons. Use the DELETE command. Using this command deletes the file named after the command from the disk, destroying the file's contents and deleting all reference to the file from the disk file directory. DELETE is a system command that is entered and executed like RUN or LIST. DELETE can also be used in an executable statement in APPLESOFT BASIC, but we discourage this use except, perhaps, for very temporary files. Here is the form:

```
DELETE FILENAME
```

Use the file destroying command very carefully, as the action is irreversible. Once the file has been deleted, there is no going back. Accidentally destroying the wrong file, especially if you have not made a backup copy, can mean that you wasted hours or days entering data into a file. Think carefully before using DELETE.

Be sure you understand the difference between DELETE and CLOSE. CLOSE merely disassociates a buffer from the file it was assigned to and flushes the buffer contents onto the disk if you are outputting data. After a CLOSE statement, the data file is still recorded on the disk. DELETE eliminates the file entirely from the disk, as well as all reference to it in the file directory.

We have used the word "copy" to describe how the INPUT statement works when data are transferred from the disk data file into the computer's memory. Copy implies that the data in the file do not change when they are input into the part of the computer's electronic memory designated as the buffer. The data in the file are unaffected and unchanged and remain in the file for another use. The only way to change data in a data file is with a WRITE and PRINT statement.

You can fill a file with data and read from the same file in the same program. But you must always CLOSE a file after outputting or recording information into it *before* you can reopen the file for input or copying data back into the computer memory. You must OPEN to output, then CLOSE and OPEN to read back the data. This procedure resets the file pointer to the beginning of the file.

The following program illustrates the procedure to open and close the files at the appropriate times. Quality assurance data are entered from a manufacturing process into a file. The program will read the QA values from the file and accumulate the number of responses in each category (1 through 6) in an array, and then print the results. The program is self-documented by REM statements.

```
RUN
QUALITY CONTROL MEASUREMENTS:
ACCUMULATED RESULTS

QA NUMBER          QUANTITY

1                  6
2                  5
3                  2
4                  10
5                  9
6                  2
```

```
100  REM     FILE INPUT/OUTPUT DEMO
110  :
120  REM     PROGRAM TO ENTER QUALITY CONTROL RESULTS
130  REM     INTO FILE.  PREPARE SIMPLE REPORT
140  REM     FROM FILE
150  :
160  REM     VARIABLES USED
170  REM       F$ = FILE
180  REM       N = QUALITY ASSURANCE MEASURE
190  REM       V = QUALITY ASSURANCE MEASURE
200  REM       C() = COUNTING ARRAY
210  REM       D$ = CONTROL D
220  :
230  REM     FILES USED
240  REM      SEQUENTIAL FILE NAME (USER ENTERED): QUALITY CONTROL
250  REM      DATASET FORMAT:N (EACH DATASET IS ACTUALLY ONE NUMERIC VALUE)
260  :
270  REM     INITIALIZE
280  :
290  LET D$ =  CHR$ (4)
300  :
310  INPUT "ENTER FILE NAME:";F$
320  PRINT D$;"OPEN"F$
330  :
340  REM     DATA ENTRY ROUTINE
350  :
360  PRINT : PRINT "ENTER INTEGER NUMBERS 1-6 ONLY "
370  PRINT "ENTER '99' WHEN DONE ENTERING DATA.": PRINT
380  INPUT "QA NUMBER:";N
390  IF N = 99 THEN 510
400  IF N < 1 OR N > 6 THEN  PRINT "PLEASE ENTER 1-6 ONLY": GOTO 380
410  :
420  REM   WRITE-TO-FILE ROUTINE
430  :
440  PRINT D$;"WRITE"F$
450  PRINT N
460  PRINT D$
470  GOTO 380
480  :
490  REM     CLOSE FILE
500  :
510  PRINT D$;"CLOSE"F$
520  :
530  REM     OPEN FILE TO READ
540  :
550  PRINT D$;"OPEN"F$
560  :
570  REM     READ FILE AND ACCUMULATE IN ARRAY
580  :
590  ONERR  GOTO 670
600  PRINT D$;"READ"F$
610  INPUT V
620  LET C(V) = C(V) + 1
630  GOTO 610
640  :
650  REM     ERROR TEST
660  :
670  IF  PEEK (222) = 5 THEN 730
680  PRINT "UNUSUAL ERROR. STOP PROGRAM"
690  STOP
700  :
710  REM     PRINT REPORT FROM ARRAY
720  :
730  POKE 216,0
740  HOME
750  PRINT : PRINT "QUALITY CONTROL MEASUREMENTS:"
760  PRINT "ACCUMULATED RESULTS": PRINT
770  PRINT "QA NUMBER","QUANTITY": PRINT
780  FOR V = 1 TO 6
790  PRINT V,C(V)
800  NEXT V
810  :
820  REM     CLOSE FILE
830  :
840  PRINT D$;"CLOSE"F$
850  END
```

Refer to the program on p. 101 to answer the following questions:

(a) Through which statement does the computer obtain the name of the data file?

____

(b) Which statement checks the parameters for the quality control numbers?

____

(c) How does the computer know that all data have been entered? ____________

____

(d) Why are two CLOSE statements used in the same program? ____________

____

(e) What does line 590 do? ________________________________

____

(f) In line 620, how many different values can V have? ________________

\- - - - - - - - - - - - - - -

(a) line 310
(b) line 400
(c) user enters 99 as input value
(d) the data file must be closed after output and after input
(e) sets trap for end-of-data error
(f) six (1 to 6)

Help us write another program that first creates a data file called TEST, and then displays the contents of that data file. Complete lines 280, 320, 410, 470, 550, 590, 630, 670, 710, and 750. (Read the REMs and comments.)

```
100  REM     DATAFILE DEMONSTRATION
110  :
120  REM     VARIABLES USED
130  REM        A$ = OUTPUT VARIABLE
140  REM        B$ = INPUT VARIABLE
150  REM        D$ = CONTROL D
160  REM        X = FOR NEXT LOOP CONTROL VARIABLE
170  :
180  REM     FILE USED
190  REM       SEQUENTIAL FILE NAME: TEST
200  REM       DATASET FORMAT: A$ (DATASET IS ONE STRING DATA ITEM)
210  :
220  REM    INITIALIZE
230  :
240  LET D$ =  CHR$ (4)
250  :
260  REM     OPEN THE FILE
270  :
280  ______________________________________________________________
290  :
300  REM     START WRITE OPERATION
310  :
320  ______________________________________________________________
330  :
340  REM    USING A FOR-NEXT LOOP, PLACE 8 STRINGS INTO A DATA FILE
350  :
360  FOR X = 1 TO 8
370  LET A$ = "TEST" +  STR$ (X)
380  :
390  REM     PRINT TO THE FILE
400  :
410  ______________________________________________________________
420  :
430  NEXT X
440  :
450  REM   CLOSE THE FILE
460  :
470  ______________________________________________________________
480  :
490  REM     A PRINT STATEMENT TO TELL US ALL IS WELL, SO FAR
500  :
510  PRINT "FILE WRITTEN AND CLOSED"
520  :
530  REM    REOPEN THE FILE
540  :
550  ______________________________________________________________
560  :
570  REM    SET END-OF-DATA ERROR TRAP
580  :
590  ______________________________________________________________
600  :
610  REM    START THE READ OPERATION
620  :
630  ______________________________________________________________
640  :
650  REM    INPUT DATA ITEM
660  :
670  ______________________________________________________________
680  :
690  REM    TERMINATE READ OPERATION
700  :
710  ______________________________________________________________
720  :
730  REM    PRINT TO THE SCREEN
740  :
750  ______________________________________________________________
760  GOTO 630
770  :
780  REM     CLOSE FILE
790  :
800  IF  PEEK (222) = 5 THEN 820
810  PRINT : PRINT "UNUSUAL ERROR. PROGRAM TERMINATED.": PRINT
820  PRINT D$;"CLOSE TEST"
830  PRINT "FILE CLOSED."
840  END
```

\- - - - - - - - - - - - - - -

(a) 280 PRINT D$;"OPEN TEST"
(b) 320 PRINT D$;"WRITE TEST"
(c) 410 PRINT A$
(d) 470 PRINT D$;"CLOSE TEST"
(e) 550 PRINT D$;"OPEN TEST"
(f) 590 ONERR GOTO 800
(g) 630 PRINT D$;"READ TEST"
(h) 670 INPUT B$
(i) 710 PRINT D$
(j) 750 PRINT B$

(a) Now show everything that will be printed or displayed when this program is RUN.

____

\- - - - - - - - - - - - - - -

(a)

```
]RUN
FILE WRITTEN AND CLOSED
TEST1
TEST2
TEST3
TEST4
TEST5
TEST6
TEST7
TEST8
FILE CLOSED
```

One unique feature of file programs is that sometimes nothing appears to be happening when the program is RUN. There may be no printed report or any CRT display other than RUN and READY. To the novice, this seeming lack of activity may be alarming. Be forewarned.

(a) Which statements in the previous program help assure the user that "invisible" data file activity has taken place? ______________________

- - - - - - - - - - - - - - - -

(a) lines 290 and 450

A final word about the blank PRINT D$ statement that we have used to terminate the READ or WRITE operation: If you follow our examples and procedures in your own programming, everything should work in your file-related programming. However, when you start to deviate from our procedures, you can run into some real problems.

We have been repeatedly warned by other people that there are times when the blank PRINT D$ statement will not work. On investigation (it never happened to us), we discovered that file PRINT statements must always end with a carriage return. If your most recent PRINT to file statement ends with a comma or semicolon, then a blank PRINT D$ statement will not terminate the WRITE operation. As a matter of fact, it will place the code for a Control D in your file and your file will end up filled with garbage.

```
250  PRINT D$;"WRITE FILENAME"
260  PRINT A$,
270  PRINT D$
```

Line 270 does NOT turn off the WRITE operation because of the comma at the end of line 260.

If you ignore our file programming procedures, which never use a PRINT to file statement that ends with a comma or semicolon, you must use the ASCII code signal for a carriage return, which is CHR$(13), before a READ or WRITE operation can be terminated. The procedure is to first PRINT CHR$(13), to force a carriage return, and then to PRINT D$. This forces a carriage return into your file. Some programmers do the following:

```
340  PRINT  CHR$ (13) +  CHR$ (4)
```

CHR$(13) puts in the carriage return. CHR$(4) turns off the READ or WRITE condition.

Now you are probably saying, "I'll just always use the CHR$(13) + CHR$(4) technique. That will solve the problem forever." Not so! If you always print a carriage return before the blank PRINT D$, you will be placing an "extra" carriage return in your file. This could ruin your future file reading because of the dataset format problem (the extra carriage return here and there looks like a distinct data item to the computer) and would certainly foul the operation of the end-of-file check that you use. The easiest way to resolve this problem is to make sure your program is nice and "clean."

CHAPTER 4 SELF-TEST

The problems in this self-test require you to write programs to store data in data files and then to write companion programs to display the data in those data files. All data files that you create in this self-test will be used in Chapter 5, *so don't skip this section.* The introductory module is given so your solutions will look something like the solution provided. Save the programs and files for later use, modification, and reference. Try your solutions (and debugging the programs) before looking at the solutions provided. Believe me, our "first draft" programs had to be debugged, too! Good luck and keep on hackin'.

1 a. Write a program to fill a data file with the information and format specified below:

Four data items per dataset.
First two data items are strings.
Second two data items are numeric values entered as strings.
Include data entry checks for null strings.
For the numeric values assigned to strings, include data entry tests to see that only numeric values were entered. Then convert these strings to numeric values assigned to numeric variables before storing them in the data file.
Place at least three datasets in the data file. Name this file CUST.

```
100  REM    SOLUTION TO CH4 SELFTEST PROB 1A
110  :
120  REM     VARIABLE LIST
130  REM       A$, B$ = ALPHA DATA
140  REM       M$,M, N$,N =NUMERIC DATA
150  REM       D$ = CONTROL D
160  REM       R$ = USER RESPONSE
170  :
180  REM    FILE USED
190  REM       SEQUENTIAL FILE NAME: CUST
200  REM       DATASET FORMAT: A$,B$,M,N
```

1 b. Write a companion program to display the contents of the data file named CUST that you created in 1 a.

2 a. Write a program to make a data file called GROCERY that stores your grocery shopping list. Include the description or name of each grocery item (maximum of twenty characters) and a numeric value telling the quantity of that item to buy. Store at least six datasets in the file.

```
100  REM   SOLUTION CH4 SELFTEST PROB 2A
110  :
120  REM     VARIABLES USED
130  REM      N$ = ITEM DESCRIPTION
140  REM      Q = QUANTITY TO ORDER
150  REM      D$ = CONTROL D
160  REM      R$ = USER RESPONSE
170  REM      F$ = USER ENTERED FILE NAME
180  :
190  REM     FILES USED
200  REM      SEQUENTIAL FILE NAME: GROCERY (USER ENTERED)
210  REM      DATASET FORMAT: N$,Q
```

2 b. Write a companion program to display the contents of GROCERY.

```
]RUN
ENTER NAME OF FILE:GROCERY

ITEM                QUANTITY

BEANS               80
BREAD               3
MILK                5
BUTTER              3

FILE CLOSED
```

3 a. Write a program to enter the following data in a data file for a customer credit file maintained by a small business. Each dataset consists of three items:
1. five-digit customer number (must have exactly five digits)
2. customer name (twenty characters maximum)
3. customer credit rating (a single digit number 1, 2, 3, 4, or 5)
Include data entry checks for null entries and for the parameters set forth in the list above. Enter at least three datasets in the data file. Remember, the customer numbers must be different for each customer and should be in *ascending* order, i.e., each larger than the previous one, such as 19652, 19653, 19654, etc. Name this file CREDIT.

```
100  REM     SOLUTION CH4 SELFTEST PROB 3A
110  REM     CREDIT FILE LOADER
120  :
130  REM     VARIABLES USED
140  REM      F$ = FILE NAME
150  REM      C$ = CUSTOMER # (5 CHAR.)
160  REM      N$ = CUST. NAME (20 CHAR.MAX.)
170  REM      R$ AND R = CREDIT RATING (1 CHAR)
180  REM      D$ = CONTROL D
190  REM      Q$ = USER RESPONSE
200  :
210  REM     FILES USED
220  REM       SEQUENTIAL  FILE NAME: CREDIT (USER ENTERED)
230  REM      DATASET FORMAT: C$,N$,R
240  :
```

3 b. Write a companion program to display the contents of the file named CREDIT. Our RUN looks like this.

```
ENTER FILE NAME:TRANSACTION-1
10782
1
57

18102
2
6.12

43611
1
4.34

43611
2
58.95

43611
2
88.5

80223
1
450

98702
2
43.45
 ALL DATA DISPLAYED AND FILE CLOSED
```

4 a. Write a program to enter data into a transaction data file. A transaction file is the data on a business transaction, such as that of a bank, a retail store, or a mail-order business. For our example, each transaction produces a dataset with three items, as shown below:

Account number = five characters
Transaction code = two characters (for a bank, 1 = check, 2 = deposit, etc.)
Cash amount = seven characters (9999.99 maximum amount)

Include data entry checks for null entries and for the parameters set forth above. Check cash amount entries for non-numeric characters, except the decimal point. Your program should allow the user to select (input) a name for the data file.

Create two different data files with your program, with seven datasets (seven transactions) in each data file. Name file #1, TRANSACTION-1, and name file #2, TRANSACTION-2. Use the account numbers given below for the two files. For duplicate account numbers, make a complete dataset entry, so that each of the two files contain seven datasets.

file #1	file #2
10762	10761
18102	18203
43611	43611
43611	80111
43611	80772
80223	80772
98702	89012

Note: Only the account numbers are shown here; the complete datasets also include transaction codes and amounts.

```
110 :
120  REM      VARIABLES USED
130  REM       F$ = USER ENTERED FILE NAME
140  REM       D1$ = DATASETS FROM FILE 1,2
150  REM       A$ = ACC'T NUMBER (5 CHAR.)
160  REM       T$ = TRANSACTION CODE (1 CHAR.)
170  REM       C$ = CASH AM'T (9999.99 OR 7 CHAR.MAX.)
180  REM       I = FOR NEXT LOOP CONTROL VARIABLE
190  REM       D$ = CONTROL D
200 :
210  REM      FILES USED
220  REM       SEQUENTIAL FILE NAMES: TRANSACTION 1, TRANSACTION 2 (USER
     SELECTED AND ENTERED)
230  REM       DATASET FORMAT: A$,T$,C$
240 :
```

4 b. Write a companion program to display the contents of a data file with the above dataset format. Again, the file name should be user entered so that it can be used to display the contents of TRANSACTION-1 or TRANSACTION-2.

Our sample RUN:

```
]RUN
FILE NAME:TRANSACTION-2

A/C#               T-CODE             AMOUNT

10781              1                  33.33
18203              2                  21
43811              2                  500
80111              1                  54.58
80772              1                  54.68
80772              1                  88.88
89012              2                  485.77
FILE PRINTED AND CLOSED
```

5 a. Write a program to load a data file named ADDRESS with (surprise!) names and addresses. The data has the format shown below, with each dataset containing five items in fields with one string

			55	
/1	20/21	40/41	50/12/53	57/
name	address	city	state	zip code

Include appropriate data entry checks and field padding routines. Enter at least four addresses in the data file.

```
100  REM   SOLUTION CH4 SELFTEST PROB 5A
110  :
120  REM     VARIABLES USED
130  REM        N$ = NAME(20)
140  REM        A$ = STREET ADDRESS(20)
150  REM        C$ = CITY(10)
160  REM        S$ = STATE(2)
170  REM        Z$ = ZIP CODE(5)
180  REM        E$ = CONCATENATED DATASET(57)
190  REM        D$ = CONTROL D
200  REM        R$ = USER RESPONSE
210  :
220  REM     FILE USED
230  REM        SEQUENTIAL FILE NAME: ADDRESS
240  REM        DATASET FORMAT:C$ (ONE STRING)
```

5 b. Write a companion program to display the contents of ADDRESS. Here is our sample RUN.

```
]RUN
JERALD R. BROWN
13140 FRATI LANE
SEBASTOPOL
CA
95472

REGGIE JACKSON
#1 BALLPARK RD
EVERYWHERE
US
00000

JACK SPRAT
1 LEAN DRIVE
SKINNYVILL
EA
00003

FILE CLOSED
```

6 a. Write one program and use it to create three different data files called LETTER1, LETTER2, and LETTER3. Each file should contain the text of a form letter with at least three lines of text per letter. Each line of text in the letters is to be entered and stored as one dataset.

```
100  REM    SOLUTION CH4 SELFTEST PROB6A
110  :
120  REM     VARIABLES USED
130  REM      T$ = TEXT LINE
140  REM      F$ = FILE NAME
150  REM      D$ = CONTROL D
160  REM      R$ = USER RESPONSE
170  :
180  REM     FILES USED
190  REM       SEQ. FILE NAME: LETTER#
200  REM       (#, IS USER SELECTED & ENTERED)
210  :
```

6 b. Write a companion program to display the data files above selected by the user. Our sample RUN:

```
]RUN
ENTER FORM LETTER NUMBER:1
YOU ARE HEREBY INFORMED THAT ALL ELECTRICAL SERVICE TO YOUR AREA WILL BE
DISCONTINUED AS OF JAN. 1. WE HOPE THIS WILL NOT INCONVENIENCE YOU.
FILE CLOSED
```

Answer Key

1 a.

```
100  REM     SOLUTION TO CH4 SELFTEST PROB 1A
110  :
120  REM      VARIABLE LIST
130  REM         A$, B$ = ALPHA DATA
140  REM         M$,M, N$,N =NUMERIC DATA
150  REM         D$ = CONTROL D
160  REM         R$ = USER RESPONSE
170  :
180  REM     FILE USED
190  REM         SEQUENTIAL FILE NAME: CUST
200  REM         DATASET FORMAT: A$,B$,M,N
210  :
220  REM     INITIALIZE
230  :
240  LET D$ =  CHR$ (4)
250  PRINT D$;"OPEN CUST"
260  :
270  REM       DATA ENTRY ROUTINE
280  :
290  INPUT "ENTER DATA ITEM:";A$
300  IF  LEN (A$) = 0 THEN  PRINT "PLEASE ENTER SOMETHING": GOTO 290
310  INPUT "ENTER DATA ITEM 2:";B$
320  IF  LEN (B$) = 0 THEN  PRINT "LEASE ENTER SOME DATA": GOTO 310
330  INPUT "ENTER NUMERIC DATA:";M$
340  IF  LEN (M$) = 0 THEN  PRINT : PRINT "PLEASE ENTER SOMETHING": PRINT :
     GOTO 330
350  IF  VAL (M$) = 0 THEN  PRINT : PRINT "PLEASE ENTER NUMBERS ONLY":
     PRINT : GOTO 330
360  LET M =  VAL (M$)
370  INPUT "ENTER NUMERIC ITEM 2:";N$
380  IF  LEN (N$) = 0 THEN  PRINT : PRINT "PLEASE ENTER SOMETHING": PRINT :
     GOTO 370
390  IF  VAL (N$) = 0 THEN  PRINT : PRINT "PLEASE ENTER NUMBERS ONLY":
     PRINT : GOTO 370
400  LET N =  VAL (N$)
410  :
420  REM     WRITE TO FILE
430  :
440  PRINT D$;"WRITE CUST"
450  PRINT A$: PRINT B$: PRINT M: PRINT N
460  PRINT D$
470  INPUT "MORE DATA?";R$
480  IF  LEFT$ (R$,1) <  > "Y" AND  LEFT$ (R$,1) <  > "N" THEN  PRINT :
     PRINT "TYPE 'Y' FOR YES OR 'N' FOR NO.": PRINT : GOTO 470
490  IF R$ = "Y" THEN 290
500  :
510  REM      CLOSE FILE
520  :
530  PRINT D$;"CLOSE CUST"
540  PRINT "FILE CLOSED"
550  END
```

1 b.

```
100  REM    SOLUTION TO CH4 SELFTEST PROB 1B
110  :
120  REM   VARIABLES USED
130  REM      A$,B$ = ALPHA DATA
140  REM      M,N = NUMERIC DATA
150  REM      D$ = CONTROL D
160  :
170  REM   FILE USED
180  REM       SEQUENTIAL FILE NAME: CUST
190  REM       DATASET FORMAT:A$,B$,M,N
200  :
210  REM    INITIALIZE
220  :
230  LET D$ =  CHR$ (4)
240  PRINT D$;"OPEN CUST"
250  :
260  REM   INPUT DATA FROM FILE & DISPLAY
270  :
280  ONERR  GOTO 370
290  PRINT D$;"READ CUST"
300  INPUT A$,B$,M,N
310  PRINT D$
320  PRINT A$: PRINT B$: PRINT M: PRINT N: PRINT
330  GOTO 290
340  :
350  REM      CLOSE FILE
360  :
370  IF  PEEK (222) = 5 THEN 390
380  PRINT : PRINT "UNUSUAL ERROR. PROGRAM TERMINATED.": PRINT
390  PRINT D$;"CLOSE CUST"
400  PRINT "ALL DATA DISPLAYED AND FILE CLOSED"
410  END
```

2 a.

```
100  REM   SOLUTION CH4 SELFTEST PROB 2A
110  :
120  REM     VARIABLES USED
130  REM      N$ = ITEM DESCRIPTION
140  REM      Q = QUANTITY TO ORDER
150  REM      D$ = CONTROL D
160  REM      R$ = USER RESPONSE
170  REM      F$ = USER ENTERED FILE NAME
180  :
190  REM     FILES USED
200  REM      SEQUENTIAL FILE NAME: GROCERY (USER ENTERED)
210  REM      DATASET FORMAT: N$,Q
220  :
230  REM     INITIALIZATION
240  :
250  LET D$ =  CHR$ (4)
260  INPUT "ENTER NAME OF FILE:";F$
270  PRINT D$;"OPEN"F$
280  PRINT D$;"DELETE"F$
290  PRINT D$;"OPEN"F$
300  :
310  REM     DATA ENTRY ROUTINE
320  :
330  HOME
340  PRINT "ENTER 'STOP' WHEN ALL DATA IS ENTERED.": PRINT
350  INPUT "ENTER ITEM DESCRIPTION:";N$
360  IF N$ = "STOP" THEN 550
370  IF  LEN (N$) = 0 THEN  PRINT : PRINT "PLEASE ENTER A DESCRIPTION OR
     'STOP'": PRINT :_ GOTO 350
380  IF  LEN (N$) > 20 THEN  PRINT : PRINT "SHORTEN DESCRIPTION TO 20
     CHARS. AND REENTER": PRINT : GOTO 350
390  INPUT "ENTER QUANTITY:";Q
400  IF Q >  = 1 AND Q < 10 THEN 480
410  PRINT "YOU ENTERED A QUANTITY OF ";Q
420  INPUT "IS THAT WHAT YOU WANTED?";R$
430  IF  LEFT$ (R$,1) <  > "Y" AND  LEFT$ (R$,1) <  > "N" THEN  PRINT :
     PRINT "TYPE 'Y' FOR YES OR 'N' FOR NO": PRINT : GOTO 410
440  IF  LEFT$ (R$,1) = "N" THEN 390
450  :
460  REM     WRITE TO FILE ROUTINE
470  :
480  PRINT D$;"WRITE"F$
490  PRINT N$: PRINT Q
500  PRINT D$
510  GOTO 330
520  :
530  REM     CLOSE FILE
540  :
550  PRINT D$;"CLOSE"F$
560  PRINT "FILE CLOSED"
570  END
```

2 b.

```
100  REM    SOLUTION CH4 SELFTEST PROB 2B
110  :
120  REM     VARIABLES USED
130  REM      N$ = ITEM DESCRIPTION
140  REM      Q = QUANTITY TO ORDER
150  REM      D$ = CONTROL D
160  REM      F$ = USER ENTERED FILE NAME
170  :
180  REM     FILES USED
190  REM      SEQUENTIAL FILE NAME: GROCERY (USER ENTERED)
200  REM      DATASET FORMAT: N$,Q
210  :
220  REM     INITIALIZATION
230  :
240  LET D$ =  CHR$ (4)
250  INPUT "ENTER NAME OF FILE:";F$
260  PRINT D$;"OPEN"F$
270  :
280  REM     READ AND PRINT FILE
290  :
300  PRINT : PRINT "ITEM","QUANTITY": PRINT
310  ONERR  GOTO 400
320  PRINT D$;"READ"F$
330  INPUT N$,Q
340  PRINT D$
350  PRINT N$,Q
360  GOTO 320
370  :
380  REM      CLOSE FILE
390  :
400  IF  PEEK (222) = 5 THEN 420
410  PRINT : PRINT "UNUSUAL ERROR. PROGRAM TERMINATED": PRINT : GOTO 420
420  PRINT D$;"CLOSE"F$
430  PRINT : PRINT "FILE CLOSED"
440  END
```

3 a.

```
100  REM     SOLUTION CH4 SELFTEST PROB 3A
110  REM     CREDIT FILE LOADER
120  :
130  REM     VARIABLES USED
140  REM      F$ = FILE NAME
150  REM      C$ = CUSTOMER # (5 CHAR.)
160  REM      N$ = CUST. NAME (20 CHAR.MAX.)
170  REM      R$ AND R = CREDIT RATING (1 CHAR)
180  REM      D$ = CONTROL D
190  REM      Q$ = USER RESPONSE
200  :
210  REM     FILES USED
220  REM       SEQUENTIAL  FILE NAME: CREDIT (USER ENTERED)
230  REM      DATASET FORMAT: C$,N$,R
240  :
250  REM     INITIALIZE
260  :
270  LET D$ =  CHR$ (4)
280  HOME
290  INPUT "ENTER FILE NAME:";F$
300  PRINT D$;"OPEN"F$
310  PRINT D$;"DELETE"F$
320  PRINT D$;"OPEN"F$
330  :
340  REM     DATA ENTRY ROUTINE
350  :
360  PRINT "ENTER 'STOP' WHEN FINISHED ENTERING DATA.": PRINT
370  INPUT "ENTER CUSTOMER NUMBER:";C$
380  IF C$ = "STOP" THEN 670
390  IF  LEN (C$) = 0 THEN  PRINT : PRINT "ENTER NUMBERS OR TYPE 'STOP'":
     PRINT : GOTO 370
400  IF  LEN (C$) <  > 5 THEN  PRINT : PRINT "ENTRY ERROR. NUMBER HAS 5
     DIGITS.": PRINT : GOTO 370
410  IF  VAL (C$) = 0 THEN  PRINT : PRINT "ENTRY ERROR. NUMBERS ONLY,
     PLEASE.": PRINT : GOTO 290
420  :
430  PRINT : INPUT "ENTER CUSTOMER NAME:";N$
440  IF  LEN (N$) = 0 THEN  PRINT "PLEASE ENTER A NAME, NOW.": GOTO 430
450  IF  LEN (N$) > 20 THEN  PRINT "PLEASE LIMIT NAME TO 20 CHARS AND
     REENTER.": GOTO 430

460  :
470  PRINT : INPUT "CREDIT RATING:";R$
480  IF  LEN (R$) <  > 1 THEN  PRINT "ONLY A ONE DIGIT NUMBER IS
     ACCEPTABLE.": GOTO 470
490  IF  VAL (R$) < 1 OR  VAL (R$) > 5 THEN  PRINT "NUMBERS 1-5 ONLY,
     PLEASE.": GOTO 470
500  LET R =  VAL (R$)
510  :
520  REM     PRINT TO FILE
530  :
540  PRINT D$;"WRITE"F$
550  PRINT C$: PRINT N$: PRINT R
560  PRINT D$
570  :
580  REM    MORE DATA ROUTINE
590  :
600  HOME
610  INPUT "DO YOU HAVE MORE DATA TO ENTER?";Q$
620  IF  LEFT$ (Q$,1) <  > "Y" AND  LEFT$ (Q$,1) <  > "N" THEN  PRINT :
     PRINT "ENTER 'Y' FOR YES OR 'N' FOR NO": PRINT : GOTO 610
630  IF  LEFT$ (Q$,1) = "Y" THEN 360
640  :
650  REM    CLOSE FILE
660  :
670  PRINT D$;"CLOSE"F$
680  PRINT "JOB COMPLETED"
690  END
```

3 b.

```
100  REM     SOLUTION CH4 SELFTEST PROB 3B
110  REM       CREDIT FILE DISPLAY
120  :
130  REM       VARIABLES USED
140  REM         F$ = USER ENTERED FILE NAME
150  REM         C$ = CUST. #
160  REM         N$ = CUST. NAME
170  REM         R = CREDIT RATING
180  REM         D$ = CONTROL D
190  :
200  REM       FILES USED
210  REM         SEQUENTIAL FILE NAME: CREDIT (USER ENTERED)
220  REM         DATASET FORMAT: C$,N$,R
230  :
240  REM       INITIALIZE
250  :
260  LET D$ =  CHR$ (4)
270  HOME
280  INPUT "ENTER FILE NAME:";F$
290  PRINT D$;"OPEN"F$
300  :
310  REM       READ/PRINT FILE
320  :
330  ONERR  GOTO 420
340  PRINT D$;"READ"F$
350  INPUT C$,N$,R
360  PRINT D$
370  PRINT C$: PRINT N$: PRINT R: PRINT
380  GOTO 340
390  :
400  REM       CLOSE FILE
410  :
420  IF  PEEK (222) = 5 THEN 440
430  PRINT : PRINT "UNUSUAL ERROR. PROGRAM TERMINATED": PRINT
440  PRINT D$;"CLOSE"F$
450  PRINT " ALL DATA DISPLAYED AND FILE CLOSED"
460  END
```

4 a.

```
100  REM   SOLUTION CH4 SELFTEST PROB 4A
110  :
120  REM     VARIABLES USED
130  REM      F$ = USER ENTERED FILE NAME
140  REM      D1$ = DATASETS FROM FILE 1,2
150  REM      A$ = ACC'T NUMBER (5 CHAR.)
160  REM      T$ = TRANSACTION CODE (1 CHAR.)
170  REM      C$ = CASH AM'T (9999.99 OR 7 CHAR.MAX.)
180  REM      X = FOR NEXT LOOP CONTROL VARIABLE
190  REM      D$ = CONTROL D
200  :
210  REM     FILES USED
220  REM      SEQUENTIAL FILE NAMES: TRANSACTION 1, TRANSACTION 2 (USER
     SELECTED AND ENTERED)
230  REM      DATASET FORMAT: A$,T$,C$
240  :
250  REM     INITIALIZATION
260  :
270  LET D$ =  CHR$ (4)
280  INPUT "ENTER FILE NAME:";F1$
290  PRINT D$;"OPEN"F1$
300  PRINT D$;"DELETE"F1$
310  PRINT D$;"OPEN"F1$
320  :
330  REM     DATA ENTRY/TESTS
340  :
350  HOME
360  PRINT "ENTER -1 TO END DATA ENTRY"
370  PRINT : INPUT " ENTER ACCOUNT NUMBER (5 DIGITS):";A$
380  IF A$ = "-1" THEN 620
390  IF  VAL (A$) = 0 THEN  PRINT "PLEASE MAKE AN ENTRY.": GOTO 370
400  IF  LEN (A$) <  > 5 THEN  PRINT "YOU ENTERED ";A$;" PLEASE REENTER.":
     GOTO 370
410  INPUT "ENTER TRANSACTION CODE(1 DIGIT):";T$
420  IF  VAL (T$) = 0 THEN  PRINT "PLEASE MAKE AN ENTRY.": GOTO 410
430  IF  LEN (T$) <  > 1 THEN  PRINT "YOU ENTERED ";T$;" PLEASE REENTER.":
     GOTO 410
440  INPUT "ENTER THE AMOUNT:";C$
450  IF  VAL (C$) = 0 THEN  PRINT "PLEASE MAKE AN ENTRY.": GOTO 440
460  IF  VAL (C$) > 9999.99 THEN  PRINT : PRINT "MAXIMUM AMOUNT IS 9999.99.
     PLEASE REENTER.": PRINT : GOTO 440
470  FOR X = 1 TO  LEN (C$)
480  IF  ASC ( MID$ (C$,X,1)) >  = 48 AND  ASC ( MID$ (C$,X,1)) <  = 57 OR
     ASC ( MID$ (C$,X,1)) = 46 THEN 500
490  PRINT "INVALID ENTRY. ONLY NUMBERS AND DECIMAL POINTS ALLOWED.": GOTO
     440
500  NEXT X
510  :
520  REM     PRINT TO FILE
530  :
540  PRINT D$;"WRITE"F1$
550  PRINT A$: PRINT T$: PRINT C$
560  PRINT D$
570  HOME
580  GOTO 360
590  :
600  REM    CLOSE FILE
610  :
620  PRINT D$;"CLOSE"F1$
630  PRINT "FILE CLOSED"
640  END
```

4 b.

```
100  REM    SOLUTION CH4 SELFTEST PROB 4B
110  :
120  REM     VARIABLES USED
130  REM      F$ = USER ENTERED FILE NAME140
140  REM      A$ = ACCOUNT NUMBER
150  REM      T$ = TRANSACTION CODE
160  REM      C$ = CASH AMOUNT
170  REM      X = FOR NEXT LOOP CONTROL VARIABLE
180  REM      D$ = CONTROL D
190  :
200  REM     FILES USED
210  REM      SEQ.FILE NAMES: TRANSACTION-1, TRANSACTION-2 (USER SELECTED
     AND ENTERED)
220  REM      DATASET FORMAT:A$,T$,C$
230  :
240  REM     INITIALIZATION
250  :
260  LET D$ =  CHR$ (4)
270  INPUT "FILE NAME:";F$
280  PRINT D$;"OPEN"F$
290  HOME
300  :
310  REM     READ/DISPLAY
320  :
330  PRINT : PRINT "A/C#","T-CODE","AMOUNT": PRINT
340  ONERR  GOTO 430
350  PRINT D$;"READ"F$
360  INPUT A$,T$,C$
370  PRINT D$
380  PRINT A$,T$,C$
390  GOTO 350
400  :
410  REM     CLOSE FILE
420  :
430  IF  PEEK (222) = 5 THEN 450
440  PRINT : PRINT "UNUSUAL ERROR. PROGRAM TERMINATED.": PRINT
450  PRINT D$;"CLOSE"F$
460  PRINT "FILE PRINTED AND CLOSED"
470  END
```

5 a.

```
100  REM   SOLUTION CH4 SELFTEST PROB 5A
110  :
120  REM     VARIABLES USED
130  REM        N$ = NAME(20)
140  REM        A$ = STREET ADDRESS(20)
150  REM        C$ = CITY(10)
160  REM        S$ = STATE(2)
170  REM        Z$ = ZIP CODE(5)
180  REM        E$ = CONCATENATED DATASET(57)
190  REM        D$ = CONTROL D
200  REM        R$ = USER RESPONSE
210  :
220  REM     FILE USED
230  REM        SEQUENTIAL FILE NAME: ADDRESS
240  REM        DATASET FORMAT:C$ (ONE STRING)
250  :
260  REM     INITIALIZE
270  :
280  LET D$ =  CHR$ (4)
290  PRINT D$;"OPEN ADDRESS"
300  HOME
310  :
320  REM     DATA ENTRY
330  :
340  INPUT "ENTER NAME:";N$
350  IF  LEN (N$) < 20 THEN  LET N$ = N$ + " ": GOTO 350
360  :
370  INPUT "ENTER ADDRESS:";A$
380  IF  LEN (A$) < 20 THEN  LET A$ = A$ + " ": GOTO 380
390  :
400  INPUT "ENTER CITY NAME:";C$
410  IF  LEN (C$) < 10 THEN  LET C$ = C$ + " ": GOTO 410
420  :
430  INPUT "ENTER STATE CODE:";S$
440  IF  LEN (S$) <  > 2 THEN  PRINT "PLEASE ENTER A 2 CHAR CODE.": GOTO
     430
450  :
460  INPUT "ENTER ZIP CODE:";Z$
470  IF  LEN (Z$) <  > 5 THEN  PRINT "PLEASE ENTER 5-DIGIT CODE.": GOTO 460
480  :
490  LET E$ = N$ + A$ + C$ + S$ + Z$
500  :
510  PRINT D$;"WRITE ADDRESS"
520  PRINT E$
530  PRINT D$
540  :
550  INPUT "MORE ENTRIES?";R$
560  IF  LEFT$ (R$,1) <  > "Y" AND  LEFT$ (R$,1) <  > "N" THEN  PRINT :
     PRINT "ENTER 'Y' FOR YES OR 'N' FOR NO": PRINT : GOTO 550
570  IF  LEFT$ (R$,1) = "Y" THEN  HOME : GOTO 340
580  :
590  REM     CLOSE FILE
600  :
610  PRINT D$;"CLOSE ADDRESS"
620  PRINT "FILE CLOSED"
630  END
```

5 b.

```
100  REM    SOLUTION CH4 SELFTEST PROB 5B
110  :
120  REM     VARIABLES USED
130  REM        E$ = CONCATENATED DATASET
140  REM        D$ = CONTROL D
150  :
160  REM      FILE USED
170  REM        SEQ. FILE NAME: ADDRESS
180  REM        DATASET FORMAT: E$ (ONE STRING)
190  :
200  REM     INITIALIZE
210  :
220  LET D$ =  CHR$ (4)
230  PRINT D$;"OPEN ADDRESS"
240  HOME
250  :
260  REM     READ FILE/PRINT
270  :
280  ONERR  GOTO 420
290  PRINT D$;"READ ADDRESS"
300  INPUT E$
310  PRINT D$
320  PRINT  LEFT$ (E$,20)
330  PRINT  MID$ (E$,21,20)
340  PRINT  MID$ (E$,41,10)
350  PRINT  MID$ (E$,51,2)
360  PRINT  RIGHT$ (E$,5)
370  PRINT
380  GOTO 290
390  :
400  REM     CLOSE FILES
410  :
420  PRINT D$;"CLOSE ADDRESS"
430  PRINT "FILE CLOSED"
440  END
```

6 a.

```
100  REM    SOLUTION CH4 SELFTEST PROB6A
110  :
120  REM     VARIABLES USED
130  REM      T$ = TEXT LINE
140  REM      F$ = FILE NAME
150  REM      D$ = CONTROL D
160  REM      R$ = USER RESPONSE
170  :
180  REM     FILES USED
190  REM       SEQ. FILE NAME: LETTER#
200  REM       (# IS USER SELECTED & ENTERED)
210  :
220  REM     INITIALIZE
230  :
240  LET D$ =  CHR$ (4)
250  INPUT "ENTER LETTER FILE NUMBER:";F$
260  LET F$ = "LETTER" + F$
270  PRINT D$;"OPEN"F$
280  :
290  REM    DATA ENTRY
300  :
310  HOME
320  PRINT "ENTER TEXT LINE.  USE QUOTES AT BEGINNING AND END"
330  INPUT "TEXT LINE:";T$
340  :
350  PRINT D$;"WRITE"F$
360  PRINT  CHR$ (34);: PRINT T$;: PRINT  CHR$ (34)
370  PRINT D$
380  INPUT "MORE ENTRIES:";R$
390  IF  LEFT$ (R$,1) <  > "Y" AND  LEFT$ (R$,1) <  > "N" THEN  PRINT :
     PRINT "ENTER 'Y' FOR YES AND 'N' FOR NO": PRINT :310
400  IF  LEFT$ (R$,1) = "Y" THEN 310
410  :
420  REM     CLOSE FILE
430  :
440  PRINT D$;"CLOSE"F$
450  PRINT "FILE CLOSED"
460  END
```

6 b.

```
100  REM     SOLUTION CH4 SELFTEST PROB 6B
110  :
120  REM      VARIABLES USED
130  REM      T$ = TEXT LINE
140  REM      F$ = FILE NAME
150  REM      D$ = CONTROL D
160  REM      R$ = USER RESPONSE
170  :
180  REM      FILES USED
190  REM       SEQ. FILE NAME: LETTER#
200  REM       (WHERE # IS USER SELECTED & ENTERED)
210  REM       DATASET FORMAT:T$ (ONE STRING)
220  :
230  REM      INITIALIZE
240  :
250  LET D$ =  CHR$ (4)
260  INPUT "ENTER FORM LETTER NUMBER:";F$
270  LET F$ = "LETTER" + F$
280  PRINT D$;"OPEN"F$
290  :
300  REM     READ FILE
310  :
320  HOME
330  ONERR  GOTO 420
340  PRINT D$;"READ"F$
350  INPUT T$
360  PRINT D$
370  PRINT T$
380  GOTO 340
390  :
400  REM      CLOSE FILE
410  :
420  IF  PEEK (222) = 5 THEN 440
430  PRINT : PRINT "UNUSUAL ERROR. PROGRAM TERMINATED.": PRINT
440  PRINT D$;"CLOSE"F$
450  PRINT "FILE CLOSED"
460  END
```

CHAPTER FIVE

Sequential Data File Utility Programs

Objectives: When you finish this chapter you will be able to:

1. Write a program to add data to an existing sequential file.
2. Write a program to make a copy of a sequential data file.
3. Write a program to change the data in an existing sequential file.
4. Write a program to examine the contents in a sequential file and to change, add, or delete data.
5. Write a program to merge the contents of two sequential files into one file, maintaining the numeric or alphabetic order of the data.
6. Write a program that uses or combines selected data from more than one sequential file.

Now that you understand the BASIC statements to create and use sequential data files, let's build on this with more advanced techniques, including writing some file utility programs that help in your overall programming using data files. You will also develop embryonic file applications to practice what you have learned and provide a basis from which to develop personally useful programs. Most of the data files used in this chapter are created with programs you should have written for the Chapter 4 Self-Test, so if you skipped that, go back and write those programs before starting this chapter.

ADDING DATA TO THE END OF A SEQUENTIAL FILE

Unlike other versions of BASIC, it is quite easy to add data to the end of an existing APPLESOFT sequential file. To accomplish this you must APPEND your file rather than OPEN it. When you OPEN a file, the file pointer is moved to the first position in that file so that all subsequent file WRITE operations take place from the beginning of the file (recall the problem that arises when you attempt to overwrite an existing file). When you APPEND to an existing file, however, the file pointer is moved to the end of the file data, so that subsequent file WRITE operations take place starting after the last piece of existing data, and new data are added or appended beyond the previous end of the file. The file WRITE procedure is the same as the one used when the file was OPENed. The file APPEND statement looks like the other file operation statements:

```
100  PRINT D$;"APPEND FILENAME"
```

The only "hitch" we have found with the file APPEND operation is that you can only APPEND to an existing file. If you attempt an APPEND operation to a file not previously OPENed, the error condition – FILE NOT FOUND – will abort your program. To get around this problem (there's always a way), we will use this procedure:

```
200  PRINT D$;"OPEN FILENAME"
210  PRINT D$;"CLOSE FILENAME"
220  PRINT D$;"APPEND FILENAME"
```

Let's try an easy application. Assume you are using your personal computer to prepare a grocery list for your periodic trips to the grocery store (see problem 2 of the Chapter 4 Self-Test). Or better yet, in this modern electronic age, your list can be telecommunicated to the store of your choice and the goods will be ready for your pickup, with no shopping needed! In any event, every few days you think of new items to be added to the list to be entered into your APPLE and added to the file. Each dataset consists of one twenty-character string for the item description and one numeric value for the quantity of the item needed. With one program, you can enter the first items into the file and subsequent items as you think of them.

Here is the introductory module:

```
100  REM    APPEND DATA TO EXISTING FILE
110  :
120  REM     VARIABLES USED
130  REM      N$ = ITEM DESCRIPTION
140  REM      Q = QUANTITY TO ORDER
150  REM      D$ = CONTROL D
160  REM      R$ = USER RESPONSE
170  REM      F$ = USER ENTERED FILE NAME
180  :
190  REM     FILES USED
200  REM      SEQUENTIAL FILE NAME: GROCERY (USER ENTERED)
210  REM      DATASET FORMAT* N$,Q
220  :
```

(a) To complete the next program segment, fill in 270, 280, and 290.

```
220  :
230  REM    INITIALIZE
240  :
250  LET D$ =  CHR$ (4)
260  INPUT "ENTER FILE NAME:";F$
270
280
290
300  :
```

(a)

```
220 :
230  REM      INITIALIZE
240 :
250  LET D$ =  CHR$ (4)
260  INPUT "ENTER FILE NAME:";F$
270  PRINT D$;"OPEN"F$
280  PRINT D$;"CLOSE"F$
290  PRINT D$;"APPEND"F$
300 :
```

Here is the data entry routine with five blank lines for you to fill in. Use these clues:

Line 370 - test for stop entry.
Line 380 - test for null entry.
Line 390 - test for maximum entry length.
Line 420 - test for minimum entry of 1 and maximum entry of 10.
Line 460 - test for user response of N or NO and branch accordingly.

(a)

```
300 :
310  REM      DATA ENTRY ROUTINE
320 :
330  HOME
340  PRINT "TYPE 'STOP' WHEN ALL ITEMS ARE ENTERED."
350  PRINT
360  INPUT "ENTER ITEM DESCRIPTION:";N$
370
380
390
400 :
410  INPUT "ENTER QUANTITY:";Q
420
430  PRINT "YOU ENTERED A QUANTITY OF:";Q
440  INPUT "IS THAT WHAT YOU WANTED?";R$
450  IF  LEFT$ (R$,1) <  > "N" AND  LEFT$ (R$,1) <  > "Y" THEN  PRINT
     CHR$ (7);"PLEASE TYPE 'Y' FOR YES OR 'N' FOR NO.": PRINT : GOTO 430
460
470 :
```

(a)

```
300 :
310  REM      DATA ENTRY ROUTINE
320 :
330  HOME
340  PRINT "TYPE 'STOP' WHEN ALL ITEMS ARE ENTERED."
350  PRINT
360  INPUT "ENTER ITEM DESCRIPTION:";N$
370  IF N$ = "STOP" THEN 570
380  IF  LEN (N$) = 0 THEN  PRINT : PRINT "PLEASE ENTER A DESCRIPTION OR
     'STOP'": PRINT : GOTO 360
390  IF  LEN (N$) > 20 THEN  PRINT : PRINT "PLEASE LIMIT DESCRIPTION TO 20
     CHARS.MAX.": PRINT : GOTO 360
400 :
410  INPUT "ENTER QUANTITY:";Q
420  IF Q >  = 1 AND Q <  = 10 THEN 500
430  PRINT "YOU ENTERED A QUANTITY OF:";Q
440  INPUT "IS THAT WHAT YOU WANTED?";R$
450  IF  LEFT$ (R$,1) <  > "N" AND  LEFT$ (R$,1) <  > "Y" THEN  PRINT  CHR$
     (7);"PLEASE TYPE 'Y' FOR YES OR 'N' FOR NO.": PRINT : GOTO 430
460  IF  LEFT$ (R$,1) = "N" THEN 410
470 :
```

The file WRITE routine should be familiar since it is the same procedure you used in the last chapter. Fill in lines 500, 510, and 520.

(a)
```
470 :
480  REM      WRITE TO FILE ROUTINE
490 :
500
510
520
530  GOTO 330
540 :
550  REM      CLOSE FILE
560 :
570  PRINT D$;"CLOSE"F$
580  PRINT : PRINT "NEW DATA APPENDED AND FILE CLOSED."
590  END
```

(a)
```
470 :
480  REM      WRITE TO FILE ROUTINE
490 :
500  PRINT D$;"WRITE"F$
510  PRINT N$: PRINT Q
520  PRINT D$
530  GOTO 330
540 :
550  REM      CLOSE FILE
560 :
570  PRINT D$;"CLOSE"F$
580  PRINT : PRINT "NEW DATA APPENDED AND FILE CLOSED."
590  END
```

Following is a complete listing of the program you have developed:

```
100  REM    APPEND DATA TO EXISTING FILE
110  :
120  REM     VARIABLES USED
130  REM      N$ = ITEM DESCRIPTION
140  REM      Q = QUANTITY TO ORDER
150  REM      D$ = CONTROL D
160  REM      R$ = USER RESPONSE
170  REM      F$ = USER ENTERED FILE NAME
180  :
190  REM     FILES USED
200  REM      SEQUENTIAL FILE NAME: GROCERY (USER ENTERED)
210  REM      DATASET FORMAT* N$,Q
220  :
230  REM    INITIALIZE
240  :
250  LET D$ =  CHR$ (4)
260  INPUT "ENTER FILE NAME:";F$
270  PRINT D$;"OPEN"F$
280  PRINT D$;"CLOSE"F$
290  PRINT D$;"APPEND"F$
300  :
310  REM     DATA ENTRY ROUTINE
320  :
330  HOME
340  PRINT "TYPE 'STOP' WHEN ALL ITEMS ARE ENTERED."
350  PRINT
360  INPUT "ENTER ITEM DESCRIPTION:";N$
370  IF N$ = "STOP" THEN 570
380  IF  LEN (N$) = 0 THEN  PRINT : PRINT "PLEASE ENTER A DESCRIPTION OR_
     'STOP'": PRINT : GOTO 360
390  IF  LEN (N$) > 20 THEN  PRINT : PRINT "PLEASE LIMIT DESCRIPTION TO 20
     CHARS.MAX.": PRINT : GOTO 360
400  :
410  INPUT "ENTER QUANTITY:";Q
420  IF Q >  = 1 AND Q <  = 10 THEN 500
430  PRINT "YOU ENTERED A QUANTITY OF:";Q
440  INPUT "IS THAT WHAT YOU WANTED?";R$
450  IF  LEFT$ (R$,1) <  > "N" AND  LEFT$ (R$,1) <  > "Y" THEN  PRINT  CHR$
     (7);"PLEASE TYPE 'Y' FOR YES OR 'N' FOR NO.": PRINT : GOTO 430
460  IF  LEFT$ (R$,1) = "N" THEN 410
470  :
480  REM     WRITE TO FILE ROUTINE
490  :
500  PRINT D$;"WRITE"F$
510  PRINT N$: PRINT Q
520  PRINT D$
530  GOTO 330
540  :
550  REM     CLOSE FILE
560  :
570  PRINT D$;"CLOSE"F$
580  PRINT : PRINT "NEW DATA APPENDED AND FILE CLOSED."
590  END
```

(a) Write the corresponding program line number(s) for each step listed below.

1. Open the file for the APPEND operation. ______________________

2. Enter and test the next dataset. ______________________

3. Write the dataset to the file. ______________________

4. Close the file. ______________________

5. What must the user enter to cause the close operation to take place?

____

— — — — — — — — — — — — — — —

(a) 1. 290
    2. 310-460
    3. 480-530
    4. 570
    5. STOP

Now enter and RUN the program-appending data to the file named GROCERY. Use the program to read GROCERY (Chapter 4 Self-Test, problem 2a) to verify the success of the APPEND procedure.

You can use another procedure to add data to the end of the sequential data file or to make changes in the contents of a file. (We'll show you how to do that later.) The success of this procedure depends on how much data the file contains and the amount of available memory in your computer. The procedure uses arrays. Follow these steps:

1. OPEN the file
2. READ the file contents into one or more arrays.
3. Add to the array or change the items in the array.
4. CLOSE the file, DELETE the file.
5. OPEN the file.
6. WRITE the current array contents to the file.
7. CLOSE the file.

Use this procedure only if the file is rather small and the datasets are easy to manage (for example, when the data are all packed into one string variable). If these two circumstances are present, you are not likely to encounter errors. However, when files are large or data are placed into more than one array or into a two-dimensional array, then the probability increases that data will get lost or "forgotten," resulting in errors.

You will see this procedure used in program listings for computers other than the APPLE. For the APPLE, we recommend the APPEND procedure as illustrated in the grocery list program. It is clean and neat!

MAKING A FILE COPY

A very useful file utility program is one that makes a duplicate copy of your data file. Your APPLE system master disk is equipped with such a program. This allows you to make back-up copies of data files or copy a file from one disk to another. In this section, however, we will show you how to write such a program in BASIC. A file copy utility program in BASIC not only allows you to make back-up copies of data files, it can also be incorporated into later programs to change data in existing data files.

You now have the background to write a file copying program. Follow these steps:

1. OPEN the source or original file. (Use the file named CUST created in the Chapter 4 Self-Test.)

2. OPEN the file that will become the copy. (Name this file CUST COPY.)
3. Test the source file for end-of-data using ONERR.
4. READ the first dataset.
5. Terminate the READ operation.
6. WRITE to the copy file.
7. Terminate the WRITE operation.
8. Return to step 3 above.
9. CLOSE both files.

Assume that you are going to copy a file that contains an unknown number of datasets, with each dataset containing two twenty-five-character strings and two numeric variables. Use the file named CUST created in the Chapter 4 Self-Test. Here is the introductory module and the initialization section. Fill in the blanks in lines 260, 290, and 320 to complete steps 1 and 2 of the outline.

(a)

```
100  REM     UTILITY PROGRAM TO COPY FILES
110  :
120  REM      VARIABLES USED
130  REM        A$, B$ = STRING VARIABLES
140  REM        A,B = NUMERIC VARIABLES
150  REM        D$ = CONTROL D
160  REM         F$ = USER ENTERED SOURCE FILE NAME
170  REM        F1$ = USER ENTERED COPY FILE NAME
180  :
190  REM      FILES USED
200  REM        SEQUENTIAL SOURCE FILE NAME: CUST (USER ENTERED)
210  REM        SEQ. COPY FILE NAME: CUST COPY (USER ENTERED)
220  REM       DATASET FORMAT:A$,B$,A,B
230  :
240  REM      INITIALIZATION
250  :
260
270  INPUT "ENTER SOURCE FILE NAME:";F$
280  INPUT "ENTER COPY FILE NAME:";F1$
290
300  PRINT D$;"OPEN"F1$
310  PRINT D$;"DELETE"F1$
320
330  :
```

(a)

```
100  REM     UTILITY PROGRAM TO COPY FILES
110  :
120  REM      VARIABLES USED
130  REM        A$, B$ = STRING VARIABLES
140  REM        A,B = NUMERIC VARIABLES
150  REM        D$ = CONTROL D
160  REM         F$ = USER ENTERED SOURCE FILE NAME
170  REM        F1$ = USER ENTERED COPY FILE NAME
180  :
190  REM      FILES USED
200  REM        SEQUENTIAL SOURCE FILE NAME: CUST (USER ENTERED)
210  REM        SEQ. COPY FILE NAME: CUST COPY (USER ENTERED)
220  REM       DATASET FORMAT:A$,B$,A,B
230  :
240  REM      INITIALIZATION
250  :
260  LET D$ =  CHR$ (4)
270  INPUT "ENTER SOURCE FILE NAME:";F$
280  INPUT "ENTER COPY FILE NAME:";F1$
290  PRINT D$;"OPEN"F$
300  PRINT D$;"OPEN"F1$
310  PRINT D$;"DELETE"F1$
320  PRINT D$;"OPEN"F1$
330  :
```

The routine at lines 300, 310, and 320 is a good procedure to follow; always OPEN, then DELETE, a file to which you plan to WRITE, to avoid overprinting existing data (if any) and ending up with a possible mixture of new and old data in your file. The second OPEN statement at line 320 assures an empty OPEN file for the copy.

Here is the program module to READ from the source file and WRITE to the copy file. Fill in the blanks in lines 370, 380, 430, and 440 to complete steps 3, 4, 5, 6, 7, and 8 of the outline.

(a)
```
340  REM      READ FROM SOURCE FILE
350  :
360  ONERR  GOTO 500
370
380
390  PRINT D$
400  :
410  REM      WRITE TO COPY FILE
420  :
430
440
450  PRINT D$
460  GOTO 370
470  :
```

(a)
```
340  REM      READ FROM SOURCE FILE
350  :
360  ONERR  GOTO 500
370  PRINT D$;"READ"F$
380  INPUT A$,B$,A,B
390  PRINT D$
400  :
410  REM      WRITE TO COPY FILE
420  :
430  PRINT D$;"WRITE"F1$
440  PRINT A$: PRINT B$: PRINT A: PRINT B
450  PRINT D$
460  GOTO 370
470  :
```

And finally, the close file routine. Fill in the blank at line 490 to close both files with one CLOSE statement, completing step 9 of the outline.

(a)
```
480  REM      CLOSE FILES
490
500  IF  PEEK (222) <  > 5 THEN  PRINT : PRINT "UNUSUAL ERROR PROGRAM
     TERMINATED.": PRINT : GOTO 510
510  :
520  END
```

(a)
```
480  REM      CLOSE FILES
490  :
500  IF  PEEK (222) <  > 5 THEN  PRINT : PRINT "UNUSUAL ERROR PROGRAM
     TERMINATED.": PRINT : GOTO 510
510  PRINT D$;"CLOSE"
520  END
```

Here is a complete listing of the program you have just completed.

```
100  REM    UTILITY PROGRAM TO COPY FILES
110  :
120  REM      VARIABLES USED
130  REM        A$, B$ = STRING VARIABLES
140  REM        A,B = NUMERIC VARIABLES
150  REM        D$ = CONTROL D
160  REM         F$ = USER ENTERED SOURCE FILE NAME
170  REM        F1$ = USER ENTERED COPY FILE NAME
180  :
190  REM      FILES USED
200  REM        SEQUENTIAL SOURCE FILE NAME: CUST (USER ENTERED)
210  REM        SEQ. COPY FILE NAME: CUST COPY (USER ENTERED)
220  REM       DATASET FORMAT:A$,B$,A,B
230  :
240  REM      INITIALIZATION
250  :
260  LET D$ =  CHR$ (4)
270  INPUT "ENTER SOURCE FILE NAME:";F$
280  INPUT "ENTER COPY FILE NAME:";F1$
290  PRINT D$;"OPEN"F$
300  PRINT D$;"OPEN"F1$
310  PRINT D$;"DELETE"F1$
320  PRINT D$;"OPEN"F1$
330  :
340  REM      READ FROM SOURCE FILE
350  :
360  ONERR  GOTO 500
370  PRINT D$;"READ"F$
380  INPUT A$,B$,A,B
390  PRINT D$
400  :
410  REM      WRITE TO COPY FILE
420  :
430  PRINT D$;"WRITE"F1$
440  PRINT A$: PRINT B$: PRINT A: PRINT B
450  PRINT D$
460  GOTO 370
470  :
480  REM      CLOSE FILES
490  :
500  IF  PEEK (222) <  > 5 THEN  PRINT : PRINT "UNUSUAL ERROR PROGRAM
     TERMINATED.": PRINT : GOTO 510
510  PRINT D$;"CLOSE"
520  END
```

(a) When you RUN this program, what appears on the screen?

(a) RUN

ENTER SOURCE FILE NAME:

ENTER COPY FILE NAME:

(CURSOR)

It can be unsettling to get no more than the above display from a program when so much internal activity is supposed to be taking place. The final flashing "cursor" is the only clue that your program completed its task. But you don't know for sure that it did. We have a suggestion.

Add a statement at line 505 that prints a message indicating that the job is complete. For example,

```
505 PRINT "COPY COMPLETED"
```

A statement such as this lets you know that the program did execute past the error trap at line 500. This will verify that at least that much was done. Then add line 515 PRINT "FILE CLOSED" to indicate to the user that the program has executed past the CLOSE operation.

The blank PRINT D$ in lines 390 and 450 were placed there to terminate the operation in progress before starting a new operation. In this case, however, the termination procedure was not necessary, as a new PRINT D$ of any type terminates the previous file operation. That is, the WRITE statement in line 430 would have automatically terminated the READ from line 370. We left the blank PRINT D$ statements in our program for clarity to the reader, and encourage you to do the same. Though not always necessary, the blank PRINT D$ to terminate a file operation makes your program much more readable and avoids the question, "Is this the time CTRL D is needed or not?"

You now have a complete file-copying utility program. You can use it to copy any sequential data file by simply changing the INPUT and PRINT statements to conform to the data format or datasets in the particular data file you want to copy. We encourage you to enter and RUN this program using the datafile named CUST with the corresponding dataset format that you created in the Chapter 4 Self-Test, problem 1a.

After you have created CUST COPY, modify the program you wrote for the Chapter 4 Self-Test, problem 1b, to read and display the contents of CUST COPY. Modify lines 240, 290, and 390 in the solution we provided for Chapter 4 Self-Test, problem 1b.

(a) 240 ____________________

290 ____________________

390 ____________________

(a)
```
240  PRINT D$;"OPEN CUST COPY"
290  PRINT D$;"READ CUST COPY"
390  PRINT D$;"CLOSE CUST COPY"
```

CHANGING DATA IN A FILE

We implied earlier in this book that it is not easy to change data that are already located in a sequential data file, but it can be done. The procedure is straightforward: copy all unchanged data into a temporary file, make any changes by writing to the temporary file, and then either copy the temporary file back into the original file or use the RENAME statement. A few tricks will be explained, as you are guided in writing this program.

```
]RUN
ENTER FILE NAME:CREDIT
ENTER 'STOP' TO END DATA ENTRY.

ENTER CUSTOMER #:12345
PAUL ARMITICE CREDIT RATING: 4
ENTER NEW CREDIT RATING:5
RENAME COMPLETED
DO YOU HAVE MORE CREDIT RATING CHANGES?Y
ENTER 'STOP' TO END DATA ENTRY.

ENTER CUSTOMER #:12346
MISS PIGGY CREDIT RATING: 1
ENTER NEW CREDIT RATING:2
RENAME COMPLETED
DO YOU HAVE MORE CREDIT RATING CHANGES?NO

PROGRAM COMPLETED AS REQUESTED.
```

While the procedure outlined below is tailored to the particular dataset used in this example, the basic idea is easily adaptable to data files with different datasets.

1. OPEN the customer credit file. Use the file named CREDIT created in the Chapter 4 Self-Test.
2. OPEN a temporary file. Name this file TEMP.
3. Enter the customer number for the client whose credit rating is to be changed. Include data-entry tests and a "no more searches" option.
4. Check for end-of-data in credit file using ONERR. If end-of-data is found:
   a. display an error message indicating an unsuccessful search.
   b. CLOSE both files.
   c. return to step 1.
5. READ a complete dataset.
6. Test for wanted customer number.
7. PRINT rejected datasets to temporary file (those which are to be copied to the new file unchanged).
8. Display data; ask user to enter changes, with data entry test for the changes.
9. PRINT dataset with new data to temporary file.
10. PRINT remainder of credit file datasets (those with no changes) to temporary file.
11. CLOSE both files.
12. Copy temporary file to CREDIT file, or use the RENAME operation to make the temporary file the new corrected credit file.
13. Provide the user with the option of repeating the process.

The program will be developed one segment at a time, with blanks for you to fill in, as before. Below is the introductory module, which you should understand by now, followed by the first data entry routine with data entry checks. Read it over carefully to get the flow of the program. The first three steps of the outline are completed in this module.

```
100  REM      CREDIT FILE CHANGER
110  :
120  REM      VARIABLES USED
130  REM        F$ = FILE NAME
140  REM        C$ = CUST. #
150  REM        C1$ = CUST. #
160  REM        N$ = NAME
170  REM        R$ = ENTRY VARIABLE
180  REM        R,R1 = CREDIT RATING VALUE
190  REM        D$ = CONTROL D
200  :
210  REM      FILES USED
220  REM         SEQ.FILE NAME: CREDIT (USER ENTERED)
230  REM         TEMPORARY FILE NAME: TEMP
240  REM         DATSET FORMAT: C$,N$,R
250  :
260  REM      INITIALIZE
270  :
280  LET D$ =  CHR$ (4)
290  HOME : INPUT "ENTER FILE NAME:";F$
300  PRINT D$;"OPEN"F$
310  PRINT D$;"OPEN TEMP"
320  :
330  REM      DATA ENTRY ROUTINE
340  :
350  HOME
360  PRINT "ENTER 'STOP' TO END DATA ENTRY."
370  PRINT
380  INPUT "ENTER CUSTOMER #:";C$
390  IF C$ = "STOP" THEN 1070
400  IF  LEN (C$) = 0 THEN  PRINT "ENTER CUSTOMER NUMBER OR TYPE 'STOP'":
     GOTO 380
410  IF  LEN (C$) <  > 5 THEN  PRINT "ENTRY ERROR. REENTER WITH 5 DIGITS.":
     GOTO 380
420  IF  VAL (C$) = 0 THEN  PRINT "ENTRY ERROR.  NUMBERS ONLY.": GOTO 380
430  :
```

Now for the interesting part. The program must search through the data file for the customer number that the user entered.

(a) When searching the data file for the customer number and encountering the end of the file without finding the customer, what should the program do?

____

____

____

(b) Before another search is made for a customer number in the file, what must be done to the file?

____

____

____

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _

(a) Print an error message indicating that the customer was not in the file (see the sample RUN shown earlier).
(b) CLOSE and reOPEN the files to reset the file pointer to the beginning of the data files. (Very important!)

(a) Fill in lines 470, 480, 490, 510, 520, and 530 below. These correspond to outline steps 5, 6, and 7.

```
440  REM      FILE SEARCH ROUTINE
450  :
460  ONERR  GOTO 550
470
480
490
500  IF C$ = C1$ THEN 630
510
520
530
540  GOTO 470
550  PRINT  CHR$ (7);"ERROR MESSAGE. WE CANNOT FIND"
560  PRINT "CUSTOMER # ";C$;" ON THE FILE."
570  PRINT "PLEASE CHECK YOUR NUMBER AND REENTER."
580  PRINT D$;"CLOSE"
590  GOTO 300
600  :
```

```
440  REM      FILE SEARCH ROUTINE
450  :
460  ONERR  GOTO 550
470  PRINT D$;"READ"F$
480  INPUT C1$,N$,R
490  PRINT D$
500  IF C$ = C1$ THEN 630
510  PRINT D$;"WRITE TEMP"
520  PRINT C1$: PRINT N$: PRINT R
530  PRINT D$
540  GOTO 470
550  PRINT  CHR$ (7);"ERROR MESSAGE. WE CANNOT FIND"
560  PRINT "CUSTOMER # ";C$;" ON THE FILE."
570  PRINT "PLEASE CHECK YOUR NUMBER AND REENTER."
580  PRINT D$;"CLOSE"
590  GOTO 300
600  :
```

(a) In the solution above, why was variable C1$ used instead of C$? in line 480? (See line 380.)

____

____

____

(b) If you delete line 580 above, then RUN the program, what will happen if an incorrect customer number is entered at line 300 and then, after the error message at line 570, a correct customer number is entered?

____

____

(a) Two different assignments would have been made to C$, creating a program error. Note the error message at lines 550 to 570.

(b) The ONERR check in line 460 will detect the end of the file for both entries, and the error message will be printed after both entries. The second customer number may be valid, but since the pointer was not reset to the beginning of the file, the error message will reappear.

When the file has been searched and the correct customer found, the program prints the customer name on the screen (line 640) as a double check to the operator that the correction is being made for the right customer. Outline steps 8 and 9 are contained in this module.

```
610  REM     CUST # FOUND.  PROCEED W/ DATA ENTRY
620  :
630  HOME
640  PRINT N$;" CREDIT RATING: ";R
650  INPUT "ENTER NEW CREDIT RATING:";R$
660  IF  LEN (R$) <  > 1 THEN  PRINT "ONLY ONE DIGIT NUMBER IS
     ACCEPTABLE.": GOTO 650
670  IF  VAL (R$) < 1 OR  VAL (R$) > 5 THEN  PRINT "NUMBERS 1-5 ONLY,
     PLEASE.": GOTO 650
680  LET R1 =  VAL (R$)
690  :
700  REM    PRINT NEW INFO TO TEMP
710  :
720  PRINT D$;"WRITE TEMP"
730  PRINT C$: PRINT N$: PRINT R1
740  PRINT D$
750  :
```

In line 730, the new customer rating (R1) is written into the temporary file, along with the accompanying customer number and name. You have now completed the routines to search the original file and to place old and new data into the temporary file.

(a) Considering the location of the file pointer in the CREDIT file, what should the program do next?

(a) Write the remainder of the CREDIT file to the temporary file.

Fill in all the blanks in the program segment below, including lines 790, 800, 810, 820, 830, 840, and 910, completing steps 10 and 11 of the outline.

(a)
```
760  REM      PRINT REMAINDER OF FILE TO TEMP
770  :
780  ONERR  GOTO 890
790
800
810
820
830
840
850  GOTO 790
860  :
870  REM      CLOSE FILES
880  :
890  IF  PEEK (222) = 5 THEN 910
900  PRINT : PRINT "UNUSUAL ERROR. PROGRAM TERMINATED.": PRINT
910
920  :
```

(a)
```
760  REM      PRINT REMAINDER OF FILE TO TEMP
770  :
780  ONERR  GOTO 890
790  PRINT D$;"READ"F$
800  INPUT C$,N$,R
810  PRINT D$
820  PRINT D$;"WRITE TEMP"
830  PRINT C$: PRINT N$: PRINT R
840  PRINT D$
850  GOTO 790
860  :
870  REM      CLOSE FILES
880  :
890  IF  PEEK (222) = 5 THEN 910
900  PRINT : PRINT "UNUSUAL ERROR. PROGRAM TERMINATED.": PRINT
910  PRINT D$;"CLOSE"
920  :
```

The final program module should copy the complete temporary file back into the original credit file. We could use a file copy program like the one completed earlier in this chapter for that. However, your APPLE has a command that allows you to RENAME a program or file. It is quite easy to use:

```
100  PRINT D$;"RENAME OLD NAME,NEW NAME"
```

Or, if you are using files named in variables:

```
110  PRINT D$;"RENAME"F$,F1$
```

or

```
120  PRINT D$;"RENAME OLD NAME,"F1$
```

Note: The punctuation shown above (the comma) is very important.

Your files should be closed before you RENAME. If not, however, RENAME will close them first. There is one problem with RENAME: It does not bother to check whether there is already another program with the new name on your disk. It just moves ahead. This can result in two files on your disk with the same name – in which case you have a real problem. The solution we devised was to DELETE the old copy of the credit file before we RENAMEd the temporary file. Here is the final module of the program that completes the copy or RENAME operation, including steps 12 and 13 of our original procedure outline.

```
930  REM      DELETE/RENAME FILE
940  :
950  PRINT D$;"DELETE"F$
960  PRINT D$;"RENAME TEMP,"F$
970  PRINT "RENAME COMPLETED"
980  :
990  REM      CONTINUE REQUEST
1000 :
1010  INPUT "DO YOU HAVE MORE CREDIT RATING CHANGES?";R$
1020  IF  LEFT$ (R$,1) <  > "Y" AND  LEFT$ (R$,1) <  > "N" THEN  PRINT
      CHR$ (7);"ENTER 'Y' FOR YES OR 'N' FOR NO.": PRINT : GOTO 1010
1030  IF  LEFT$ (R$,1) = "Y" THEN 300
1040  PRINT : PRINT "PROGRAM COMPLETED AS REQUESTED."
1050  END
```

If you RUN this program with large files, each change will take considerable computer time. If you enter the data in the original file in customer number order, and also enter all changes in customer number order; the need to repeatedly execute the RENAME routine is eliminated, reducing the computer time between transactions.

Here is a complete listing of the credit file change program. You are encouraged to enter and RUN this program using the datafile named CREDIT that you created in the Chapter 4 Self-Test.

```
100  REM      CREDIT FILE CHANGER
110  :
120  REM      VARIABLES USED
130  REM        F$ = FILE NAME
140  REM        C$ = CUST. #
150  REM        C1$ = CUST. #
160  REM        N$ = NAME
170  REM        R$ = ENTRY VARIABLE
180  REM        R,R1 = CREDIT RATING VALUE
190  REM        D$ = CONTROL D
200  :
210  REM      FILES USED
220  REM         SEQ.FILE NAME: CREDIT (USER ENTERED)
230  REM         TEMPORARY FILE NAME: TEMP
240  REM         DATSET FORMAT: C$,N$,R
250  :
260  REM      INITIALIZE
270  :
280  LET D$ =  CHR$ (4)
290  HOME : INPUT "ENTER FILE NAME:";F$
300  PRINT D$;"OPEN"F$
310  PRINT D$;"OPEN TEMP"
320  :
330  REM      DATA ENTRY ROUTINE
340  :
350  HOME
360  PRINT "ENTER 'STOP' TO END DATA ENTRY."
370  PRINT
380  INPUT "ENTER CUSTOMER #:";C$
390  IF C$ = "STOP" THEN 1080
400  IF  LEN (C$) = 0 THEN  PRINT "ENTER CUSTOMER NUMBER OR TYPE 'STOP'":
     GOTO 380
410  IF  LEN (C$) <  > 5 THEN  PRINT "ENTRY ERROR. REENTER WITH 5 DIGITS.":
     GOTO 380
420  IF  VAL (C$) = 0 THEN  PRINT "ENTRY ERROR.  NUMBERS ONLY.": GOTO 380
430  :
440  REM      FILE SEARCH ROUTINE
450  :
460  ONERR  GOTO 550
470  PRINT D$;"READ"F$
480  INPUT C1$,N$,R
490  PRINT D$
500  IF C$ = C1$ THEN 630
510  PRINT D$;"WRITE TEMP"
520  PRINT C1$: PRINT N$: PRINT R
530  PRINT D$
540  GOTO 470
550  PRINT  CHR$ (7);"ERROR MESSAGE. WE CANNOT FIND"
560  PRINT "CUSTOMER # ";C$;" ON THE FILE."
570  PRINT "PLEASE CHECK YOUR NUMBER AND REENTER."
580  PRINT D$;"CLOSE"
590  GOTO 300
600  :
610  REM      CUST # FOUND.  PROCEED W/ DATA ENTRY
620  :
630  HOME
640  PRINT N$;" CREDIT RATING: ";R
650  INPUT "ENTER NEW CREDIT RATING:";R$
660  IF  LEN (R$) <  > 1 THEN  PRINT "ONLY ONE DIGIT NUMBER IS
     ACCEPTABLE.": GOTO 650
670  IF  VAL (R$) < 1 OR  VAL (R$) > 5 THEN  PRINT "NUMBERS 1-5 ONLY,
     PLEASE.": GOTO 650
680  LET R1 =  VAL (R$)
690  :
700  REM     PRINT NEW INFO TO TEMP
710  :
720  PRINT D$;"WRITE TEMP"
730  PRINT C$: PRINT N$: PRINT R1
740  PRINT D$
750  :
```

```
760  REM      PRINT REMAINDER OF FILE TO TEMP
770  :
780  ONERR  GOTO 890
790  PRINT D$;"READ"F$
800  INPUT C$,N$,R
810  PRINT D$
820  PRINT D$;"WRITE TEMP"
830  PRINT C$: PRINT N$: PRINT R
840  PRINT D$
850  GOTO 790
860  :
870  REM      CLOSE FILES
880  :
890  IF  PEEK (222) = 5 THEN 910
900  PRINT : PRINT "UNUSUAL ERROR. PROGRAM TERMINATED.": PRINT
910  PRINT D$;"CLOSE"
920  :
930  REM      DELETE/RENAME FILE
940  :
950  PRINT D$;"DELETE"F$
960  PRINT D$;"RENAME TEMP,"F$
970  PRINT "RENAME COMPLETED"
980  :
990  REM      CONTINUE REQUEST
1000 :
1010  INPUT "DO YOU HAVE MORE CREDIT RATING CHANGES?";R$
1020  IF  LEFT$ (R$,1) <  > "Y" AND  LEFT$ (R$,1) <  > "N" THEN  PRINT
      CHR$ (7);"ENTER 'Y' FOR YES OR 'N' FOR NO.": PRINT : GOTO 1010
1030  IF  LEFT$ (R$,1) = "Y" THEN 300
1040  PRINT : PRINT "PROGRAM COMPLETED AS REQUESTED."
1050  END
```

(a) Write the corresponding program line number(s) for each step in the outline.

1. OPEN the credit file. ______________
2. OPEN a temporary file. ______________
3. Enter the customer number, the item to be searched (include data entry tests and a "no more searches" option). ______________
4. Check for end-of-data in credit file. If end-of-data is found:
   a. display an error message indicating an unsuccessful search ______________
   b. CLOSE both files. ______________
   c. return to step 1. ______________
5. READ a complete dataset. ______________
6. Test for wanted customer number. ______________
7. PRINT rejected datasets to temporary file. ______________
8. Display needed information; ask user for changes with data entry test. ______________
9. PRINT dataset with new data to temporary file. ______________
10. PRINT remainder of credit file to temporary file. ______________
11. CLOSE both files. ______________
12. RENAME temporary file as credit file. ______________
13. Provide the user with the option of repeating the process. ______________

(a) 1. 300
2. 310
3. 360–420
4. 460
4a. 550–570
4b. 580
4c. 590
5. 470–490
6. 500
7. 510–530
8. 640–680
9. 720–740
10. 780–850
11. 910
12. 950–970
13. 1010–1040

EDITING, DELETING, AND INSERTING FILE DATA

Whenever we work extensively with files, we write a small utility program that lets us read through the file, one item at a time, to verify that everything is as it should be. A properly written data file editing program also lets you make changes in the file data as it reads through the file. We will start with a simple program to examine the contents of a file, one data item at a time. Our example will use the previous application – the CREDIT file. Remember the dataset consists of:

1. a five-digit customer number stored as a string
2. a twenty-character customer name
3. a credit rating, stored as a numeric value from 1 through 5

The first program below allows you to look at each dataset, one item at a time, with the prompt "PRESS RETURN TO CONTINUE." The PRESS RETURN TO CONTINUE technique is very popular for CRT screen-oriented systems. The program allows the user to review the data displayed for the length of time needed and then move to the next dataset. The program then refreshes, or clears, the screen to remove "screen clutter" before the next data are displayed, using the HOME instruction. Examine the program to see how the user INPUT statement is used in the PRESS RETURN TO CONTINUE technique.

```
100  REM      CREDIT FILE EDITOR (VERSION 1)
110  REM     THIS PROGRAM DEMONSTRATES
120  REM       PRESS 'RETURN' TO CONTINUE
130  :
140  REM      VARIABLES USED
150  REM         C$ = CUST # (5)
160  REM         N$ = CUST NAME (20)
170  REM         R = CREDIT RATING (1)
180  REM         R$ = USER RESPONSE
190  REM         F$ = FILE NAME
200  REM         D$ = CONTROL D
210  :
220  REM      FILES USED
230  REM         SEQ. FILE NAME: CREDIT (USER ENTERED)
240  REM           DATASET FORMAT: C$,N$,R
250  :
260  REM      INITIALIZATION
270  :
280  LET D$ =  CHR$ (4)
290  INPUT "ENTER FILE NAME:";F$
300  PRINT D$;"OPEN"F$
310  :
320  REM      READ FILE AND DISPLAY
330  :
340  HOME
350  PRINT "PRESS 'RETURN' TO DISPLAY NEXT ITEM.": PRINT
360  ONERR  GOTO 510
370  PRINT D$;"READ"F$
380  INPUT C$,N$,R
390  PRINT D$
400  PRINT C$
410  INPUT "";R$
420  PRINT N$
430  INPUT "";R$
440  PRINT R
450  INPUT "";R$
460  PRINT
470  GOTO 340
480  :
490  REM      CLOSE FILE
500  :
510  IF  PEEK (222) = 5 THEN 530
520  PRINT : PRINT "UNUSUAL ERROR. PROGRAM TERMINATED."
530  PRINT D$;"CLOSE"
540  HOME
550  PRINT "JOB COMPLETED"
560  END
```

(a) What is assigned to R$ in lines 410, 430, and 450?

____

(b) Since R$ acts as a dummy variable in the program above, what is the purpose of lines 410, 430, and 450?

____

____

____

(c) How often was the screen "refreshed" in the program above?

____

- - - - - - - - - - - - - - -

(a) Nothing (a null string)
(b) Keeps the data items on the CRT display until the user presses RETURN to continue (Program waits at INPUT statement until RETURN key is pressed, with or without any other entry.)
(c) Before (or after) each complete dataset of three items was displayed

The next version of this program allows the user to change any data items as they are displayed on the screen, or accept data "as is" by pressing RETURN to continue. The procedure includes copying the credit data file to a temporary file "TEMPFIL" as you read through the file making changes. Here is the first part of the program, which includes the ability to change the customer number.

```
100  REM     CREDIT FILE EDITOR (VERSION 2)
110  REM     THIS PROGRAM DEMONSTRATES
120  REM     TYPE 'C' TO CHANGE ITEM, OR
130  REM     PRESS 'RETURN' TO CONTINUE.
140  :
150  REM      VARIABLES USED
160  REM        C$ = CUST # (5)
170  REM        N$ = CUST NAME (20)
180  REM        R = CREDIT RATING
190  REM        R$ = USER RESPONSE
200  REM        F$ = FILE NAME
210  REM        D$ = CONTROL D
220  :
230  REM      FILES USED
240  REM        SEQ. FILE NAME: CREDIT (USER ENTERED)
250  REM        SEQ. TEMPORARY FILE NAME: TEMPFIL
260  REM        DATASET FORMAT: C$,N$,R
270  :
280  REM      INITIALIZATION
290  :
300  LET D$ =  CHR$ (4)
310  INPUT "ENTER FILE NAME:";F$
320  PRINT D$;"OPEN"F$
330  PRINT D$;"OPEN TEMPFIL"
340  PRINT D$;"DELETE TEMPFIL"
350  PRINT D$;"OPEN TEMPFIL"
360  :
370  REM      READ FILE AND DISPLAY
380  :
390  HOME
400  PRINT "TYPE 'C' TO CHANGE ITEM DISPLAYED."
410  PRINT "PRESS 'RETURN' TO CONTINUE WITHOUT CHANGES."
420  ONERR  GOTO 770
430  PRINT D$;"READ"F$
440  INPUT C$,N$,R
450  PRINT D$
460  :
470  REM     DISPLAY & CHANGE OPTION FOR CUST. #
480  :
490  PRINT : PRINT C$
500  INPUT "";R$
510  IF R$ <  > "" AND R$ <  > "C" THEN  PRINT  CHR$ (7);"ENTRY ERROR. TRY
     AGAIN ": GOTO 500
520  IF  LEFT$ (R$,1) = "C" THEN  GOSUB 880
530  :
850  :
860  REM     CHANGE CUST # SUBROUTINE
870  :
880  INPUT "ENTER NEW CUST. #:";C$
890  IF  LEN (C$) = 0 THEN  PRINT "ENTER NUMBERS PLEASE.": GOTO 740
900  IF  LEN (C$) <  > 5 THEN  PRINT "ENTRY ERROR.  REENTER WITH 5
     DIGITS.": GOTO 880
910  IF  VAL (C$) = 0 THEN  PRINT "ENTRY ERROR, NUMBERS ONLY.": GOTO 880
920  RETURN
930  :
```

Notice the few additions: the temporary file (lines 260 and 340); the instruction changes (lines 130 and 370); and the entry test (line 470). For reasons that will become apparent, a subroutine (lines 700 through 750) is used for entering the change to the customer number. The same data entry checks are used that were originally used in the credit file creating program. Caution: This program segment does not write the new customer number to TEMPFIL. In order to maintain identical files, use one statement to write the entire dataset into TEMPFIL as was originally done with the credit rating data file. If you are particularly sharp, you may have noted that the new customer number was assigned to C$, replacing the old customer number stored there. Can you look ahead and see why?

Now its your turn. Write a routine that will allow a change in the customer name. Use the subroutine format like that above. Fill in lines 960, 970, 980, and 990.

(a)

```
540  REM  DISPLAY AND CHANGE OPTION FOR NAME
550  :
560  PRINT : PRINT N$
570  INPUT "";R$
580  IF  LEFT$ (R$,1) <  > "" AND  LEFT$ (R$,1) <  > "C" THEN  PRINT :
     PRINT "PRESS 'RETURN' FOR NO CHANGE OR ENTER 'C' TO CHANGE NAME.":
     PRINT : GOTO 570
590  IF R$ = "C" THEN  GOSUB 960
600  :
940  REM      NAME CHANGE SUBROUTINE
950  :
960
970
980
990
1000 :
```

(a)

```
540  REM  DISPLAY AND CHANGE OPTION FOR NAME
550  :
560  PRINT : PRINT N$
570  INPUT "";R$
580  IF  LEFT$ (R$,1) <  > "" AND  LEFT$ (R$,1) <  > "C" THEN  PRINT :
     PRINT "PRESS 'RETURN' FOR NO CHANGE OR ENTER 'C' TO CHANGE NAME.":
     PRINT : GOTO 570
590  IF R$ = "C" THEN  GOSUB 960
600  :
940  REM      NAME CHANGE SUBROUTINE
950  :
960  INPUT "ENTER NEW NAME:";N$
970  IF  LEN (N$) = 0 THEN  PRINT : PRINT "NO ENTRY MADE. PLEASE ENTER AS
     REQUESTED.": PRINT : GOTO 960
980  IF  LEN (N$) > 20 THEN  PRINT : PRINT "ABBREVIATE NAME TO 20
     CHARACTERS OR LESS.": PRINT : GOTO 960
990  RETURN
1000 :
```

Nice work! Now, write a program segment that allows a change to be entered for the credit rating. Upon returning from the subroutine, have the program record the entire dataset, including changes, if any, to TEMPFIL. Fill in lines 700, 710, 720, 1030, 1040, 1050, and 1060.

(a)
```
610  REM   DISPLAY & CHANGE OPTION FOR RATING
620  :
630  PRINT : PRINT R
640  INPUT "";R$
650  IF R$ <  > "" AND R$ <  > "C" THEN  PRINT : PRINT "PLEASE PRESS
     'RETURN' IF NO CHANGE, OR TYPE'C' TO CHANGE RATING.": PRINT : GOTO 640
660  IF R$ = "C" THEN  GOSUB 1030
670  :
680  REM    WRITE ONE DATASET BACK TO FILE
690  :
700
710
720
730  GOTO 390
740  :
1010  REM    CREDIT RATING CHANGE SUBROUTINE
1020  :
1030
1040
1050
1060
1070  RETURN
1080  :
```

(a)
```
610  REM   DISPLAY & CHANGE OPTION FOR RATING
620  :
630  PRINT : PRINT R
640  INPUT "";R$
650  IF R$ <  > "" AND R$ <  > "C" THEN  PRINT : PRINT "PLEASE PRESS
     'RETURN' IF NO CHANGE, OR TYPE'C' TO CHANGE RATING.": PRINT : GOTO 640
660  IF R$ = "C" THEN  GOSUB 1030
670  :
680  REM    WRITE ONE DATASET BACK TO FILE
690  :
700  PRINT D$;"WRITE TEMPFIL"
710  PRINT C$: PRINT N$: PRINT R
720  PRINT D$
730  GOTO 390
740  :
1010  REM    CREDIT RATING CHANGE SUBROUTINE
1020  :
1030  INPUT "ENTER NEW CREDIT RATING:";R$
1040  IF  LEN (R$) <  > 1 THEN  PRINT : PRINT "ENTER ONE DIGIT NUMBER ONLY,
      PLEASE.": PRINT : GOTO 1030
1050  IF  VAL (R$) < 1 OR  VAL (R$) > 5 THEN  PRINT : PRINT "ENTER DIGITS
      1 TO 5 ONLY.": PRINT : GOTO 1030
1060  LET R =  VAL (R$)
1070  RETURN
1080  :
```

Did you get line 710? Carefully planned, the routine that prints or writes to the file uses the same variables (C$, N$, and R) that can contain either new data or the original unchanged data items.

(a) Describe the last routine needed to complete this program.

(a) Close the files and RENAME TEMPFIL to F$.

The end of data error trap is already set up in line 420 to branch to line 770.

While experiencing a bit of *dejà vu*, complete the final section to RENAME TEMPFIL by filling in lines 770, 780, 800, 810, and 820.

(a)

```
750  REM     CLOSE FILES
760  :
770
780
790  HOME : PRINT "WORKING"
800
810
820
830  PRINT : PRINT "JOB COMPLETE."
840  END
850  :
```

(a)

```
750  REM     CLOSE FILES
760  :
770  IF  PEEK (222) = 5 THEN 790
780  PRINT : PRINT "UNUSUAL ERROR. PROGRAM TERMINATED. READ AND DISPLAY
     FILE CONTENTS TO CHECK FOR ERRORS.": PRINT : GOTO 800
790  HOME : PRINT "WORKING"
800  PRINT D$;"CLOSE"
810  PRINT D$;"DELETE"F$
820  PRINT D$;"RENAME TEMPFIL,"F$
830  PRINT : PRINT "JOB COMPLETE."
840  END
850  :
```

Here is a complete listing of the second version of the credit file editor program. Be sure to enter and RUN this program before continuing.

```
100  REM     CREDIT FILE EDITOR (VERSION 2)
110  REM     THIS PROGRAM DEMONSTRATES
120  REM     TYPE 'C' TO CHANGE ITEM, OR
130  REM     PRESS 'RETURN' TO CONTINUE.
140  :
150  REM      VARIABLES USED
160  REM        C$ = CUST # (5)
170  REM        N$ = CUST NAME (20)
180  REM        R = CREDIT RATING
190  REM        R$ = USER RESPONSE
200  REM        F$ = FILE NAME
210  REM        D$ = CONTROL D
220  :
230  REM      FILES USED
240  REM        SEQ. FILE NAME: CREDIT (USER ENTERED)
250  REM        SEQ. TEMPORARY FILE NAME: TEMPFIL
260  REM        DATASET FORMAT: C$,N$,R
270  :
280  REM      INITIALIZATION
290  :
300  LET D$ =  CHR$ (4)
310  INPUT "ENTER FILE NAME:";F$
320  PRINT D$;"OPEN"F$
330  PRINT D$;"OPEN TEMPFIL"
340  PRINT D$;"DELETE TEMPFIL"
350  PRINT D$;"OPEN TEMPFIL"
360  :
370  REM      READ FILE AND DISPLAY
380  :
390  HOME
400  PRINT "TYPE 'C' TO CHANGE ITEM DISPLAYED."
410  PRINT "PRESS 'RETURN' TO CONTINUE WITHOUT CHANGES."
420  ONERR  GOTO 770
430  PRINT D$;"READ"F$
440  INPUT C$,N$,R
450  PRINT D$
460  :
470  REM    DISPLAY & CHANGE OPTION FOR CUST. #
480  :
490  PRINT : PRINT C$
500  INPUT "";R$
510  IF R$ <  > "" AND R$ <  > "C" THEN  PRINT  CHR$ (7);"ENTRY ERROR. TRY
     AGAIN.": GOTO 500
520  IF  LEFT$ (R$,1) = "C" THEN  GOSUB 880
530  :
540  REM  DISPLAY AND CHANGE OPTION FOR NAME
550  :
560  PRINT : PRINT N$
570  INPUT "";R$
580  IF  LEFT$ (R$,1) <  > "" AND  LEFT$ (R$,1) <  > "C" THEN  PRINT :
     PRINT "PRESS 'RETURN' FOR NO CHANGE OR ENTER 'C' TO CHANGE NAME.":
     PRINT : GOTO 570
590  IF R$ = "C" THEN  GOSUB 960
600  :
610  REM   DISPLAY & CHANGE OPTION FOR RATING
620  :
630  PRINT : PRINT R
640  INPUT "";R$
650  IF R$ <  > "" AND R$ <  > "C" THEN  PRINT : PRINT "PLEASE PRESS
     'RETURN' IF NO CHANGE, OR TYPE'C' TO CHANGE RATING.": PRINT : GOTO 640
660  IF R$ = "C" THEN  GOSUB 1030
670  :
680  REM    WRITE ONE DATASET BACK TO FILE
690  :
700  PRINT D$;"WRITE TEMPFIL"
710  PRINT C$: PRINT N$: PRINT R
720  PRINT D$
730  GOTO 390
740  :
```

```
750  REM    CLOSE FILES
760  :
770  IF  PEEK (222) = 5 THEN 790
780  PRINT : PRINT "UNUSUAL ERROR. PROGRAM TERMINATED. READ AND DISPLAY
     FILE CONTENTS TO CHECK FOR ERRORS.": PRINT : GOTO 800
790  HOME : PRINT "WORKING"
800  PRINT D$;"CLOSE"
810  PRINT D$;"DELETE"F$
820  PRINT D$;"RENAME TEMPFIL,"F$
830  PRINT : PRINT "JOB COMPLETE."
840  END
850  :
860  REM    CHANGE CUST # SUBROUTINE
870  :
880  INPUT "ENTER NEW CUST. #:";C$
890  IF  LEN (C$) = 0 THEN  PRINT "ENTER NUMBERS PLEASE.": GOTO 740
900  IF  LEN (C$) <  > 5 THEN  PRINT "ENTRY ERROR.  REENTER WITH 5
     DIGITS.": GOTO 880
910  IF  VAL (C$) = 0 THEN  PRINT "ENTRY ERROR, NUMBERS ONLY.": GOTO 880
920  RETURN
930  :
940  REM    NAME CHANGE SUBROUTINE
950  :
960  INPUT "ENTER NEW NAME:";N$
970  IF  LEN (N$) = 0 THEN  PRINT : PRINT "NO ENTRY MADE. PLEASE ENTER AS
     REQUESTED.": PRINT : GOTO 960
980  IF  LEN (N$) > 20 THEN  PRINT : PRINT "ABBREVIATE NAME TO 20
     CHARACTERS OR LESS.": PRINT : GOTO 960
990  RETURN
1000 :
1010 REM    CREDIT RATING CHANGE SUBROUTINE
1020 :
1030 INPUT "ENTER NEW CREDIT RATING:";R$
1040 IF  LEN (R$) <  > 1 THEN  PRINT : PRINT "ENTER ONE DIGIT NUMBER ONLY,
     PLEASE.": PRINT : GOTO 1030
1050 IF  VAL (R$) < 1 OR  VAL (R$) > 5 THEN  PRINT : PRINT "ENTER DIGITS
     1 TO 5 ONLY.": PRINT : GOTO 1030
1060 LET R =  VAL (R$)
1070 RETURN
1080 :
```

Yet another desireable editing feature is the ability to delete a complete dataset from a data file. This is in addition to the program's ability to make changes in an existing dataset. To delete a dataset, have the program read the dataset from the file, but *not* copy it into TEMPFIL. Thus, the dataset "disappears." This editing option can be integrated into the existing program you have been developing. First, enter a statement to inform the user of the option to delete a dataset.

```
395  PRINT : PRINT "TYPE 'D' TO DELETE THIS ENTIRE DATASET FROM THE FILE."
```

(a) Complete the change in the statement line that tests for legal user inputs.

____

(b) Write a statement to branch to line 390, thus never writing the current dataset if the user entered 'D'.
[525]

____

- - - - - - - - - - - - - - - -

(a)
```
510  IF R$ <  > "" AND R$ <  > "C" AND R$ <  > "D" THEN  PRINT : PRINT
     CHR$ (7);"ENTRY ERROR. READ THE INSTRUCTIONS AND TRY AGAIN.": PRINT :
     GOTO 500
```
(b)
```
525  IF R$ = "D" THEN 430
```

You now have a model for a file editor that allows for changes, deletions, or no changes. Another useful editing feature allows you to keep data in numerical or alphabetical order by insertion of a new dataset part way through an existing data file. After locating a certain dataset, the new dataset is inserted by using the subroutines used to make changes in the file. How's that for program efficiency. Following are some of the new statements needed, with space for you to complete lines 396, 510, and 526.

(a)
```
396

510

526

841 :
842  REM   SUBROUTINE TO WRITE CURRENT DATASET TO FILE UNCHANGED BEFORE NEW
     DATASET IS INSERTED
843 :
844  PRINT D$;"WRITE TEMPFIL"
845  PRINT C$: PRINT N$: PRINT R
846  PRINT D$
847  RETURN
848 :
```

(a)
```
396  PRINT : PRINT "TYPE 'I' TO INSERT A NEW DATASET AFTER THE ONE
     DISPLAYED. CURRENT DATASET DISPLAYED WILL BE PLACED IN THE FILE
     UNCHANGED.": PRINT
397 :
398 :
510  IF R$ <  > "" AND R$ <  > "C" AND R$ <  > "D" AND R$ <  > "I" THEN
     PRINT : PRINT  CHR$(7);"ENTRY ERROR. READ DIRECTIONS AND ENTER
     ACCORDINGLY.": PRINT : GOTO 500
511 :
512 :
526  IF R$ = "I" THEN  GOSUB 844: GOSUB 880: GOSUB 960: GOSUB 1030: GOTO
     700
527 :
528 :
841 :
842  REM   SUBROUTINE TO WRITE CURRENT DATASET TO FILE UNCHANGED BEFORE
     NEW DATASET IS INSERTED
843 :
844  PRINT D$;"WRITE TEMPFIL"
845  PRINT C$: PRINT N$: PRINT R
846  PRINT D$
847  RETURN
848 :
```

To change, delete, or insert data in the CREDIT file gather together this data file editing utility program.

```
100  REM    CREDIT FILE EDITOR (VERSION 3)
110  REM    THIS PROGRAM ALLOWS CHANGES IN CURRENT DATA, DELETION OF
     DATASETS, AND
120  REM    INSERTION OF NEW DATASETS. IT ALSO ALLOWS YOU TO
130  REM    PRESS 'RETURN' TO CONTINUE DISPLAY OF DATA WITH NO CHANGES TO
     DATA ITEMS.
140  :
150  REM     VARIABLES USED
160  REM       C$ = CUST # (5)
170  REM       N$ = CUST NAME (20)
180  REM       R = CREDIT RATING
190  REM       R$ = USER RESPONSE
200  REM       F$ = FILE NAME
210  REM       D$ = CONTROL D
220  :
230  REM     FILES USED
240  REM       SEQ. FILE NAME: CREDIT (USER ENTERED)
250  REM       SEQ. TEMPORARY FILE NAME: TEMPFIL
260  REM       DATASET FORMAT: C$,N$,R
270  :
280  REM     INITIALIZATION
290  :
300  LET D$ =  CHR$ (4)
310  INPUT "ENTER FILE NAME:";F$
320  PRINT D$;"OPEN"F$
330  PRINT D$;"OPEN TEMPFIL"
340  PRINT D$;"DELETE TEMPFIL"
350  PRINT D$;"OPEN TEMPFIL"
360  :
370  REM     READ FILE AND DISPLAY
380  :
390  HOME
395  PRINT : PRINT "TYPE 'D' TO DELETE THIS ENTIRE DATASET FROM THE FILE."
396  PRINT : PRINT "TYPE 'I' TO INSERT A NEW DATASET AFTER THE ONE
     DISPLAYED. CURRENT DATASET DISPLAYED WILL BE PLACED IN THE FILE
     UNCHANGED.": PRINT
400  PRINT "TYPE 'C' TO CHANGE ITEM DISPLAYED.": PRINT
410  PRINT "PRESS 'RETURN' TO CONTINUE WITHOUT CHANGES."
420  ONERR  GOTO 770
430  PRINT D$;"READ"F$
440  INPUT C$,N$,R
450  PRINT D$
460  :
470  REM    DISPLAY & CHANGE OPTION FOR CUST. #
480  :
490  PRINT : PRINT C$
500  INPUT "";R$
510  IF R$ <  > "" AND R$ <  > "C" AND R$ <  > "D" AND R$ <  > "I" THEN
     PRINT : PRINT  CHR$(7);"ENTRY ERROR. READ DIRECTIONS AND ENTER
     ACCORDINGLY.": PRINT : GOTO 500
520  IF  LEFT$ (R$,1) = "C" THEN  GOSUB 880
525  IF R$ = "D" THEN 430
526  IF R$ = "I" THEN  GOSUB 844: GOSUB 880: GOSUB 960: GOSUB 1030: GOTO
     700
530  :
540  REM  DISPLAY AND CHANGE OPTION FOR NAME
550  :
560  PRINT : PRINT N$
570  INPUT "";R$
580  IF  LEFT$ (R$,1) <  > "" AND  LEFT$ (R$,1) <  > "C" THEN  PRINT :
     PRINT "PRESS 'RETURN' FOR NO CHANGE OR ENTER 'C' TO CHANGE NAME.":
     PRINT : GOTO 570
590  IF R$ = "C" THEN  GOSUB 960
600  :
610  REM   DISPLAY & CHANGE OPTION FOR RATING
620  :
630  PRINT : PRINT R
640  INPUT "";R$
650  IF R$ <  > "" AND R$ <  > "C" THEN  PRINT : PRINT "PLEASE PRESS
     'RETURN' IF NO CHANGE, OR TYPE'C' TO CHANGE RATING.": PRINT :
     GOTO 640
660  IF R$ = "C" THEN  GOSUB 1030
670  :
```

continued on next page

```
680  REM    WRITE ONE DATASET BACK TO FILE
690  :
700  PRINT D$;"WRITE TEMPFIL"
710  PRINT C$: PRINT N$: PRINT R
720  PRINT D$
730  GOTO 390
740  :
750  REM    CLOSE FILES
760  :
770  IF  PEEK (222) = 5 THEN 790
780  PRINT : PRINT "UNUSUAL ERROR. PROGRAM TERMINATED. READ AND DISPLAY
     FILE CONTENTS TO CHECK FOR ERRORS.": PRINT : GOTO 800
790  HOME : PRINT "WORKING"
800  PRINT D$;"CLOSE"
810  PRINT D$;"DELETE"F$
820  PRINT D$;"RENAME TEMPFIL,"F$
830  PRINT : PRINT "JOB COMPLETE."
840  END
841  :
842  REM   SUBROUTINE TO WRITE CURRENT DATASET TO FILE UNCHANGED BEFORE
     NEW DATASET IS INSERTED
843  :
844  PRINT D$;"WRITE TEMPFIL"
845  PRINT C$: PRINT N$: PRINT R
846  PRINT D$
847  RETURN
850  :
860  REM     CHANGE CUST # SUBROUTINE
870  :
880  INPUT "ENTER NEW CUST. #:";C$
890  IF  LEN (C$) = 0 THEN  PRINT "ENTER NUMBERS PLEASE.": GOTO 740
900  IF  LEN (C$) <  > 5 THEN  PRINT "ENTRY ERROR.  REENTER WITH 5
     DIGITS.": GOTO 880
910  IF  VAL (C$) = 0 THEN  PRINT "ENTRY ERROR, NUMBERS ONLY.": GOTO 880
920  RETURN
930  :
940  REM     NAME CHANGE SUBROUTINE
950  :
960  INPUT "ENTER NEW NAME:";N$
970  IF  LEN (N$) = 0 THEN  PRINT : PRINT "NO ENTRY MADE. PLEASE ENTER AS
     REQUESTED.": PRINT : GOTO 960
980  IF  LEN (N$) > 20 THEN  PRINT : PRINT "ABBREVIATE NAME TO 20
     CHARACTERS OR LESS.": PRINT : GOTO 960
990  RETURN
1000 :
1010 REM     CREDIT RATING CHANGE SUBROUTINE
1020 :
1030 INPUT "ENTER NEW CREDIT RATING:";R$
1040 IF  LEN (R$) <  > 1 THEN  PRINT : PRINT "ENTER ONE DIGIT NUMBER ONLY,
     :PLEASE.": PRINT GOTO 1030
1050 IF  VAL (R$) < 1 OR  VAL (R$) > 5 THEN  PRINT : PRINT "ENTER DIGITS
     :1 TO 5 ONLY.": PRINT GOTO 1030
1060 LET R =  VAL (R$)
1070 RETURN
1080 :
```

The following outline for the final version of the program allows for insertion, deletion, or changes of data in the file.

(1) Open the source file.
(2) Open the temporary file.
(3) Display a "menu" for the user to select changes to be made, including a "no changes" option.
(4) Set ONERR for end-of-file detection.
(5) Read the entire dataset from the file and display the first data *item* (not dataset) in the current dataset.
(6) Allow the user to enter a selection from the "menu" and test for the legal selection possibilities.
(7) If user entered "C" for change:
    (a) Allow user to enter change with data entry checks.

(b) Display next data item from current dataset (if any items remain in this dataset).
(c) User entered option for another change and test selection.
(d) User entered change with data entry checks.
(e) Repeat (7) (b), (c), and (d) until all items in a dataset have been through the change option.
(f) Print the dataset (with any changes) to the temporary file.
(g) Go to step (3).

(8) If user entered "I" for insert:
(a) Print the dataset to the temporary file.
(b) User enters new dataset with data entry checks.
(c) Print the newly entered data to the temporary file.
(d) Go to step (3).

(9) If user entered "D" for delete, go to step (5).
(10) If the user entered no response (just pressed the RETURN key), go to steps (7) (b) to (g).
(11) Close both files.
(12) RENAME TEMPFIL to source file name.

(a) Write the corresponding program line number(s) for each step in the outline below, except for item (10), where you are to fill in the blanks in the parentheses.

(1) Open the source file. ______________________________

(2) Open the temporary file. ______________________________

(3) Display a "menu" for the user to select changes to be made, including a "no changes" option. ______________________________

(4) Set ONERR for end-of-file detection. ______________________________

(5) Read the entire dataset from the file and display the first data *item* (not dataset) in the current dataset. ______________________________

(6) Allow the user to enter a selection from the "menu" and test for the legal selection possibilities. ______________________________

(7) If user entered "C" for change:

(a) Allow user to enter change with data entry checks. ______________________________

(b) Display next data item from current dataset (if any items remain in this dataset). ______________________________

(c) User entered option for another change and test selection. ______________________________

(d) User entered change with data entry checks. ______________

____

(e) Repeat (7) (b), (c), and (d) until all items in a dataset have been through the change option. ______________

(f) Print the dataset (with any changes) to the temporary file. ________

(g) Go to step (3). ______________

(8) If user entered "I" for insert:

(a) Print the dataset to the temporary file. ______________

(b) User enters new dataset with data entry checks. ______________

____

(c) Print the newly entered data to the temporary file. ______________

(d) Go to step (3). ______________

(9) If user entered "D" for delete, go to step (5). ______________

(10) If the user entered no response (just pressed the RETURN key), go to steps (__) (__) to (__) (__). (Fill in the blanks.)

(11) Close both files. ______________

(12) RENAME TEMPFIL to source file name. ______________

____

- - - - - - - - - - - - - - - -

(a) (1) line 320
(2) lines 330 to 350
(3) lines 390 to 410
(4) line 420
(5) lines 430 to 490
(6) lines 500 to 526
(7) (a) lines 880 to 920
(b) line 560
(c) lines 570 to 590
(d) lines 880 to 920
(e) lines 560 to 590, 880 to 920
(f) lines 700 to 720
(g) line 730
(8) (a) lines 844 to 847
(b) lines 880 to 920, 960 to 990, and 1030 to 1070.

(c) lines 700 to 720
(d) line 730
(9) line 525
(10) steps (7) (b) to (7) (g)
(11) line 800
(12) lines 810 and 820

Enter and RUN the program; put it through its paces. Test all of the possible change options that this program makes available, and verify that the changes were actually made to the file.

MERGING THE CONTENTS OF FILE

In many business applications of computers, information in data files is maintained in alphabetic or numeric order. This can be done by customer number, customer name, product number, or some other key to filing. It is often necessary or desirable to merge the contents of two data files, both already in some order, to a make a third data file with the same order or sequence. A utility program to merge files also allows you to learn some new file programming techniques with wider applications.

Follow these steps to merge two data files into one.

(1) Open the two files to be merged (#1 and #2).
(2) Open, delete, and reopen the file (#3) that will contain the merged data.
(3) Use ONERR to branch to step (10) if end-of-file is encountered for either file #1 or file #2.
(4) Read the first dataset from file #1.
(5) Read the first dataset from file #2.
(6) Test datasets to see which file dataset (#1 or #2) is to be copied or printed to the merge file (#3).
(7) Print the selected dataset to file #3; this requires two separate routines:
  (a) One if file #1 dataset is selected, or
  (b) Another if file #2 dataset is selected.
(8) Read another dataset from whichever file's dataset was printed to file #3 in step (7). Again, two separate routines are needed:
  (a) Read another dataset from file #1, or
  (b) Read another dataset from file #2.
(9) Again, separate routines are needed to "dump" or transfer the remaining data in file #1 or #2 to file #3:
  (a) If file #1 comes to end-of-file first, copy the remaining datasets in file #2 to file #3, or
  (b) If file #2 comes to end-of-file first, copy the remaining datasets in file #1 to file #3.
(10) Close all files.
(11) Optional routine to display merged data files for confirmation of a successful merge.

The model program merges two transaction files into a third larger file that combines the other two. In the example, each transaction produces a dataset as shown below.

Account number = five characters
Transaction code = two characters (for a bank, 1 = check, 2 = deposit, etc.)
Amount = seven characters

This data is contained in the files named TRANSACTION-1 and TRANSACTION-2. Assume that the datasets are stored in two data files each in ascending numerical order by account number (problem 3 in the Chapter 4 Self-Test). The goal is to produce a third file named TRANSACTION-MERGE that combines the data in the first two files, but maintains the numerical order when the file merging is complete. Also assume that more than one dataset can have the same account number in either or both data files.

This last assumption requires a decision. When merging, if two datasets have the same account number, the program will copy the dataset from file #1 first, then the dataset with the same number from file #2.

FILE #1	FILE #2
10762	10761
18102	18203
43611	43611
43611	80111
43611	80772
80223	80772
98702	89012

File #3 (files #1 and #2 merged into one)

```
10761
10762
18102
18203
43611
43611
43611
43611
80111
80223
80772
80772
89102
98702
```

(Note: Only the account numbers are shown here; the complete datasets also include transaction codes and amounts.)

While the outline provides the logic, structure, and flow of the program, the summary of the program modules is given below to further aid your understanding of what may seem, at first, to be a very complicated program. The modules are:

Introduction
Initialize
Read first dataset from file #1
Read first dataset from file #2
Compare datasets
Print one dataset from file #1 to merged file
Read subsequent dataset from file #1
Print one dataset from file #2 to merged file
Read subsequent dataset from file #2
Copy leftover datasets from file #1 to merged file
Copy leftover datasets from file #2 to merged file
Close files
Open, display all datasets and close merged file

This program is called Merge. It gets tricky, so read the text and program segments carefully. The initializing process is familiar; you should have no trouble completing steps 1 and 2 of the outline.

```
100  REM      MERGE FILES UTILITY PROGRAM
110  :
120  REM      VARIABLES USED
130  REM       F1$,F2$,F3$ = USER ENTERED FILE NAMES
140  REM        A1$,A2$ = ACC'T NUMBER(5 CHAR.)
150  REM        T1$,T2$ = TRANSACTION CODE(1 CHAR.)
160  REM        C1$,C2$ = CASH AM'T(9999.99 OR 7 CHAR. MAX.)
170  REM       X = FOR NEXT LOOP CONTROL VARIABLE
180  REM       D$ = CONTROL D
190  :
200  REM      FILES USED
210  REM        SEQ. FILE NAMES: TRANSACTION-1, TRANSACTION-2,
     TRANSACTION-MERGE (ALL USER ENTERED)
220  REM       DATASET FORMAT: A$,T$,C$
230  :
240  REM     INITIALIZE
250  :
260  LET D$ =  CHR$ (4)
270  INPUT "ENTER SOURCE FILE 1:";F1$
280  INPUT "ENTER SOURCE FILE 2:";F2$
290  INPUT "ENTER OUTPUT (MERGED) FILE NAME:";F3$
300  HOME : PRINT "WORKING"
310  :
320  PRINT D$;"OPEN"F1$
330  PRINT D$;"OPEN"F2$
340  PRINT D$;"OPEN"F3$
350  PRINT D$;"DELETE"F3$
360  PRINT D$;"OPEN"F3$
370  :
```

(a) Why is the OPEN-DELETE-OPEN sequence used for the F3$ file?

____

____

____

- - - - - - - - - - - - - - - -

(a) The other two files are source files. F3$ (the merged file) is the only one to be written to, and this section of the program makes certain no extraneous data are in the file to begin with.

Next, the first dataset is read from file #1. Notice that the end-of-file error test is made before the first dataset is read, just in case the file has no data. This corresponds to steps 3 and 4 of the outline. If file #1 is empty to begin with, GOTO 1010.

```
380  REM     READ SOURCE 1
390  :
400  ONERR  GOTO 1010
410  PRINT D$;"READ"F1$
420  INPUT A1$,T1$,C1$
430  PRINT D$
440  LET A1 =  VAL (A1$)
450  :
```

Line 440 coverts the string that contains the account number into a numeric value. Now write the next segment corresponding to step 5 in the outline. The program should read the first data item from file #2. Fill in lines 490, 500, 510, and 520.

(a)
```
460  REM     READ SOURCE 2
470  :
480  ONERR  GOTO 900
490
500
510
520
530  :
```

(a)
```
460  REM     READ SOURCE 2
470  :
480  ONERR  GOTO 900
490  PRINT D$;"READ"F2$
500  INPUT A2$,T2$,C2$
510  PRINT D$
520  LET A2 =  VAL (A2$)
530  :
```

The next decision is which dataset – that from file #1 or that from file #2 – will be copied into file #3 first? This corresponds to step 6 in the outline.

```
540  REM     MERGE TESTING
550  :
560  IF A1 = A2 THEN 620
570  IF A1 < A2 THEN 620
580  GOTO 740
590  :
```

The program so far, as shown below, provides only for input of the first dataset from each of the two files to be merged, and compares the numeric values of the account numbers.

```
100  REM      MERGE FILES UTILITY PROGRAM
110  :
120  REM      VARIABLES USED
130  REM        F1$,F2$,F3$ = USER ENTERED FILE NAMES
140  REM          A1$,A2$ = ACC'T NUMBER(5 CHAR.)
150  REM          T1$,T2$ = TRANSACTION CODE(1 CHAR.)
160  REM          C1$,C2$ = CASH AM'T(9999.99 OR 7 CHAR. MAX.)
170  REM        X = FOR NEXT LOOP CONTROL VARIABLE
180  REM        D$ = CONTROL D
190  :
200  REM      FILES USED
210  REM          SEQ. FILE NAMES: TRANSACTION-1, TRANSACTION-2,
     TRANSACTION-MERGE (ALL USER ENTERED)
220  REM        DATASET FORMAT: A$,T$,C$
230  :
240  REM     INITIALIZE
250  :
260  LET D$ =  CHR$ (4)
270  INPUT "ENTER SOURCE FILE 1:";F1$
280  INPUT "ENTER SOURCE FILE 2:";F2$
290  INPUT "ENTER OUTPUT (MERGED) FILE NAME:";F3$
300  HOME : PRINT "WORKING"
310  :
320  PRINT D$;"OPEN"F1$
330  PRINT D$;"OPEN"F2$
340  PRINT D$;"OPEN"F3$
350  PRINT D$;"DELETE"F3$
360  PRINT D$;"OPEN"F3$
370  :
380  REM     READ SOURCE 1
390  :
400  ONERR  GOTO 1010
410  PRINT D$;"READ"F1$
420  INPUT A1$,T1$,C1$
430  PRINT D$
440  LET A1 =  VAL (A1$)
450  :
460  REM      READ SOURCE 2
470  :
480  ONERR  GOTO 900
490  PRINT D$;"READ"F2$
500  INPUT A2$,T2$,C2$
510  PRINT D$
520  LET A2 =  VAL (A2$)
530  :
540  REM      MERGE TESTING
550  :
560  IF A1 = A2 THEN 620
570  IF A1 < A2 THEN 620
580  GOTO 740
590  :
```

(a) Look at lines 560 and 570. What should happen in the program routine that starts at line 620?

(b) The program tests for equality in line 560. In line 570, the test was for A1 less than A2. If both tests are false, what is the relationship of A1 to A2?

(c) What should happen in the program routine at line 740 that line 580 branches to?

(a) The dataset from source file #1 is copied.
(b) A1 is greater than A2.
(c) The dataset from source file #2 to file #3 is printed.

Continue with the file copying segment for copying a dataset from file #1 to file #3 (outline step 7a).

```
600  REM    PRINT #1 TO #3, READ #1
610  :
620  PRINT D$;"WRITE"F3$
630  PRINT A1$; PRINT T1$: PRINT C1$
640  PRINT D$
```

(a) After executing the above segment, the program should now read another dataset from file #1. You might want to have the program branch back to the routine at line 410 and continue executing from there. Why would this result in a program error?

(a) The routine at line 410 reads from file #1, but then continues to read another dataset from file #2, replacing the dataset already assigned to A2$, T2$, and C2$ without copying them to file #3.

The rest of this program segment is used for reading the next data item from file #1. This corresponds to outline step 8a.

```
600  REM    PRINT #1 TO #3, READ #1
610  :
620  PRINT D$;"WRITE"F3$
630  PRINT A1$: PRINT T1$: PRINT C1$
640  PRINT D$
650  ONERR  GOTO 1010
660  PRINT D$;"READ"F1$
670  INPUT A1$,T1$,C1$
680  PRINT D$
690  LET A1 =  VAL (A1$)
700  GOTO 560
710  :
```

(a) When the program finds the end of file #1, it branches to line 1010. Think ahead: What should happen in the routine at line 1010?

(a) Since all datasets have been read from file #1 and copied to file #3, all the remaining data from file #2 should be copied into file #3 (you'll see this routine soon).

Here is the routine we need to copy a dataset from file #2 to file #3, and to read a new dataset from file #2. This corresponds to outline steps 7b and 8b.

```
720  REM     PRINT #2 TO #3, READ #2
730  :
740  PRINT D$;"WRITE"F3$
750  PRINT A2$: PRINT T2$: PRINT C2$
760  PRINT D$
770  ONERR  GOTO 900
780  PRINT D$;"READ"F2$
790  INPUT A2$,T2$,C2$
800  PRINT D$
810  LET A2 =  VAL (A2$)
820  GOTO 560
830  :
```

Notice how carefully you must think through these file utility programs. You are nearing the end; only a few more "clean up" routines are needed. Two similar routines are needed to copy or dump the remainders of file #2 to file #3, and file #1 to file #3. First, here are the program instructions that correspond to the outline, step 9a.

```
950  REM     DUMP #2 TO #3
960  :
1010  PRINT D$;"WRITE"F3$
1020  PRINT A2$: PRINT T2$: PRINT C2$
1030  PRINT D$
1040  GOTO 970
1050  :
```

Line 1010 is branched to from lines 400 or 650 on end of file checks for file #1.

The rest is easy. Here is the complete routine. Check file #2 for end of file and, if encountered, dump any remaining file #2 datasets to file #3.

```
950  REM     DUMP #2 TO #3
960  :
970  ONERR  GOTO 1080
980  PRINT D$;"READ"F2$
990  INPUT A2$,T2$,C2$
1000  PRINT D$
1010  PRINT D$;"WRITE"F3$
1020  PRINT A2$: PRINT T2$: PRINT C2$
1030  PRINT D$
1040  GOTO 970
1050  :
```

Write the corresponding routine to dump file #1 to file #3. The end of data error statement should branch to line 1080. Complete lines 860, 870, 880, 890, 900, 910, and 920.

(a)
```
840  REM      DUMP #1 TO #3
850  :
860
870
880
890
900
910
920
930  GOTO 860
940  :
```

(b) The ONERR trap in lines 860 and 970 both branch to line 1080. What final routine should appear there?

- - - - - - - - - - - - - - -

(a)
```
840  REM      DUMP #1 TO #3
850  :
860  ONERR  GOTO 1080
870  PRINT D$;"READ"F1$
880  INPUT A1$,T1$,C1$
890  PRINT D$
900  PRINT D$;"WRITE"F3$
910  PRINT A1$: PRINT T1$: PRINT C1$
920  PRINT D$
930  GOTO 860
940  :
```

(b) Close all files, since all data have been copied and merged.

Once the files are closed, the program gives the user the option to display the contents of the merged files to verify that it did happen and to judge whether the program works properly. In Merge all the activity takes place between the computer memory and the disk with no evidence of the action appearing on the CRT screen. You only see RUN, so did it really happen? The routine included at the end of the complete listing of Merge lets you be sure (see 1150 through 1330).

```
100  REM     MERGE FILES UTILITY PROGRAM
110  :
120  REM     VARIABLES USED
130  REM       F1$,F2$,F3$ = USER ENTERED FILE NAMES
140  REM        A1$,A2$ = ACC'T NUMBER(5 CHAR.)
150  REM        T1$,T2$ = TRANSACTION CODE(1 CHAR.)
160  REM        C1$,C2$ = CASH AM'T(9999.99 OR 7 CHAR. MAX.)
170  REM       X = FOR NEXT LOOP CONTROL VARIABLE
180  REM       D$ = CONTROL D
190  :
200  REM     FILES USED
210  REM        SEQ. FILE NAMES: TRANSACTION-1, TRANSACTION-2,
     TRANSACTION-MERGE (ALL USER ENTERED)
220  REM       DATASET FORMAT: A$,T$,C$
230  :
240  REM    INITIALIZE
250  :
260  LET D$ =  CHR$ (4)
270  INPUT "ENTER SOURCE FILE 1:";F1$
280  INPUT "ENTER SOURCE FILE 2:";F2$
290  INPUT "ENTER OUTPUT (MERGED) FILE NAME:";F3$
300  HOME : PRINT "WORKING"
310  :
320  PRINT D$;"OPEN"F1$
330  PRINT D$;"OPEN"F2$
340  PRINT D$;"OPEN"F3$
350  PRINT D$;"DELETE"F3$
360  PRINT D$;"OPEN"F3$
370  :
380  REM    READ SOURCE 1
390  :
400  ONERR  GOTO 1010
410  PRINT D$;"READ"F1$
420  INPUT A1$,T1$,C1$
430  PRINT D$
440  LET A1 =  VAL (A1$)
450  :
460  REM     READ SOURCE 2
470  :
480  ONERR  GOTO 900
490  PRINT D$;"READ"F2$
500  INPUT A2$,T2$,C2$
510  PRINT D$
520  LET A2 =  VAL (A2$)
530  :
540  REM     MERGE TESTING
550  :
560  IF A1 = A2 THEN 620
570  IF A1 < A2 THEN 620
580  GOTO 740
590  :
600  REM    PRINT #1 TO #3, READ #1
610  :
620  PRINT D$;"WRITE"F3$
630  PRINT A1$: PRINT T1$: PRINT C1$
640  PRINT D$
650  ONERR  GOTO 1010
660  PRINT D$;"READ"F1$
670  INPUT A1$,T1$,C1$
680  PRINT D$
690  LET A1 =  VAL (A1$)
700  GOTO 560
710  :
720  REM    PRINT #2 TO #3, READ #2
730  :
740  PRINT D$;"WRITE"F3$
750  PRINT A2$: PRINT T2$: PRINT C2$
760  PRINT D$
770  ONERR  GOTO 900
780  PRINT D$;"READ"F2$
790  INPUT A2$,T2$,C2$
800  PRINT D$
810  LET A2 =  VAL (A2$)
820  GOTO 560
830  :
```

continued on next page

```
840  REM      DUMP #1 TO #3
850  :
860  ONERR  GOTO 1080
870  PRINT D$;"READ"F1$
880  INPUT A1$,T1$,C1$
890  PRINT D$
900  PRINT D$;"WRITE"F3$
910  PRINT A1$: PRINT T1$: PRINT C1$
920  PRINT D$
930  GOTO 860
940  :
950  REM      DUMP #2 TO #3
960  :
970  ONERR  GOTO 1080
980  PRINT D$;"READ"F2$
990  INPUT A2$,T2$,C2$
1000  PRINT D$
1010  PRINT D$;"WRITE"F3$
1020  PRINT A2$: PRINT T2$: PRINT C2$
1030  PRINT D$
1040  GOTO 970
1050  :
1060  REM      CLOSE FILES
1070  :
1080  IF  PEEK (222) = 5 THEN 1100
1090  PRINT : PRINT  CHR$ (7);"UNUSUAL ERROR. PROGRAM TERMINATED."
1100  PRINT D$;"CLOSE"
1110  PRINT : PRINT "JOB COMPLETED."
1120  :
1130  REM     REQUEST TO DISPLAY MERGED FILES
1140  :
1150  PRINT : INPUT "DO YOU WANT TO SEE THE MERGED DATA?";R$
1160  IF  LEFT$ (R$,1) <  > "N" AND  LEFT$ (R$,1) <  > "Y" THEN  PRINT :
      PRINT "ENTER 'Y' FOR YES OR 'N' FOR NO.": PRINT : GOTO 1150
1170  IF R$ = "Y" THEN 1220
1180  IF R$ = "N" THEN 1330
1190  :
1200  REM      PRINT CONTENTS OF MERGED FILE
1210  :
1220  PRINT D$;"OPEN"F3$
1230  ONERR  GOTO 1320
1240  PRINT D$;"READ"F3$
1250  INPUT A$,T$,C$
1260  PRINT D$
1270  PRINT A$,T$,C$
1280  GOTO 1240
1290  :
1300  REM      CLOSE FILE
1310  :
1320  PRINT D$;"CLOSE"
1330  END
```

(a) Write the corresponding program line number(s) for each step of the following outline.

(1) Open the two files to be merged (#1 and #2).

____

(2) Open, delete, and reopen the file (#3) that will contain the merged data.

____

(3) Use ONERR to branch to step (9) if end-of-file is encountered for either file #1 or file #2. ____________________________

(4) Read the first dataset from file #1. ____________________

(5) Read the first dataset from file #2. ____________________

(6) Test datasets to see which file dataset (#1 or #2) is to be copied or printed to the merge file (#3). ______________

(7) Print the selected dataset to file #3; this requires two separate routines:

(a) One if file #1 dataset is selected, ______________ or

(b) Another if file #2 dataset is selected. ______________

(8) Read another dataset from whichever file's dataset was printed in file #3 in step (7). Again, two separate routines are needed:

(a) Read another dataset from file #1, ______________

______________ or

(b) Read another dataset from file #2. ______________

____

(9) Again, separate routines are needed to "dump" or transfer the remaining data in file #1 or #2 to file #3:

(a) If file #1 comes to end-of-file first, copy the remaining datasets in file #2 to file #3, ______________ or

(b) If file #2 comes to end-of-file first, copy the remaining datasets in file #1 to file #3. ______________

(10) Close all files. ______________

(11) Optional routine to display merged data files for confirmation of a successful merge. ______________

- - - - - - - - - - - - - - -

(a) (1) lines 320 and 330
(2) lines 340 to 360
(3) lines 400 and 480
(4) lines 410 to 430
(5) lines 490 to 510
(6) lines 560 to 580
(7) (a) lines 620 to 640
(b) lines 740 to 760
(8) (a) lines 660 to 680
(b) lines 780 to 800
(9) (a) lines 970 to 1040
(b) lines 860 to 930
(10) line 1100
(11) lines 1150 to 1330

Enter and RUN the program, using the two data files named TRANSACTION-1 and TRANSACTION-2 that you created in the Chapter 4 Self-Test, problem 4a.

PROBLEMS WITH SEQUENTIAL DATA FILES

You should be aware of some frequent errors made in using sequential files and some programming techniques used for successful programs accessing data files.

The most frequent programming error is failing to keep track of the file pointers. Each time you use a file INPUT statement in a program, ask yourself how the file pointer is affected and where it is located before and after executing the statement.

(a) How can you reset the datafile pointer to the beginning of a file? ______________

____

- - - - - - - - - - - - - - -

(a) Close the file. Pointer is at beginning of file when file is reopened.

Another frequent error occurs when a program sequentially searches through a data file for a particular dataset or data item. Let's say you have a data file of names arranged alphabetically by last names. After you enter the name to be searched, the program searches through the file until it finds the name and then prints the information on your printer for that person. Then you enter a second name. When writing the program, ask yourself where the file pointer will be located after the first search. Assume the first name searched and located is DORIAN SCHMIDT and the second name is HAMILTON ANDERSON. The data file search for the second name takes up where the search for the first name left off. The second name obviously will not be found before you reach the end-of-file. If the data file pointer was not reset to the beginning of the file after the first search, ANDERSON will never be found because the file was in alphabetical order and the search for the second name started at SCHMIDT. The solution, of course, is to make sure the program resets the pointer to the beginning of the file after every search, by using a CLOSE followed by an OPEN statement.

(a) When a file has been partially read through during a data search, why must the file pointer be reset to the beginning of the file before a new search of the file commences?

____

____

____

- - - - - - - - - - - - - - -

(a) Because if the pointer is midway in the file and the new datum searched for is near the beginning of the file, the search would not find the datum.

Errors can also occur when the contents of arrays are copied into a data file, a topic mentioned earlier. The contents of a one- or two-dimensional array can be copied into a file or read from a file back into an array, provided you use the correct programming techniques. Such data manipulation has many uses. There is a tendency to think of array data as something that is used up or consumed, but storing array data in a file gives it permanence.

To load array data into a data file from a one-dimensional array:

P	
(1)	1761
(2)	18
(3)	1942
(4)	24
(5)	8209
(6)	2

The correct procedure:

```
200  PRINT D$;"WRITE FILENAME"
210  FOR X = 1 TO 6
220  PRINT P(X)
230  NEXT X
240  PRINT D$
```

Similarly, to load array data into a data file from a two-dimensional array:

C	(1,1)	(1,2)	(1,3)
(1,1)	A	C	P
(2,1)	N	M	S
(3,1)	G	H	T
(4,1)	B	D	E

The correct procedure:

```
300  PRINT D$;"WRITE FILENAME"
310  FOR X = 1 TO 4
320  FOR Y = 1 TO 3
330  PRINT C(X,Y)
340  NEXT Y
350  NEXT X
360  PRINT D$
```

(a) To read data into (or out of) an array from (or to) a data file, what programming technique is used? ______________________

(a) FOR NEXT loop

Another useful technique deals with applications where data are to be added to a file. Let's say a client number needs to be assigned to a new client or customer as part of a new dataset. In a business environment, the new client number might be assigned by data preparation personnel or the data entry person, relying on a list or on their knowledge of what number was last used. However, if you let the computer do it you can avoid "human error" commonly mislabeled "computer error." In the data file and after any copy made for modification of the file, reserve the very first file data position for the next available client number. Then when new clients are added to the file, follow these steps.

1. Read the first data item (next available client number) = N.
2. Assign N to the next client.
3. Increment N by 1 (or perhaps by +2 or +5 or +10 to leave room for future client data to be squeezed in) = N1.
4. Then have the program place N1 as the first item in the temporary file.
5. Copy the rest of the old file to the temporary file.
6. Place the new client data in the temporary file.
7. Copy the temporary file (including N1) back to the old file.
8. Repeat from step 1 for each new client.

Using the first part of a data file to hold information needed by the program, followed by the regular data, is a broadly useful technique. For example, the contents of an array could be placed at the head or beginning of a file, followed by the main datasets that make up the file. This procedure prevents using a separate data file for array data that are a part of the file. Just don't forget how the data file is set up, or some rather horrific file input errors could ensue. Such information should be included in the documentation prepared for each program and its corresponding data files. We recommend including the dataset format in the introductory module of all programs that deal with data files.

A LETTER-WRITING PROGRAM

The next sequential file application example is a letter-writing program you may find useful in your home or business. This application presents some new techniques and reviews others.

Assume that you did the Chapter 4 Self-Test and have three form letters stored in data files called LETTER1, LETTER2, and LETTER3. When these letters are printed, you want the program to put the inside address and salutation in the letter from data located in yet another sequential data file called ADDRESS. The file ADDRESS contains the names and addresses in the mailing list. The data have the format shown below, with each dataset containing five items in fields within one string.

			55	
/1	20/21	40/41	50/12/53	57/
name	address	city	state	zip code

The salutation for each letter will be:

Dear resident of (name of city)

To print the letters on your line printer, be sure to turn the printer on by using PR#1 or PR#2. See your system's reference material for details if you are unfamiliar with these instructions.

The program uses the CRT screen to enter which form letter (1, 2, or 3) you want to send to each name on the mailing list. This program, then, uses four data files (only two data files at a time), a line printer, and a CRT screen. If you don't have a line printer, the program is easily adapted to have all the program output displayed on a CRT screen. Some interesting techniques can be learned from this example.

Follow these steps for this particular program.

(1) Open the ADDRESS data file.
(2) Use ONERR to check for end-of-file for ADDRESS and if found, close all files and end the program.
(3) Input the address dataset and display the name.
(4) User entry option to select the form letter to this address (or to skip this address), with data entry checks. If skipped, go to step (2).
(5) Open selected form letter file.
(6) Print inside heading address.
(7) Print salutation with addressee's last name.
(8) Use ONERR to check for end-of-file for letter file and if found,
    (a) close that form letter file, and
    (b) repeat from step (2).
(9) Input a dataset (one line of text from the letter file) and print it.
(10) Repeat steps (8) and (9).

Look at the introductory module of the program. The ADDRESS file is opened and, as indicated in the line 290 remark, the LETTER files are user selected and opened when selected.

```
100  REM      LETTER WRITING PROGRAM
110  :
120  REM      VARIABLES USED
130  REM       N$ = FIELDED ADDRESS STRING
140  REM       R$ = USER RESPONSE
150  REM       T$ = LETTER FILE TEXT STRING
160  REM       F$ = FILE NAME
170  REM       D$ = CONTROL D
180  REM      FILES USED
190  REM       SEQ.FILE NAME: ADDRESS
200  REM       DATASET FORMAT: ONE FIELDED STRING
210  REM       SEQ.FILE NAMES: LETTER1, LETTER2, LETTER3 (NUMBER FOR FILE
                NAME IS USER SELECTED)
220  REM       DATASET FORMAT: ONE OR MORE LONG STRINGS
230  :
240  REM       INITIALIZATION
250  :
260  LET D$ =  CHR$ (4)
270  PRINT D$;"OPEN ADDRESS"
280  :
290  REM      LETTER FILE IS USER SELECTED AND OPENED WHEN NEEDED
300  :
310  REM      READ NAME/ADDRESS
320  :
330  ONERR  GOTO 850
340  PRINT D$;"READ ADDRESS"
350  INPUT N$
360  PRINT D$
370  :
```

The program assigns the first name and address dataset string to variable N$ in line 350. Notice that the program tests for the end of file marker *before* the first datum is read from the file. Always include this ONERR strategy in your programs dealing with sequential data files.

Now it's your turn. Have the program display the party's name on the CRT, and then ask the user to select the letter to be printed to this party. Fill in lines 410, 440, and 450.

(a)
```
380  REM      DISPLAY NAME/LETTER REQUEST
390  :
400  HOME
410
420  PRINT "ENTER 1, 2, OR 3 TO SELECT LETTER1, LETTER2, OR LETTER3 FOR
     ABOVE ADRESSEE."
430  INPUT "ENTER '9' TO SKIP ABOVE ADDRESS:";R$
440
450
460  :
```

(a)
```
380  REM      DISPLAY NAME/LETTER REQUEST
390  :
400  HOME
410  PRINT  LEFT$ (N$,20): PRINT
420  PRINT "ENTER 1, 2, OR 3 TO SELECT LETTER1, LETTER2, OR LETTER3 FOR
     ABOVE ADDRESSEE."
430  INPUT "ENTER '9' TO SKIP ABOVE ADDRESS:";R$
440  IF R$ = "9" THEN 340
450  IF  VAL (R$) < 1 OR  VAL (R$) > 3 THEN  PRINT "ERROR.  LETTERS 1-3
     ONLY.": GOTO 420
460  :
```

Examine the following routine for creating the name of an existing data file.

```
470  REM      INITIALIZE LETTER FILE
480  :
490  LET F$ = "LETTER" + R$
500  PRINT D$;"OPEN"F$
510  :
```

(a) If the user enters 2 in response to line 430, what file name is created and assigned to F$?

____

(a) LETTER2 (Note the string concatenation in line 000)

Write the inside address printing statements (to be printed by the line printer). Fill in lines 560, 570, and 580.

(a)
```
520  REM      PRINT INSIDE ADDRESS"
530  :
540  PRINT D$;"PR#1"
550  PRINT : PRINT : PRINT
560
570
580
590  :
```

(a)
```
520  REM      PRINT INSIDE ADDRESS"
530  :
540  PRINT D$;"PR#1"
550  PRINT : PRINT : PRINT
560  PRINT  LEFT$ (N$,20)
570  PRINT  MID$ (N$,21,20)
580  PRINT  MID$ (N$,41,10), MID$ (N$,51,2), RIGHT$ (N$,5)
590  :
```

This next routine prints the salutation. Notice how the city name is extracted from N$ in line 630.

```
600  REM      PRINT SALUTATION
610  :
620  PRINT : PRINT
630  PRINT "DEAR RESIDENT OF "; MID$ (N$,41,10)
640  :
```

(a) For practice, write a BASIC statement that would print this alternate salutation: HELLO THERE ALL YOU FOLKS AT <u>(street address)</u>

____

(a)
```
630  PRINT "HELLO THERE ALL YOU FOLKS AT "; MID$ (N$,21,20)
```

The next routine to print the text of the letter is fairly straightforward. The data input loop continues until that file data are exhausted. Assume that all line feeds and carriage returns are included with the text in the data file.

```
650  REM      PRINT TEXT OF LETTER
660  :
670  ONERR  GOTO 780
680  PRINT D$;"PR#0"
690  PRINT D$;"READ"F$
700  INPUT T$
710  PRINT D$
720  PRINT D$;"PR#1"
730  PRINT T$
740  GOTO 680
750  :
760  REM      CLOSE LETTER FILE AND RETURN FOR NEXT ADDRESS
770  :
780  PRINT D$;"CLOSE"F$
790  IF  PEEK (222) = 5 THEN 810
800  PRINT : PRINT  CHR$ (7);"UNUSUAL ERROR. PROGRAM TERMINATED.": PRINT :
     GOTO 850
810  GOTO 330
```

(a) Give two reasons for closing the letter file in line 780.

(b) Without checking back, what happens in the routine starting at line 330, which is branched to from line 810 GOTO 330?

\- - - - - - - - - - - - - - -

(a) Resets the pointer so that the letter can be used again, and only one OPEN statement is needed for all letter files
(b) End-of-data tests and next name and address data set are read.

And now, you write the last routine necessary to properly complete this program by completing line 850.

(a)
```
830  REM      CLOSE ADDRESS FILE
840  :
850
860  PRINT "JOB COMPLETED"
```

\- - - - - - - - - - - - - - -

(a)
```
830  REM      CLOSE ADDRESS FILE
840  :
850  PRINT D$;"CLOSE"
860  PRINT "JOB COMPLETED"
```

Following is a complete listing of the letter-writing program.

```
100  REM      LETTER WRITING PROGRAM
110  :
120  REM      VARIABLES USED
130  REM       N$ = FIELDED ADDRESS STRING
140  REM       R$ = USER RESPONSE
150  REM       T$ = LETTER FILE TEXT STRING
160  REM       F$ = FILE NAME
170  REM       D$ = CONTROL D
180  REM      FILES USED
190  REM       SEQ.FILE NAME: ADDRESS
200  REM       DATASET FORMAT: ONE FIELDED STRING
210  REM       SEQ.FILE NAMES: LETTER1, LETTER2, LETTER2 (NUMBER FOR FILE
     NAME IS USER SELECTED)
220  REM       DATASET FORMAT: ONE OR MORE LONG STRINGS
230  :
240  REM      INITIALIZATION
250  :
260  LET D$ =  CHR$ (4)
270  PRINT D$;"OPEN ADDRESS"
280  :
290  REM      LETTER FILE IS USER SELECTED AND OPENED WHEN NEEDED
300  :
310  REM      READ NAME/ADDRESS
320  :
330  ONERR  GOTO 850
340  PRINT D$;"READ ADDRESS"
350  INPUT N$
360  PRINT D$
370  :
380  REM      DISPLAY NAME/LETTER REQUEST
390  :
400  HOME
410  PRINT  LEFT$ (N$,20): PRINT
420  PRINT "ENTER 1, 2, OR 3 TO SELECT LETTER1, LETTER2, OR LETTER3 FOR
     ABOVE ADDRESSEE."
430  INPUT "ENTER '9' TO SKIP ABOVE ADDRESS:";R$
440  IF R$ = "9" THEN 340
450  IF  VAL (R$) < 1 OR  VAL (R$) > 3 THEN  PRINT "ERROR.  LETTERS 1-3
     ONLY.": GOTO 420
460  :
470  REM      INITIALIZE LETTER FILE
480  :
490  LET F$ = "LETTER" + R$
500  PRINT D$;"OPEN"F$
510  :
520  REM      PRINT INSIDE ADDRESS"
530  :
540  PRINT D$;"PR#1"
550  PRINT : PRINT : PRINT
560  PRINT  LEFT$ (N$,20)
570  PRINT  MID$ (N$,21,20)
580  PRINT  MID$ (N$,41,10), MID$ (N$,51,2), RIGHT$ (N$,5)
590  :
600  REM      PRINT SALUTATION
610  :
620  PRINT : PRINT
630  PRINT "DEAR RESIDENT OF "; MID$ (N$,41,10)
640  :
650  REM      PRINT TEXT OF LETTER
660  :
670  ONERR  GOTO 780
680  PRINT D$;"PR#0"
690  PRINT D$;"READ"F$
700  INPUT T$
710  PRINT D$
720  PRINT D$;"PR#1"
730  PRINT T$
740  GOTO 680
750  :
```

continued on next page

```
760  REM      CLOSE LETTER FILE AND RETURN FOR NEXT ADDRESS
770  :
780  PRINT D$;"CLOSE"F$
790  IF  PEEK (222) = 5 THEN 810
800  PRINT : PRINT  CHR$ (7);"UNUSUAL ERROR. PROGRAM TERMINATED.": PRINT :
     GOTO 850
810  GOTO 330
820  :
830  REM      CLOSE ADDRESS FILE
840  :
850  PRINT D$;"CLOSE"
860  PRINT "JOB COMPLETED"
```

Enter and RUN the program. If you are not using a printer, modify lines 540, 680, and 720. Be sure the disks with the ADDRESS and LETTER files are in the disk drive.

CHAPTER 5 SELF-TEST

1. Write a program to make a copy of the ADDRESS file that you created in the Chapter 4 Self-Test, problem 5, and that you used in the letter-writing program. Name the copy file ADDRESS COPY. Include a routine to display the contents of ADDRESS COPY to verify a successful copy.

```
100  REM    COPY PROGRAM FOR 'ADDRESS'
110  REM      VARIABLES USED
120  REM        N$ = CONCATENATED DATASET
130  REM        R$ = USER RESPONSE
140  REM        D$ = CONTROL D
150  REM      FILES USED
160  REM        SEQ. FILE NAMES: ADDRESS, ADDRESS COPY
170  REM        DATASET FORMAT: N$ (BOTH FILES)
```

2a. Write a program that you can use to create a sequential data file whose items are the titles of computer magazines. Use the program to create two separate files, named MAGLIST1 and MAGLIST2, using the titles given below. Maintain alphabetical order of the data items within each file.

File One:	File Two:
BYTE Magazine	Creative Computing
Compute	DATAMATION
Dr. Dobbs Journal	Interface Age
Kilobaud Microcomputing	ON Computing
Recreational computing	Personal Computing

```
100  REM    CREATE MAGAZINE TITLE FILES
110  :
120  REM    VARIABLES USED
130  REM    M$ = MAGAZINE TITLE
140  REM    F$ = USER SELECTED FILE NAME
150  REM    D$ = CONTROL D
160  REM    FILES USED
170  REM      SEQ. FILE NAMES: MAGLIST1, MAGLIST2 (USER SELECTED AND
              ENTERED)
180  REM      DATASET FORMAT: M$ (ONE STRING FOR TITLE)
190  :
```

2b. Write a program that can display the contents of the user-selected file of magazine titles, including either MAGLIST1 or MAGLIST2. Use the program to verify the contents of the files mentioned.

```
100  REM     READ/DISPLAY MAGLIST FILES
110  :
120  REM     VARIABLES USED
130  REM     M$ = MAGAZINE TITLE
140  REM     F$ = USER SELECTED FILE NAME
150  REM     D$ = CONTROL D
160  REM     FILES USED
170  REM       SEQ. FILE NAMES: MAGLIST1, MAGLIST2 (USER SELECTED AND
               ENTERED)
180  REM       DATASET FORMAT: M$ (ONE STRING FOR TITLE)
190  :
```

2c. Write a program to merge into one alphabetically organized sequential data file the contents of MAGLIST1 and MAGLIST2. These two files should have their own data organized alphabetically within each file. Name the merged file MAGLISTMERGE. Include a routine at the end of this program (similar to the program from Chapter 5, Self-Test question 2b) to automatically display MAGLISTMERGE to verify a successful and complete merge. Refer back to this chapter for guidelines to organizing your program.

```
100  REM    SOLUTION TO CH5 SELFTEST PROB 2C
110  :
120  REM    VARIBLES USED
130  REM      M1$, M2$ = MAGAZINE TITLES
140  REM      D$ = CONTROL D
150  REM    FILES USED
160  REM      SEQ. FILE NAMES:MAGLIST1, MAGLIST2, MAGLISTMERGE
170  REM      DATASET FORMAT: M$ (ONE STRING DATASET, ALL FILES)
180  :
190  REM    INITIALIZE
200  :
```

3. Write a program that allows you to enter a list of household maintenance tasks to be done into a sequential data file, and allows you to add to or delete from the data file using a temporary file for the updates. Name the source file WORK REMINDER and the temporary file TEMPFILE.

```
100  REM    SOLUTION CH5 SELFTEST PROB 3
110  :
120  REM     VARIABLES USED
130  REM         A$ = WORK DESCRIPTION
140  REM         R$ = RESPONSE VARIABLE
150  REM         D$ = CONTROL D
160  REM     FILES USED
170  REM       SEQ. FILE NAMES: WORK REMINDER, TEMPFILE
180  :
190  REM       DATASET FORMATS: A$ (ONE STRING, SAME FOR BOTH FILES)
200  :
```

Answer Key

1.

```
100  REM   COPY PROGRAM FOR 'ADDRESS'
110  REM     VARIABLES USED
120  REM       N$ = CONCATENATED DATASET
130  REM       R$ = USER RESPONSE
140  REM       D$ = CONTROL D
150  REM     FILES USED
160  REM       SEQ. FILE NAMES: ADDRESS, ADDRESS COPY
170  REM       DATASET FORMAT: N$ (BOTH FILES)
180  :
190  REM    INITIALIZE
200  :
210  HOME : PRINT
220  PRINT "FILE COPYING IN PROGRESS."
230  LET D$ =  CHR$ (4)
240  PRINT D$;"OPEN ADDRESS COPY"
250  PRINT D$;"DELETE ADDRESS COPY"
260  PRINT D$"OPEN ADDRESS COPY"
270  PRINT D$;"OPEN ADDRESS"
280  ONERR  GOTO 420
290  :
300  REM   COPYING ROUTINE
310  :
320  PRINT D$;"READ ADDRESS"
330  INPUT N$
340  PRINT D$
350  PRINT D$;"WRITE ADDRESS COPY"
360  PRINT N$
370  PRINT D$
380  GOTO 320
390  :
400  REM   CLOSE FILES
410  :
420  PRINT D$;"CLOSE"
430  PRINT "FILE COPIED AND CLOSED."
440  :
450  REM    DISPLAY OPTION
460  :
470  PRINT
480  INPUT "WOULD YOU LIKE TO SEE THE COPIED FILE (Y OR N)?";R$
490  IF R$ <  > "Y" AND R$ <  > "N" THEN  PRINT  CHR$ (7);"TYPE 'Y' FOR YES
     OR 'N' FOR NO.": PRINT : GOTO 480
500  IF R$ = "N" THEN 610
510  ONERR  GOTO 590
520  PRINT
530  PRINT D$;"OPEN ADDRESS COPY"
540  PRINT D$;"READ ADDRESS COPY"
550  INPUT N$
560  PRINT D$
570  PRINT N$
580  PRINT : GOTO 540
590  PRINT D$;"CLOSE"
600  PRINT "END OF COPIED FILE"
610  END
```

2a.

```
100  REM    CREATE MAGAZINE TITLE FILES
110  :
120  REM    VARIABLES USED
130  REM    M$ = MAGAZINE TITLE
140  REM    F$ = USER SELECTED FILE NAME
150  REM    D$ = CONTROL D
160  REM    FILES USED
170  REM      SEQ. FILE NAMES: MAGLIST1, MAGLIST2 (USER SELECTED AND
              ENTERED)
180  REM      DATASET FORMAT: M$ (ONE STRING FOR TITLE)
190  :
200  REM    INITIALIZE
210  :
220  LET D$ =  CHR$ (4)
230  INPUT "ENTER FILE NAME:";F$
240  PRINT D$;"OPEN"F$
250  :
260  REM   DATA ENTRY ROUTINE
270  :
280  HOME
290  PRINT "ENTER '9' IF NO MORE TITLES."
300  INPUT "ENTER TITLE:";M$
310  IF  LEN (M$) = 0 THEN  PRINT : PRINT  CHR$ (7);"PLEASE ENTER AS
     REQUESTED.": PRINT : GOTO 300
320  IF M$ = "9" THEN 430
330  :
340  REM    WRITE TO FILE ROUTINE
350  :
360  PRINT D$;"WRITE"F$
370  PRINT M$
380  PRINT D$
390  GOTO 280
400  :
410  REM   CLOSE FILE
420  :
430  PRINT D$;"CLOSE"F$
440  PRINT "FILE CLOSED"
```

2b.

```
100  REM    READ/DISPLAY MAGLIST FILES
110  :
120  REM    VARIABLES USED
130  REM    M$ = MAGAZINE TITLE
140  REM    F$ = USER SELECTED FILE NAME
150  REM    D$ = CONTROL D
160  REM    FILES USED
170  REM      SEQ. FILE NAMES: MAGLIST1, MAGLIST2 (USER SELECTED AND
              ENTERED)
180  REM      DATASET FORMAT: M$ (ONE STRING FOR TITLE)
190  :
200  REM    INITIALIZE
210  :
220  LET D$ =  CHR$ (4)
230  INPUT "ENTER FILE NAME:";F$
240  PRINT D$;"OPEN"F$
250  :
260  REM    READ/DISPLAY ROUTINE
270  :
280  PRINT
290  ONERR  GOTO 380
300  PRINT D$;"READ"F$
310  INPUT M$
320  PRINT D$
330  PRINT M$
340  GOTO 300
350  :
360  REM   CLOSE FILE
370  :
380  IF  PEEK (222) = 5 THEN 400
390  PRINT : PRINT  CHR$ (7);"UNUSUAL ERROR. PROGRAM TERMINATED."
400  PRINT D$;"CLOSE"F$
410  PRINT : PRINT "FILE CLOSED"
```

2c.
```
100  REM     SOLUTION TO CH5 SELFTEST PROB 2C
110  :
120  REM     VARIBLES USED
130  REM       M1$, M2$ = MAGAZINE TITLES
140  REM       D$ = CONTROL D
150  REM     FILES USED
160  REM       SEQ. FILE NAMES:MAGLIST1, MAGLIST2, MAGLISTMERGE
170  REM       DATASET FORMAT: M$ (ONE STRING DATASET, ALL FILES)
180  :
190  REM     INITIALIZE
200  :
210  HOME : PRINT : PRINT "WORKING"
220  LET D$ =  CHR$ (4)
230  PRINT D$;"OPEN MAGLIST1"
240  PRINT D$;"OPEN MAGLIST2"
250  PRINT D$;"OPEN MAGLISTMERGE"
260  PRINT D$;"DELETE MAGLISTMERGE"
270  PRINT D$;"OPEN MAGLISTMERGE"
280  :
290  REM     READ DATASET FROM FILE 1
300  :
310  ONERR  GOTO 870
320  PRINT D$;"READ MAGLIST1"
330  INPUT M1$
340  PRINT D$
350  :
360  REM     READ DATASET FROM FILE 2
370  :
380  ONERR  GOTO 770
390  PRINT D$;"READ MAGLIST2"
400  INPUT M2$
410  PRINT D$
420  :
430  REM     COMPARE FOR ALPHABETICAL ORDER
440  :
450  IF M1$ < M2$ THEN 510
460  IF M1$ > M2$ THEN 620
470  GOTO 510
480  :
490  REM     WRITE FILE 1 ITEM TO MERGE, THEN READ FILE 1
500  :
510  PRINT D$;"WRITE MAGLISTMERGE"
520  PRINT M1$
530  PRINT D$
540  ONERR  GOTO 880
550  PRINT D$;"READ MAGLIST1"
560  INPUT M1$
570  PRINT D$
580  GOTO 450
590  :
600  REM     WRITE FILE 2 ITEM TO MERGE, THEN READ FILE 1
610  :
620  PRINT D$;"WRITE MAGLISTMERGE"
630  PRINT M2$
640  PRINT D$
650  ONERR  GOTO 770
660  PRINT D$;"READ MAGLIST2"
670  INPUT M2$
680  PRINT D$
690  GOTO 450
700  :
710  REM    DUMP REMAINING FILE 1 TO MERGE
720  :
730  ONERR  GOTO 950
740  PRINT D$;"READ MAGLIST1"
750  INPUT M1$
760  PRINT D$
770  PRINT D$;"WRITE MAGLISTMERGE"
78C  PRINT M1$
790  PRINT D$
800  GOTO 730
810  :
```

continued on next page

```
820  REM   DUMP REMAINING FILE 2 TO MERGE
830  :
840  ONERR  GOTO 950
850  PRINT D$;"READ MAGLIST2"
860  INPUT M2$
870  PRINT D$
880  PRINT D$;"WRITE MAGLISTMERGE"
890  PRINT M2$
900  PRINT D$
910  GOTO 840
920  :
930  REM    CLOSE FILES
940  :
950  PRINT D$;"CLOSE MAGLIST1"
960  PRINT D$;"CLOSE MAGLIST2"
970  PRINT D$;"CLOSE MAGLISTMERGE"
980  :
990  REM    DISPLAY MERGED DATA
1000  :
1010  PRINT
1020  ONERR  GOTO 1090
1030  PRINT D$;"OPEN MAGLISTMERGE"
1040  PRINT D$;"READ MAGLISTMERGE"
1050  INPUT M$
1060  PRINT D$
1070  PRINT M$
1080  GOTO 1040
1090  PRINT D$;"CLOSE MAGLISTMERGE"
1100  PRINT : PRINT "FILE DISPLAYED AND CLOSED."
```

3.
```
100  REM   SOLUTION CH5 SELFTEST PROB 3
110  :
120  REM    VARIABLES USED
130  REM        A$ = WORK DESCRIPTION
140  REM        R$ = RESPONSE VARIABLE
150  REM        D$ = CONTROL D
160  REM    FILES USED
170  REM      SEQ. FILE NAMES: WORK REMINDER, TEMPFILE
180  :
190  REM      DATASET FORMATS: A$ (ONE STRING, SAME FOR BOTH FILES)
200  :
210  REM     INITIALIZE
220  :
230  LET D$ =  CHR$ (4)
240  PRINT D$;"OPEN WORK REMINDER"
250  PRINT D$;"OPEN TEMPFILE"
260  PRINT D$;"CLOSE TEMPFILE"
270  PRINT D$;"OPEN TEMPFILE"
280  :
290  REM    READ/DISPLAY FILE DATA
300  :
310  HOME
320  PRINT "TYPE 'D' TO DELETE AN ITEM"
330  PRINT "PRESS 'RETURN' TO DISPLAY NEXT ITEM."
340  ONERR  GOTO 540
350  PRINT D$;"READ WORK REMINDER"
360  INPUT A$
370  PRINT D$
380  PRINT A$
390  INPUT "";B$
400  IF B$ <  > "" AND B$ <  > "D" THEN  PRINT  CHR$ (7);"PLEASE TYPE 'D'
     TO DELETE THE ITEM DISPLAYED ABOVE, OR PRESS 'RETURN' TO DISPLAY THE
     NEXT ITEM.": GOTO 390
410  IF B$ = "D" THEN  PRINT A$;" REMOVED FROM LIST.": PRINT : GOTO 350
420  :
430  REM    ROUTINE TO RETAIN DATA ITEM
440  :
450  PRINT D$;"WRITE TEMPFILE"
460  PRINT A$
470  PRINT D$
480  GOTO 350
490  :
500  REM    ROUTINE TO ADD ITEMS TO FILE
510  IF  PEEK (222) = 5 THEN 530
520  PRINT : PRINT  CHR$ (7);"UNUSUAL ERROR. PROGRAM TERMINATED.": PRINT :
     GOTO 660
530  HOME
540  HOME : PRINT
550  INPUT "DO YOU WISH TO ADD ANOTHER ITEM (Y OR N)?";R$
560  IF R$ <  > "Y" AND R$ <  > "N" THEN  PRINT  CHR$ (7);"PLEASE TYPE 'Y'
     FOR YES OR 'N' FOR NO.": GOTO 550
570  IF R$ = "N" THEN 670
580  PRINT
590  INPUT "ENTER NEW ITEM:";A$
600  PRINT D$;"WRITE TEMPFILE"
610  PRINT A$
620  PRINT D$
630  GOTO 540
640  :
650  REM    CLOSE FILES, RENAME TEMPFILE
660  :
670  PRINT D$;"CLOSE TEMPFILE"
680  PRINT D$;"CLOSE WORK REMINDER"
690  PRINT D$;"DELETE WORK REMINDER"
700  PRINT D$;"RENAME TEMPFILE,WORK REMINDER"
710  PRINT : PRINT "FILE CLOSED"
```

CHAPTER SIX
Random Access Data Files

Objectives: When you complete this chapter, you will be able to create, verify, copy, and change random access disk data files. You will also be able to convert sequential files to random access files. The random access file manipulating statements you will use are similar to those used with sequential files and, therefore, should be familiar to you.

WHAT IS A RANDOM ACCESS FILE?

A random access data file is a disk file divided into sections called records. Each record can contain one complete dataset. The typical random access data file format of placing only one entire dataset into each record makes finding and changing data easy. The structure also allows for fast access of data, whether located in the first or last record in the file. These two strengths of random access files are the greatest weakness of sequential data files.

Random access files use the same BASIC file manipulation statements as sequential files. The only difference in statement formats is the provision for the record number and the length of the record. Random access files on your APPLE computer use what is called a variable length record. This means that the programmer determines how long, in bytes, the records for the file will be. Once established, each record in the file has the same length.

The length of the record is dependent on the amount of data in the dataset being written to the file. In Chapter 4 we discussed the storage requirements of data that are placed in the file. With random access files it is imperative that you plan your file structure based on storage requirements or you will experience file errors. To review, the storage requirement for string information is one byte per character in the string, plus one byte for "overhead." If you include a twenty-character name in each dataset, then each name will occupy, at most, twenty-one bytes of storage. Numeric information works the same way: one byte per character in the number, plus one byte for "overhead." A numeric integer value of 1 through 999 takes a maximum of four bytes in a random access file: three for the number, plus one for "overhead." A value such as 542.45 has 6 characters (counting the decimal point), and will take seven bytes, including "overhead."

(a) In a random access file application that uses a twenty-character name, a twenty-character address, and a twelve-character phone number string, how large will the record need to be in bytes? ______________

(a) 55 bytes

For each random access file, you will need to compute the record size based on the dataset that is used for that file. It is important that you indicate the record size in the introductory module of your program so that the record size is permanently recorded somewhere. Once a file program is written, there is no instruction that will help you find the record size. You should include the record size in the introductory module of the program, and in any other documentation you prepare. This is as important as documenting the dataset formats; it should not be taken lightly.

The variable-size record available in APPLESOFT BASIC means that the use of diskette space is very efficient. Other computers use a fixed-size record length of 256 bytes. In those systems, if the dataset only uses fifty bytes, the remaining 206 bytes in the record are wasted, and much valuable disk storage space goes unused. This will not be the case in your APPLESOFT programs where you will tailor the record size to the dataset used in each random access file.

Random access files require more planning and more carefully designed systems for organizing and using data. Once planned, random access files may require much less programming to accomplish the same activities as sequential files. Random access files are best used when the data in the files will change frequently. This might be the case with a customer charge account file or when you have a large data base, such as a credit information file that will be accessed in no particular order (randomly). For large scale applications, you may find yourself designing systems that use both sequential files and some random access files.

(a) What are two advantages of random access files over sequential files?

____

____

____

(a) Fast access to all datasets (records), regardless of position within the file, and ease of changing data within a particular dataset or record.

INITIALIZING RANDOM ACCESS FILES

For random access files, the OPEN statement serves the same purpose of opening the file and assigning the buffer. In addition, the OPEN statement indicates the length of the file records in bytes. The format of the OPEN statement for random access files is as follows:

Remember commas

```
120  PRINT D$;"OPEN FILENAME,L50"

130  PRINT D$;"OPEN"F$",L50"
```

Notice the unusual punctuation in line 130 above. The comma is an integral and essential part of the OPEN statement. Therefore, it must be included inside the quotation marks, as shown in lines 120 and 130. You will NOT get an error message if you use an incorrect format in the OPEN statement. However, you will not open the file the way you intended either, so enter these statements carefully. Notice how a file name assigned to a string variable (F$) is outside the quotations that enclose "OPEN" and ",L50" in line 130.

(a) What is the record length in the OPEN statements above? ____________________

\- - - - - - - - - - - - - - - -

(a) Fifty bytes

SIMPLE READ AND WRITE OPERATIONS TO RANDOM ACCESS FILES

Our first random access file application is to create an inventory of repair parts. The dataset includes a six-digit product number entered as a string, a product description of twenty characters, and a numeric quantity that will be no larger than 999, with no fractional amount.

(a) What is the record size needed for this application? ____________________

____

(b) Here is the introductory module. Complete the OPEN statement by filling in line 310.

```
2 :
100  REM      INVENTORY RANDOM FILE
110 :
120  REM      VARIABLES USED
130  REM        N$ = PRODUCT NUMBER (6)
140  REM        P$ = PROD. DESCRIPTION (20)
150  REM        Q =QUANTITY (<=999)
160  REM        D$ = CONTROL D
170  REM        R1 = RECORD COUNT
180  REM        R$ = USER RESPONSE
190 :
200  REM      FILES USED
210  REM         RANDOM ACCESS FILE NAME: INVEN
220  REM         RECORD SIZE: 32 BYTES
230  REM         DATASET FORMAT:N$,P$,Q
240 :
250  REM      INITIALIZE
260 :
270  LET R1 = 1
280  LET D$ =  CHR$ (4)
290  PRINT D$;"OPEN INVEN"
300  PRINT D$;"DELETE INVEN"
310
320 :
```

(a) 32 bytes. six + one for the product number, twenty + one for the description and three + one for the quantity.

(b) `310 PRINT D$;"OPEN INVEN,L32"`

In line 270 in problem (b) we initialized the variable R1 to one (1). This variable is used to keep track of the file record count in this program. Dataset number one is in record number one, dataset number two is in record number two, etc.

Here is the data entry module for this application. We have left out the data entry tests so that the structure of the program is more clearly revealed in the program listings. By now, you know how to design good data entry error traps, and your completed programs should include them. You will see how difficult accurate data entry can be if you use the "bare bones" program listed below.

```
330  REM      DATA ENTRY MODULE
340 :
350  HOME
360  INPUT "ENTER PRODUCT NUMBER (6):";N$
370  REM      DATA ENTRY TESTS
380  INPUT "ENTER PROD. DESCRIPT.(20 CHAR):";P$
390  REM      DATA ENTRY TESTS
400  INPUT "ENTER QUANTITY:";Q
410  REM      DATA ENTRY TESTS
420 :
```

The file is OPEN; the data are entered. The next operation is to print the data to the file in the first record. The file WRITE instruction for random access files is similar to the sequential file instruction, but now also includes the record number of the random access record to be printed:

```
240  PRINT D$;"WRITE FILENAME,R51"

250  PRINT D$;"WRITE"F$",R"R1
```

In line 240 above, the WRITE statement moves the file pointer to record number 51, where the next PRINT statements will write the information to the file. Notice in line 250 how all variables are placed outside of the quotation marks. Notice, too, the similarity in format to the random access OPEN statement, where the L, for length of file, and the comma that precedes it are always within quotation marks. In random access file READ and WRITE statements, the R for Record and the comma that precedes it must be enclosed in quotation marks.

(a) What record will be printed by the WRITE statement in line 250 above? ________

____

____

— — — — — — — — — — — — — — —

(a) Whatever record value is assigned to variable R1. (In our example program, the record number is 1, for the first dataset.)

The PRINT statements for random access files use the same format as the statements used with sequential files. You must turn the WRITE operation *on,* PRINT the dataset to the file, and turn the WRITE operation *off.*

(a) Here is the next part of our inventory program. Fill in the blank lines at 450, 460, and 470.

```
430  REM     PRINT TO FILE
440  :
450
460
470
480  :
490  INPUT "MORE ENTRIES?";R$
500  IF  LEFT$ (R$,1) <  > "Y" AND  LEFT$ (R$,1) <  > "N" THEN  PRINT :
     PRINT  CHR$ (7);"TYPE 'Y' FOR YES OR 'N' FOR NO.": PRINT : GOTO 490
510  IF  LEFT$ (R$,1) = "N" THEN 600
520  :
530  REM     INCREASE RECORD COUNT
540  :
550  LET R1 = R1 + 1
560  GOTO 350
570  :
```

(b) What is the purpose of line 550? ____

____

— — — — — — — — — — — — — — —

(a)
```
430  REM     PRINT TO FILE
440  :
450  PRINT D$;"WRITE INVEN, R";R1
460  PRINT N$: PRINT P$: PRINT Q
470  PRINT D$
480  :
490  INPUT "MORE ENTRIES?";R$
500  IF  LEFT$ (R$,1) <  > "Y" AND  LEFT$ (R$,1) <  > "N" THEN  PRINT :
     PRINT  CHR$ (7);"TYPE 'Y' FOR YES OR 'N' FOR NO.": PRINT : GOTO 490
510  IF  LEFT$ (R$,1) = "N" THEN 600
520  :
530  REM     INCREASE RECORD COUNT
540  :
550  LET R1 = R1 + 1
560  GOTO 350
570  :
```

(b) Increments the record number by one so that if another dataset is entered, it will be recorded in the next random access record.

The final program module is the file close routine. The format of the random access CLOSE statement is the same as that used with sequential files.

```
580  REM     CLOSE FILE
590  :
600  PRINT D$;"CLOSE INVEN"
610  PRINT "FILE CLOSED"
620  END
```

Here is the complete listing of our random access file printing inventory application.

```
100  REM      INVENTORY RANDOM FILE
110  :
120  REM      VARIABLES USED
130  REM        N$ = PRODUCT NUMBER (6)
140  REM        P$ = PROD. DESCRIPTION (20)
150  REM        Q =QUANTITY (<=999)
160  REM        D$ = CONTROL D
170  REM        R1 = RECORD COUNT
180  REM        R$ = USER RESPONSE
190  :
200  REM      FILES USED
210  REM         RANDOM ACCESS FILE NAME: INVEN
220  REM         RECORD SIZE: 32 BYTES
230  REM         DATASET FORMAT:N$,P$,Q
240  :
250  REM      INITIALIZE
260  :
270  LET R1 = 1
280  LET D$ =  CHR$ (4)
290  PRINT D$;"OPEN INVEN"
300  PRINT D$;"DELETE INVEN"
310  PRINT D$;"OPEN INVEN, L32"
320  :
330  REM      DATA ENTRY MODULE
340  :
350  HOME
360  INPUT "ENTER PRODUCT NUMBER (6):";N$
370  REM      DATA ENTRY TESTS
380  INPUT "ENTER PROD. DESCRIPT.(20 CHAR):";P$
390  REM      DATA ENTRY TESTS
400  INPUT "ENTER QUANTITY:";Q
410  REM      DATA ENTRY TESTS
420  :
430  REM    PRINT TO FILE
440  :
450  PRINT D$;"WRITE INVEN, R";R1
460  PRINT N$: PRINT P$: PRINT Q
470  PRINT D$
480  :
490  INPUT "MORE ENTRIES?";R$
500  IF  LEFT$ (R$,1) <  > "Y" AND  LEFT$ (R$,1) <  > "N" THEN  PRINT :
     PRINT  CHR$ (7);"TYPE 'Y' FOR YES OR 'N' FOR NO.": PRINT : GOTO 490
510  IF  LEFT$ (R$,1) = "N" THEN 600
520  :
530  REM    INCREASE RECORD COUNT
540  :
550  LET R1 = R1 + 1
560  GOTO 350
570  :
580  REM      CLOSE FILE
590  :
600  PRINT D$;"CLOSE INVEN"
610  PRINT "FILE CLOSED"
620  END
```

Many uses of random access files require that the BASIC program accessing the file know where the file ends or how many datasets (records) exist in the file. As no system command is available in APPLESOFT to count or display the number of records in a file, your programs to create and use random access files should provide a counting variable to keep track of the total number of records that are used in the file. This process is used often in programming applications.

The numbering of random access file records actually begins at zero, so the very first record in a random access file is record zero (R0). This record is sometimes used to keep "housekeeping" information. One item of data that could be saved in R0 is the record number for the last filled record in the file. Then, when you want to add data to the file, you would follow these steps:

1. OPEN the file.
2. READ R0 to find the record number for the last filled record.
3. Increment the last record by one (1).
4. Enter data.
5. PRINT to the file.
6. Ask for more entries.
6a. If yes, increment the record counter by one and return for more data.
6b. If no, PRINT the current record counter value to R0, so that the record number for the last filled record is available the next time it is needed.
7. CLOSE the file.

When creating a random access file, a counting statement such as LET R1 = R1 + 1 can be used. The placement of the counting statement within a program is crucial for counting accuracy. Only datasets actually entered must be counted, so the counting statement is usually after the dataset PRINT statement. In this way, if no more data are forthcoming, the record number will not have already been increased.

Notice where the record counting statement is placed in the previous program. The logic in this case is to increase the record counting variable by one after the user responds "yes" to the question, MORE ENTRIES?

In the example program to create the INVEN file, no provision is made to store the record count for the future reference or use by BASIC programs that access the file. Our strategy is to store the record count in R0, the first record in the file. This record is accessed by using R0 in a READ or WRITE statement.

```
470  PRINT D$;"READ FILENAME, R0"

980  PRINT D$;"WRITE FILENAME, R0"
```

Caution: Don't accidentally type the letter O (oh) for the number zero.

(a) Modify the program that creates the INVEN file so that the total number of records containing data (record count) is placed in R0. This routine should be included in the Close File Module.

____

____

____

____

____

____

____

(a)
```
580  REM      CLOSE FILE
590  :
600  PRINT D$;"WRITE INVEN, R0"
610  PRINT R1
620  PRINT D$
630  PRINT D$;"CLOSE INVEN"
640  PRINT "FILE CLOSED"
650  END
```

Enter and RUN the modified program. Create the file INVEN for use in this section, as well as later programs.

Now let's write a separate program to display the contents of this random access file. Here is the introductory module and initialization module.

```
100  REM      INVEN READ/PRINT
110  :
120  REM      VARIABLES USED
130  REM        N$ = PRODUCT NUMBER (6)
140  REM        P$ = PROD. DESCRIPTION (20)
150  REM        Q =QUANTITY (<=999)
160  REM        D$ = CONTROL D
170  REM        R1 = RECORD #
180  :
190  REM      FILES USED
200  REM          R.A.FILE NAME: INVEN
210  REM          RECORD LENGTH: 32 BYTES
220  REM          DATASET FORMAT:N$,P$,Q
230  :
240  REM      INITIALIZE
250  :
260  LET R1 = 1
270  LET D$ =  CHR$ (4)
280  PRINT D$;"OPEN INVEN, L32"
290  :
```

(a) What is the purpose of line 260 above? ______________________

____

(b) What does the L32 in line 280 represent? ______________________

(a) Assigns the number one (1) to R1 to initialize the record counting variable
(b) The record length of thirty-two bytes

The random access READ statement follows the same format as the WRITE statement, in that it requires a record number be included in the statement.

```
250  PRINT D$;"READ FILENAME,R"R1
```

Here is the file read and report printing module of the inventory reading program.

```
300  REM      PRINT HEADING
310  :
320  PRINT "PROD #"; TAB( 10);"PROD DESCR"; TAB( 26);"QUANTITY"
330  :
340  REM      FILE READ/PRINT
350  :
360  ONERR  GOTO 460
370  PRINT D$;"READ INVEN,R";R1
380  INPUT N$,P$,Q
390  PRINT D$
400  PRINT N$; TAB( 10);P$; TAB( 31);Q
410  LET R1 = R1 + 1
420  GOTO 370
430  :
440  REM      CLOSE FILES
450  :
460  PRINT D$;"CLOSE"
470  END
```

The INPUT statement at line 380 has the same format as that used with sequential files. The ONERR statement at line 360 works the same way as with sequential files. The only real difference between a sequential file program and this one is the READ statement format and the addition of line 410.

(a) What is the purpose of line 410 above?

____

____

- - - - - - - - - - - - - - - -

(a) Increments the record number variable by one so that the next record in the file will be read.

Next, let's make use of the record count, instead of depending on ONERR to determine the end of the file. You can do this using a FOR NEXT loop to read only the number of datasets (records) that contain information. Notice how important this makes the accuracy of the record count. An "extra" count will lead to an OUT OF DATA error message if the program tries to read a nonexistent record. On the other hand, if the count is one short, one dataset will be left inaccessible.

First the record count is accessed and assigned to variable R1.

```
310  PRINT D$;"READ INVEN,R0"
320  INPUT R1
330  PRINT D$
```

Next, the value of R1 is used to tell the FOR NEXT loop how many datasets to read, and the FOR NEXT loop control variable X is used to count off the records.

```
340  FOR X = 1 TO R1
350  PRINT D$;"READ INVEN,R"X
360  INPUT N$,P$,Q
370  PRINT D$
380  PRINT N$; TAB( 10);P$; TAB( 31);Q
390  NEXT X
```

(a) In which line is the record number to INPUT determined? ________________

(b) What is the record number of the first dataset accessed? ________________

(c) How many records will have been accessed when the FOR NEXT loop finishes execution? ________________

(a) line 350 (value of FOR NEXT loop control variable, X)
(b) one
(c) equal to value of R1

Below is another version of the program. Enter the program (and the first version if you wish) and display the contents of the INVEN file on your screen.

```
100 REM     INVEN READ/PRINT
110 :
120 REM     VARIABLES USED
130 REM       N$ = PRODUCT NUMBER (6)
140 REM       P$ = PROD. DESCRIPTION (20)
150 REM       Q =QUANTITY (<=999)
160 REM       D$ = CONTROL D
170 REM       R1 = RECORD #
180 :
190 REM     FILES USED
200 REM         R.A.FILE NAME: INVEN
210 REM         RECORD LENGTH: 32 BYTES
220 REM         DATASET FORMAT:N$,P$,Q
230 :
240 REM     INITIALIZE
250 :
260 LET D$ =  CHR$ (4)
270 PRINT D$;"OPEN INVEN, L32"
280 :
290 REM     PRINT HEADING
300 :
310 PRINT "PROD #"; TAB( 10);"PROD DESCR"; TAB( 26);"QUANTITY": PRINT
320 :
330 REM     FILE READ/PRINT
340 :
350 PRINT D$;"READ INVEN,R0"
360 INPUT R1
370 PRINT D$
380 FOR X = 1 TO R1
390 PRINT D$;"READ INVEN,R"X
400 INPUT N$,P$,Q
410 PRINT D$
420 PRINT N$; TAB( 10);P$; TAB( 31);Q
430 NEXT X
440 :
450 REM     CLOSE FILES
460 :
470 PRINT D$;"CLOSE"
480 END
```

ADDING DATA TO THE END OF A RANDOM ACCESS FILE

In the next application we want a program to add new datasets to an already existing random access file. To make it easy, we will add data to the current end of an existing file, rather than insert new records into the middle of the file.

First, create the random access file to which you will later be asked to add or change data. Name the file PHONE. The program should keep track of the number of records used in the file and place this information in record R0 before closing the file. The dataset has the following items entered as strings:

customer number (five characters)
customer name (twenty-character maximum)
customer phone number (eight characters, e.g., 999-9999)

Here is the introductory module. You complete the program.

(a)
```
100  REM    CREATE FILE NAMED 'PHONE'
110  :
120  REM    VARIABLES USED
130  REM      N$ = CUSTOMER # (5 CHAR.)
140  REM      C$ = CUST. NAME (20 CHAR. MAX.)
150  REM      P$ = PHONE NUMBER (XXX-XXXX OR 8 CHAR.)
160  REM      R$ = USER RESONSE
170  REM      D$ = CONTROL D
180  REM    FILE USED
190  REM      R-A FILE NAME: PHONE
200  REM      RECORD LENGTH: 36 BYTES
210  REM      DATASET FORMAT: N$,C$,P$
220  :
```

(a)
```
100  REM     CREATE FILE NAMED 'PHONE'
110  :
120  REM    VARIABLES USED
130  REM      N$ = CUSTOMER # (5 CHAR.)
140  REM      C$ = CUST. NAME (20 CHAR. MAX.)
150  REM      P$ = PHONE NUMBER (XXX-XXXX OR 8 CHAR.)
160  REM      R$ = USER RESONSE
170  REM      D$ = CONTROL D
180  REM    FILE USED
190  REM      R-A FILE NAME: PHONE
200  REM      RECORD LENGTH: 36 BYTES
210  REM      DATASET FORMAT: N$,C$,P$
220  :
230  REM    INITIALIZE
240  :
250  LET D$ =  CHR$ (4)
260  PRINT D$;"OPEN PHONE, L36"
270  LET R1 = 0
280  :
290  REM    DATA ENTRY MODULE
300  :
310  HOME
320  INPUT "ENTER 'STOP' OR CUSTOMER NUMBER (5 CHAR.)";N$
330  IF N$ = "STOP" THEN 520
340  LET R1 = R1 + 1
350  :
360  REM    DATA ENTRY TESTS
370  :
380  INPUT "ENTER CUSTOMER NAME (20 CHAR. MAX.):";C$
390  REM    DATA ENTRY TESTS
400  INPUT "ENTER PHONE NUMBER:";P$
410  REM    DATA ENTRY TESTS
420  :
430  REM    WRITE TO FILE
440  :
450  PRINT D$;"WRITE PHONE,R";R1
460  PRINT N$: PRINT C$: PRINT P$
470  PRINT D$
480  GOTO 320
490  :
500  REM    CLOSE FILE
510  :
520  PRINT D$;"WRITE PHONE,R0"
530  PRINT R1
540  PRINT D$;"CLOSE"
550  PRINT : PRINT "FILE CLOSED"
```

Next, write a companion program that will display the contents of PHONE, using the FOR NEXT loop technique to cycle through the records in the file.

(a) ____

____

____

____

____

____

____

____

____

____

(a)
```
100  REM     CREATE FILE NAMED 'PHONE'
110  :
120  REM     VARIABLES USED
130  REM       N$ = CUSTOMER # (5 CHAR.)
140  REM       C$ = CUST. NAME (20 CHAR. MAX.)
150  REM       P$ = PHONE NUMBER (XXX-XXXX OR 8 CHAR.)
160  REM       R$ = USER RESONSE
170  REM       D$ = CONTROL D
180  REM     FILE USED
190  REM       R-A FILE NAME: PHONE
200  REM       RECORD LENGTH: 36 BYTES
210  REM       DATASET FORMAT: N$,C$,P$
220  :
230  REM     INITIALIZE
240  :
250  LET D$ =  CHR$ (4)
260  PRINT D$;"OPEN PHONE, L36"
270  :
280  REM     READ RECORD 0
290  :
300  HOME
310  PRINT D$;"READ PHONE, R0"
320  INPUT R1
330  PRINT D$
340  IF R1 = 0 THEN  PRINT "FILE EMPTY": GOTO 470
350  :
360  REM     READ/DISPLAY ROUTINE
370  :
380  FOR X = 1 TO R1
390  PRINT D$;"READ PHONE,R";X
400  INPUT N$,C$,P$
410  PRINT D$
420  PRINT N$;C$;P$
430  NEXT X
440  :
450  REM     CLOSE FILE
460  :
470  PRINT D$;"CLOSE"
480  PRINT : PRINT "FILE DISPLAYED AND CLOSED."
```

Our random access file is a customer list entered by customer number. The dataset includes the customer number, name, and phone number. To add new datasets to the file we must follow these steps:

1. Initialize and OPEN the file.
2. Ascertain the number of records in the file containing information.
3. Enter new data.
4. WRITE new data to the file.
5. Increment record count.
6. Return to step 3.
7. Write the new record count to R0 and CLOSE the file.

Here is the introductory module and initialization module. (Nothing really new here!)

```
100  REM     ADDING TO R-A FILE NAMED PHONE
110  :
120  REM      VARIABLES USED
130  REM       N$ = CUST. NUMBER (5)
140  REM       C$ = CUST. NAME (20)
150  REM       P$ = PHONE NUMBER (10)
160  REM       R1 = RECORD COUNTER
170  REM       D$ = CONTROL D
180  :
190  REM      FILES USED
200  REM      RANDOM ACCESS FILE NAME: PHONE
210  REM      RECORD LENGTH: 36 BYTES
220  REM      DATASET FORMAT: N$,C$,P$
230  :
240  REM      INITIALIZATION
250  :
260  LET D$ =  CHR$ (4)
270  PRINT D$;"OPEN PHONE,L36"
280  :
```

The next program module ascertains the end of file location by reading record R0. Complete lines 310, 320, and 330.

(a)

```
290  REM      LOCATE LAST FULL RECORD
300  :
310
320
330
340  PRINT : PRINT "RECORD COUNT: ";R1: PRINT
350  :
```

(a)

```
290  REM      LOCATE LAST FULL RECORD
300  :
310  PRINT D$;"READ PHONE,R0"
320  INPUT R1
330  PRINT D$
340  PRINT : PRINT "RECORD COUNT: ";R1: PRINT
350  :
```

Next comes the data entry module and the file WRITE module. Fill in lines 480, 490, 500, and 540 below. (You may also wish to construct the data entry checks now.)

(a)

```
360  REM      DATA ENTRY MODULE
370  :
380  LET R1 = R1 + 1
390  INPUT "ENTER CUST. #:";N$
400  REM      DATA ENTRY TESTS
410  INPUT "ENTER CUST. NAME:";C$
420  REM      DATA ENTRY TEST
430  INPUT "ENTER PHONE #:";P$
440  REM      DATA ENTRY TESTS
450  :
460  : REM      WRITE TO FILE ROUTINE
470  :
480
490
500
510  INPUT "MORE ENTRIES?";R$
520  IF  LEFT$ (R$,1) <  > "Y" AND  LEFT$ (R$,1) <  > "N" THEN  PRINT :
     PRINT  CHR$ (7);"ENTER 'Y' FOR YES OR 'N' FOR NO": PRINT : GOTO 510
530  IF  LEFT$ (R$,1) = "N" THEN 580
540
550  :
```

(a)

```
360  REM      DATA ENTRY MODULE
370  :
380  LET R1 = R1 + 1
390  INPUT "ENTER CUST. #:";N$
400  REM      DATA ENTRY TESTS
410  INPUT "ENTER CUST. NAME:";C$
420  REM      DATA ENTRY TEST
430  INPUT "ENTER PHONE #:";P$
440  REM      DATA ENTRY TESTS
450  :
460  : REM      WRITE TO FILE ROUTINE
470  :
480  PRINT D$;"WRITE PHONE, R";R1
490  PRINT N$: PRINT C$: PRINT P$
500  PRINT D$
510  INPUT "MORE ENTRIES?";R$
520  IF  LEFT$ (R$,1) <  > "Y" AND  LEFT$ (R$,1) <  > "N" THEN  PRINT :
     PRINT  CHR$ (7);"ENTER 'Y' FOR YES OR 'N' FOR NO": PRINT : GOTO 510
530  IF  LEFT$ (R$,1) = "N" THEN 580
540  GOTO 380
550  :
```

The final program segment shown below closes the file and posts the record count to record zero.

```
560  REM      CLOSE FILE
570  :
580  PRINT D$;"WRITE PHONE, R0"
590  PRINT R1
600  PRINT D$
610  PRINT D$;"CLOSE PHONE"
620  PRINT : PRINT "FILE CLOSED"
630  PRINT : PRINT "NEW RECORD COUNT: ";R1
```

Here is the complete listing of the program to add data to an existing random access file program

```
100  REM     ADDING TO R-A FILE NAMED PHONE
110  :
120  REM      VARIABLES USED
130  REM       N$ = CUST. NUMBER (5)
140  REM       C$ = CUST. NAME (20)
150  REM       P$ = PHONE NUMBER (10)
160  REM       R1 = RECORD COUNTER
170  REM       D$ = CONTROL D
180  :
190  REM      FILES USED
200  REM      RANDOM ACCESS FILE NAME: PHONE
210  REM      RECORD LENGTH: 36 BYTES
220  REM      DATASET FORMAT: N$,C$,P$
230  :
240  REM      INITIALIZATION
250  :
260  LET D$ =  CHR$ (4)
270  PRINT D$;"OPEN PHONE,L36"
280  :
290  REM      LOCATE LAST FULL RECORD
300  :
310  PRINT D$;"READ PHONE,R0"
320  INPUT R1
330  PRINT D$
340  PRINT : PRINT "RECORD COUNT: ";R1: PRINT
350  :
360  REM      DATA ENTRY MODULE
370  :
380  LET R1 = R1 + 1
390  INPUT "ENTER CUST. #:";N$
400  REM      DATA ENTRY TESTS
410  INPUT "ENTER CUST. NAME:";C$
420  REM      DATA ENTRY TEST
430  INPUT "ENTER PHONE #:";P$
440  REM      DATA ENTRY TESTS
450  :
460  : REM     WRITE TO FILE ROUTINE
470  :
480  PRINT D$;"WRITE PHONE, R";R1
490  PRINT N$: PRINT C$: PRINT P$
500  PRINT D$
510  INPUT "MORE ENTRIES?";R$
520  IF  LEFT$ (R$,1) <  > "Y" AND  LEFT$ (R$,1) <  > "N" THEN  PRINT :
     PRINT  CHR$ (7);"ENTER 'Y' FOR YES OR 'N' FOR NO": PRINT : GOTO 510
530  IF  LEFT$ (R$,1) = "N" THEN 580
540  GOTO 380
550  :
560  REM      CLOSE FILE
570  :
580  PRINT D$;"WRITE PHONE, R0"
590  PRINT R1
600  PRINT D$
610  PRINT D$;"CLOSE PHONE"
620  PRINT : PRINT "FILE CLOSED"
630  PRINT : PRINT "NEW RECORD COUNT: ";R1
```

Enter the program and add data to PHONE. Then use the previously written program that reads and displays PHONE to verify that the additions are now in the file.

RANDOM ACCESS FILE UTILITY PROGRAMS

Having covered the essentials of using random access files, let's write two file utility programs to further your understanding and provide models for similar programs you can write. The first program simply copies the data from one random access file into another random access file, record for record. The data are both alphabetic and numeric.

Write a program to create a random access file named MASTER. This file will be used later in this section by a file utility program that makes a copy of a random access file. You can decide what information corresponds to the variables listed in the introductory module given below. Use your imagination!

(a)
```
100  REM    CREATE FILE NAMED MASTER
110  :
120  REM   VARIABLES USED
130  REM     C$=20 CHAR. MAX.
140  REM     S=8 CHAR. MAX.
150  REM     Q=4 CHAR. MAX.
160  REM     M$=30 CHAR. MAX.
170  REM     R1=RECORD NUMBER
180  REM     D$=CONTROL D
190  :
200  REM   FILES USED
210  REM     R-A SOURCE FILE NAME: MASTER
215  REM       RECORD LENGTH: 66 BYTES
216  REM     DATASET FORMAT: C$,S,Q,M$
230  :
```

(a)

```
230 :
240  REM    INITIALIZE
250 :
260  LET D$ =  CHR$ (4)
270  LET R1 = 1
280  PRINT D$;"OPEN MASTER,L66"
290 :
300  REM     DATA ENTRY ROUTINE
310 :
320  INPUT "ENTER STRING DATA (20 CHAR.MAX.):";G$
330  REM       DATA ENTRY TESTS GO HERE
340  INPUT "ENTER NUMERIC VALUE (8 CHAR.MAX.):";S
350  REM       DATA ENTRY TESTS GO HERE
360  INPUT "ENTER NUMERIC VALUE (4 CHAR.MAX.):";Q
370  REM       DATA ENTRY TESTS GO HERE
380  INPUT "ENTER STRING DATA (30 CHAR.MAX.):";M$
390  REM       DATA ENTRY TESTS GO HERE
400 :
410  REM     WRITE DATASET TO FILE
420 :
430  PRINT D$;"WRITE MASTER,R"R1
440  PRINT G$: PRINT S: PRINT Q: PRINT M$
450  PRINT D$
460  INPUT "MORE DATA TO ENTER(Y OR N)?";R$
470  REM     USER RESPONSE DATA ENTRY TESTS GO HERE
480  IF R$ = "N" THEN 500
485  LET R1 = R1 + 1
486  HOME
487  GOTO 320
490  REM     CLOSE FILE
500  PRINT D$;"WRITE MASTER,R0"
510  PRINT R1
520  PRINT D$
530  PRINT D$;"CLOSE"
```

Now write a companion program to read and display the contents of MASTER. Allow the user to enter the file name. Include a "PRESS RETURN TO DISPLAY NEXT DATASET" routine inside the read/display loop.

(a)
```
100  REM    READ AND DISPLAY MASTER FILE
110  :
120  REM    VARIABLES USED
130  REM       G$ = 30 CHAR. MAX.
140  REM       S = 8 CHAR. MAX.
150  REM       Q = 4 CHAR. MAX.
160  REM       M$ = 50 CHAR. MAX.
170  REM       D$ = CONTROL D
180  REM       R1 = RECORD COUNTER
190  REM       R$ = USER RESPONSE VARIABLE
200  REM       F$ = USER ENTERED FILE NAME (MASTER)
210  REM    FILES USED
220  REM       R-A FILE NAME: MASTER
230  REM       DATASET FORMAT: G$,S,Q,M$
240  REM       RECORD LENGTH: 66
250  :
```

(a)
```
250  :
260  REM     INITIALIZE
270  :
280  LET D$ =  CHR$ (4)
290  INPUT "ENTER NAME OF FILE:";F$
300  REM     DATA ENTRY TESTS GO HERE
310  PRINT
320  PRINT D$;"OPEN"F$",L66"
330  :
340  REM     DATA ENTRY MODULE
350  :
360  PRINT D$;"READ"F$",R0"
370  INPUT R1
380  PRINT D$
390  FOR X = 1 TO R1
400  PRINT D$;"READ"F$",R"X
410  INPUT C$,S,Q,M$
420  PRINT D$
430  PRINT C$: PRINT S: PRINT Q: PRINT M$
440  PRINT : INPUT "PRESS 'RETURN' TO DISPLAY NEXT DATASET";R$: PRINT
450  HOME
460  NEXT X
470  :
480  REM     CLOSE FILE
490  :
500  PRINT D$;"CLOSE"
510  PRINT : PRINT "FILE DISPLAYED AND CLOSED"
520  END
```

Follow these steps to create a random access file copying program:

1. OPEN the source file.
2. OPEN and clear the copy file.
3. Determine record count.
4. READ source file record.
5. WRITE copy file.
6. Return to step 4 until end of file.
7. CLOSE the files after posting record count in copy file.

We will now help you write a program that will make a copy of MASTER. The copy file is named STORE1. Here is the introductory module:

```
100  REM    PROGRAM TO MAKE A COPY OF R-A FILE 'MASTER'
110  :
120  REM     VARIABLES USED
130  REM      C$ = (20)
140  REM      S  = (8)
150  REM      Q  = (4)
160  REM      M$ = (30)
170  REM      R1 = RECORD COUNTER
180  REM      D$ = CONTROL D
190  :
200  REM     FILES USED
210  REM      R-A SOURCE FILE NAME: MASTER
220  REM      R-A COPY FILE NAME: STORE1
230  REM      RECORD LENGTH: 66 BYTES
240  REM      DATASET FORMAT: C$,S,Q,M$
250  :
```

Notice that we have only indicated the length of the variables; what data they represent is not important and has been left to your discretion and imagination.

As with sequential files, we recommend the OPEN-DELETE-OPEN sequence to clear a file of any previous data, thus preventing the accidental appearance at the end of the file of data left over from any previous version of STORE1. Complete the following segment to initialize the two files. Fill in lines 310, 320, 330, and 340.

(a)
```
260  REM      INITIALIZE
270  :
280  HOME : PRINT "WORKING"
290  LET D$ =  CHR$ (4)
300  LET R1 = 1
310
320
330
340
350  :
```

(a)
```
260  REM      INITIALIZE
270  :
280  HOME : PRINT "WORKING"
290  LET D$ =  CHR$ (4)
300  LET R1 = 1
310  PRINT D$;"OPEN MASTER, L66"
320  PRINT D$;"OPEN STORE1"
330  PRINT D$;"DELETE STORE1"
340  PRINT D$;"OPEN STORE1, L66"
350  :
```

The next section reads from the source file and writes to the copy file. Fill in the blanks in lines 380, 390, 400, 420, 430, 440, 480, 490, and 500.

(a)
```
360  REM      READ SOURCE FILE
370  :
380
390
400
410  FOR X = 1 TO R1
420
430
440
450  :
460  REM      PRINT COPY FILE
470  :
480
490
500
510  NEXT X
520  :
```

(a)
```
360  REM      READ SOURCE FILE
370  :
380  PRINT D$;"READ MASTER,R0"
390  INPUT R1
400  PRINT D$
410  FOR X = 1 TO R1
420  PRINT D$;"READ MASTER,R"X
430  INPUT C$,S,Q,M$
440  PRINT D$
450  :
460  REM      PRINT COPY FILE
470  :
480  PRINT D$;"WRITE STORE1,R"X
490  PRINT C$: PRINT S: PRINT Q: PRINT M$
500  PRINT D$
510  NEXT X
520  :
```

You probably found completing that program easy. Random access files are easy to manipulate, once you get the hang of it.

Here is a complete copy of the program.

```
100  REM      PROGRAM TO MAKE A COPY OF R-A FILE 'MASTER'
110  :
120  REM      VARIABLES USED
130  REM       C$ = (20)
140  REM       S  = (8)
150  REM       Q  = (4)
160  REM       M$ = (30)
170  REM       R1 = RECORD COUNTER
180  REM       D$ = CONTROL D
190  :
200  REM      FILES USED
210  REM       R-A SOURCE FILE NAME: MASTER
220  REM       R-A COPY FILE NAME: STORE1
230  REM       RECORD LENGTH: 66 BYTES
240  REM       DATASET FORMAT: C$,S,Q,M$
250  :
260  REM      INITIALIZE
270  :
280  HOME : PRINT "WORKING"
290  LET D$ =  CHR$ (4)
300  LET R1 = 1
310  PRINT D$;"OPEN MASTER, L66"
320  PRINT D$;"OPEN STORE1"
330  PRINT D$;"DELETE STORE1"
340  PRINT D$;"OPEN STORE1, L66"
350  :
360  REM      READ SOURCE FILE
370  :
380  PRINT D$;"READ MASTER,R0"
390  INPUT R1
400  PRINT D$
410  FOR X = 1 TO R1
420  PRINT D$;"READ MASTER,R"X
430  INPUT C$,S,Q,M$
440  PRINT D$
450  :
460  REM      PRINT COPY FILE
470  :
480  PRINT D$;"WRITE STORE1,R"X
490  PRINT C$: PRINT S: PRINT Q: PRINT M$
500  PRINT D$
510  NEXT X
520  :
530  REM      CLOSE FILES
540  :
550  PRINT D$;"WRITE STORE1,R0"
560  PRINT R1
570  PRINT D$
580  PRINT D$;"CLOSE"
590  PRINT : PRINT "FILE COPY COMPLETE"
600  END
```

(a) Check your understanding of the file copying program by filling in the corresponding program line number(s) for each step in the following outline.

1. OPEN the source file. ______________________

2. OPEN and clear the copy file. ______________________

3. Determine record count ______________________

4. READ source file record. ______________________

5. WRITE copy file. ______________________

6. Return to step 4 until end-of-file. ______________________

7. CLOSE the file after posting the record count in copy file. ______________________

(a) 1. line 310
2. lines 320 to 340
3. lines 380 to 400
4. lines 420 to 440
5. lines 480 to 500
6. lines 410 to 510
7. lines 550 to 580

CHANGING DATA IN AN EXISTING RANDOM ACCESS FILE

So far, you have learned how to add data to a random access file and how to make a copy of a random access file. Next, let's consider a versatile utility program that allows a number of options for changing the data in a random access file. We will be using the INVEN file you created earlier in this chapter. We will use the complete dataset with product code number, product description, quantity available, and record count stored in R0. You want your program to display the datasets in the file, one record at a time, and allow the user the following options:

1. Change all data items.
2. Change the code number only.
3. Change the description only.
4. Change the quantity only.
5. No change to this record.

Follow these steps:

1. OPEN the file.
2. Determine record count.
3. READ a dataset.
4. Display the dataset.

5. Display the "menu" of choices.
6. Request and test choice.
7. Branch to appropriate subroutines according to choice made.
8. Return to step 3 above.
9. CLOSE the file.

Here is the complete program:

```
100  REM     INVEN FILE EDITOR
110  :
120  REM     VARIABLES USED
130  REM      C$ = PART NO. (8)
140  REM      P$ = DESCRIPTION (20)
150  REM      Q = QUANTITY (3)
160  REM      D$ = CONTROL D
170  REM      R1 = RECORD NUMBER
180  :
190  REM     FILES USED
200  REM      R-A FILE NAME: INVEN
210  REM      RECORD LENGTH: 32 BYTES
220  REM      DATASET FORMAT: C$,P$,Q
230  :
240  REM     INITIALIZE
250  :
260  LET D$ =  CHR$ (4)
270  PRINT D$;"OPEN INVEN, L32"
280  :
290  REM      READ ONE RECORD
300  :
310  PRINT D$;"READ INVEN,R0"
320  INPUT R1
330  PRINT D$
340  FOR X = 1 TO R1
350  PRINT D$;"READ INVEN,R"X
360  INPUT C$,P$,Q
370  PRINT D$
380  :
390  REM     DISPLAY DATASET AND OPTIONS
400  :
410  HOME
420  PRINT "PROD #:";C$
430  PRINT "DESCRIPT:";P$
440  PRINT "QUANTITY:";Q
450  PRINT
460  PRINT "ENTER ONE OF THESE OPTIONS:"
470  PRINT "  1.  CHANGE ALL"
480  PRINT "  2.  CHANGE NUMBER ONLY"
490  PRINT "  3.  CHANGE DESCRIPTION ONLY"
500  PRINT "  4.  CHANGE QUANTITY ONLY"
510  PRINT "  5.  NO CHANGE FOR THIS DATA"
520  PRINT
530  :
540  INPUT "ENTER YOUR CHOICE:";R$
550  IF  LEN (R$) = 0 THEN  PRINT : PRINT  CHR$ (7);"PLEASE MAKE A CHOICE
     FROM THE MENU": PRINT : GOTO 540
560  LET R2 =  VAL (R$)
570  IF R2 < 1 OR R2 > 5 THEN  PRINT "ENTER NUMBER 1-5 ONLY, PLEASE": GOTO
     540
580  IF R2 = 1 THEN  GOSUB 680: GOSUB 720: GOSUB 760: GOSUB 810: GOTO 630
590  IF R2 = 2 THEN  GOSUB 680: GOSUB 810: GOTO 630
600  IF R2 = 3 THEN  GOSUB 720: GOSUB 810: GOTO 630
610  IF R2 = 4 THEN  GOSUB 760: GOSUB 810: GOTO 630
620  IF R2 = 5 THEN  GOSUB 810
630  NEXT X
640  GOTO 880
650  :
660  REM     DATA ENTRY SUBROUTINES
670  :
680  INPUT "ENTER NEW PRODUCT CODE:";C$
690  REM     DATA ENTRY TESTS
700  RETURN
710  :
720  INPUT "ENTER NEW DESCRIPTION:";P$
730  REM     DATA ENTRY TESTS
740  RETURN
750  :
760  INPUT "ENTER NEW QUANTITY:";Q
770  REM     DATA ENTRY TESTS
780  RETURN
790  :
800  REM     FILE PRINT SUBROUTINE
810  PRINT D$;"WRITE INVEN,R";X
820  PRINT C$: PRINT P$: PRINT Q
830  PRINT D$
840  RETURN
850  :
860  REM     CLOSE FILE
870  :
880  PRINT D$;"CLOSE"
890  END
```

(a) Study the program carefully and write the corresponding line numbers for each step in the outline shown below.

1. OPEN the file. ____________________
2. Determine record count. ____________________
3. READ a dataset. ____________________
4. Display the dataset. ____________________
5. Display the "menu" of choices. ____________________
6. Request and test choice. ____________________
7. Branch to appropriate subroutines according to choice made. ______________
8. Return to step 3 above. ____________________
9. CLOSE the file. ____________________

— — — — — — — — — — — — — — —

(a)
1. line 270
2. lines 310 to 330
3. lines 350 to 370
4. lines 420 to 440
5. lines 460 to 510
6. lines 540 to 570
7. lines 580 to 620
8. line 640
9. line 880

Now enter and RUN the program, testing out all change options available. Then use the final version of your program that reads and displays INVEN to verify corrections or changes made in the file.

CONVERTING SEQUENTIAL FILES TO RANDOM ACCESS FILES

Another useful file utility program is one that converts a sequential file to a random access file. The procedure involves making a copy of the sequential file and placing one dataset from the sequential file into one record in a random access file. If at some point you want to standardize your entire software collection or system into random access file format, a program modeled on the one you are about to write would do the job.

The example is a small business-type application where a sequential file contains data in this format:

customer number = five-character string
customer name = twenty-character string
credit status code = single-digit number, one to five . One-character
numeric value.

You may recognize this as the format of the customer credit file named CREDIT, a sequential file you created in Chapter 4 Self Test, problem 3. It is the same file you used in Chapter 5 for file editing application programs. The task is to copy a sequential data file into a random access file, one dataset (as described above) per record. The outline of steps is as follows:

1. OPEN the sequential file.
2. OPEN the random access file.
3. End-of-file trap for the sequential file.
4. READ one dataset from sequential file.
5. WRITE to the random access file.
6. Increment the record counter by one.
7. Return to step 4 above.
8. CLOSE the files after posting record count to random access file.

Here are the introductory and initializing modules. Read them over carefully.

```
100  REM    COPY SEQ FILE TO RA FILE
110  :
120  REM      VARIABLES USED
130  REM       N$ = CUSTOMER NUMBER (5 CHAR)
140  REM       C$ = CUST.NAME(20 CHAR.MAX.)
150  REM       R = CREDIT RATING (1 CHAR)
160  REM       D$ = CONTROL D
170  REM       R1 = RECORD COUNT
180  :
190  REM      FILES USED
200  REM       SEQ FILE NAME: CREDIT
210  REM       R-A FILE NAME: R-A CREDIT
220  REM       RECORD LENGTH: 29 BYTES
230  :
240  REM      INITIALIZE
250  :
260  HOME
270  PRINT "WORKING"
280  LET D$ =  CHR$ (4)
290  LET R1 = 0
300  PRINT D$;"OPEN CREDIT"
310  PRINT D$;"OPEN R-A CREDIT,L29"
320  :
```

(a) What is the length of the random access file record? ____________________

(b) Which will be the first record to be filled by the program? ____________________

(a) twenty-nine bytes (L29 in line 310)
(b) R1 (R1 = 1)

Here is the rest of the program. Fill in the blanks on lines 360, 370, 380, 420, 430, 440, 450, 500, 510, and 520.

(a)

```
330  REM       READ SEQ FILE
340  :
350  ONERR  GOTO 500
360
370
380
390  :
400  REM       WRITE RA FILE
410  :
420
430
440
450
460  GOTO 360
470  :
480  REM       CLOSE FILES
490  :
500
510
520
530  PRINT D$;"CLOSE"
540  PRINT : PRINT "FILE COPY COMPLETE."
550  END
```

(a)

```
330  REM       READ SEQ FILE
340  :
350  ONERR  GOTO 500
360  PRINT D$;"READ CREDIT"
370  INPUT N$,C$,R
380  PRINT D$
390  :
400  REM       WRITE RA FILE
410  :
420  LET R1 = R1 + 1
430  PRINT D$;"WRITE R-A CREDIT,R"R1
440  PRINT N$: PRINT C$: PRINT R
450  PRINT D$
460  COTO 360
470  :
480  REM       CLOSE FILES
490  :
500  PRINT D$;"WRITE R-A CRDEIT,R0"
510  PRINT R1
520  PRINT D$
530  PRINT D$;"CLOSE"
540  PRINT : PRINT "FILE COPY COMPLETE."
550  END
```

Here is the complete file conversion program. Look it over and complete the outline that follows with corresponding line numbers from the program.

(a)
```
100  REM   COPY SEQ FILE TO RA FILE
110 :
120  REM     VARIABLES USED
130  REM      N$ = CUSTOMER NUMBER (5 CHAR)
140  REM      C$ = CUST.NAME(20 CHAR.MAX.)
150  REM      R = CREDIT RATING (1 CHAR)
160  REM      D$ = CONTROL D
170  REM      R1 = RECORD COUNT
180 :
190  REM     FILES USED
200  REM      SEQ FILE NAME: CREDIT
210  REM      R-A FILE NAME: R-A CREDIT
220  REM      RECORD LENGTH: 29 BYTES
230 :
240  REM     INITIALIZE
250 :
260  HOME
270  PRINT "WORKING"
280  LET D$ =  CHR$ (4)
290  LET R1 = 0
300  PRINT D$;"OPEN CREDIT"
310  PRINT D$;"OPEN R-A CREDIT,L29"
320 :
330  REM     READ SEQ FILE
340 :
350  ONERR  GOTO 500
360  PRINT D$;"READ CREDIT"
370  INPUT N$,C$,R
380  PRINT D$
390 :
400  REM     WRITE RA FILE
410 :
420  LET R1 = R1 + 1
430  PRINT D$;"WRITE R-A CREDIT,R"R1
440  PRINT N$: PRINT C$: PRINT R
450  PRINT D$
460  GOTO 360
470 :
480  REM     CLOSE FILES
490 :
500  PRINT D$;"WRITE R-A CREDIT,R0"
510  PRINT R1
520  PRINT D$
530  PRINT D$;"CLOSE"
540  PRINT : PRINT "FILE COPY COMPLETE."
550  END
```

1. OPEN the sequential file. ______________________

2. OPEN the random access file. ______________________

3. Test for end-of-file of the sequential file. ______________________

4. READ one dataset from sequential file. ______________________

5. Increment the record counter by one. ______________________

6. WRITE to the random access file. ______________________

7. Return to step 4 above. ______________________

8. Post the record count to the random access file and CLOSE the files.

____

- - - - - - - - - - - - - - -

(a) 1. line 300
2. line 310
3. line 350
4. lines 360 to 380
5. line 420
6. lines 430 to 450
7. line 460
8. lines 500 to 530

Write a program to display the random access CREDIT file.

(a)
```
100  REM    DISPLAY R-A FILE NAMED R-A CREDIT
110  :
120  REM     VARIABLES USED
130  REM      F$ = USER ENTERED FILE NAME
140  REM      C$ = CUST. #
150  REM      N$ = CUST. NAME
160  REM      R = CREDIT RATING
170  REM      D$ = CONTROL D
180  REM      R1 = RECORD COUNT
190  REM      X =FOR NEXT LOOP VARIABLE
200  :
210  REM     FILES USED
220  REM       R-A FILE NAME: R-A CREDIT (USER ENTERED)
230  REM      DATASET FORMAT: C$,N$,R
240  REM      RECORD LENGTH: 29 BYTES
250  :
```

(a)

```
260  REM       INITIALIZE
270  :
280  LET D$ =  CHR$ (4)
290  HOME
300  INPUT "ENTER FILE NAME:";F$
310  PRINT D$;"OPEN"F$",L29"
320  :
330  REM       READ/PRINT FILE
340  :
350  PRINT D$;"READ"F$",R0"
360  INPUT R1
370  PRINT D$
380  FOR X = 1 TO R1
390  PRINT D$;"READ"F$",R"X
400  INPUT C$,N$,R
410  PRINT D$
420  PRINT C$: PRINT N$: PRINT R: PRINT
430  NEXT X
440  :
450  REM       CLOSE FILE
460  :
470  PRINT D$;"CLOSE"
480  PRINT " ALL DATA DISPLAYED AND FILE CLOSED"
490  END
```

CHAPTER 6 SELF-TEST

1a. Write a program to create a random access data file that contains the inventory of products carried by an imaginary business. Each random access record contains the following data for one item of inventory in the order shown below. Numbers in parentheses indicate maximum character counts. Name this file BUSINESS INVENTORY. Create the file with your program.

N$ = product number (4)
P$ = description of inventory item (20)
S$ = supplier (20)
L = reorder point (how low the stock of item can be before reordering) (3)
Y = reorder quantity (4)
Q = quantity available (currently in stock) (4)
C = cost (from supplier) (6)
U = unit selling price (what the item is sold for) (6)

Here is the introductory module and a sample RUN.

```
100  REM   SOLUTION, CH6 SELFTEST PROB 1A
110  :
120  REM     VARIABLES USED
130  REM      N$=PROD.NUMBER(4)
140  REM      P$=DESCRIPTION(20)
150  REM      S$=SUPPLIER(20)
160  REM      L=REORDER POINT(3)
170  REM      Y=REORDER QUANTITY(4)
180  REM      Q=QUANTITY IN STOCK(4)
190  REM      C=COST(TO RETAILER)(6)
200  REM      U=UNIT(RETAIL)PRICE(6)
210  REM      R$=USER RESPONSE
220  REM      D$=CONTROL D
230  REM      R1=RECORD COUNT
240  REM     FILES USED
250  REM       RA FILE NAME: BUSINESS INVENTORY
260  REM       RECORD LENGTH: 75 BYTES
270  REM       DATASET FORMAT:N$,P$,S$,L,Y,Q,C,U
280  :

]RUN
ENTER PRODUCT NUMBER(4 DIGITS): 1234
ENTER PRODUCT DESCRIPTION(20 CHAR.MAX.):SAMPLE DATA
ENTER NAME OF SUPPLIER(20 CHAR.MAX.):SOULE SOURCE
REORDER POINT:12
REORDER QUANTITY:24
QUANTITY NOW IN STOCK:36
WHOLESALE COST:.55
UNIT SELLING PRICE:1.10
MORE DATA(TYPE 'Y' FOR YES OR 'N' FOR NO)?N

1 TOTAL DATASETS. FILE CLOSED.
```

1b. Using the program from self test problem (1a), create a random access file named BUSINESS INVENTORY. Make up your own data for at least 5 records (inventory items) and enter them into the file. This file will be used in Chapter 7 examples and activities. Write a program to display the contents of BUSINESS INVENTORY, including the record count.

1c. Write a program to create a sequential (not random access) file called POINTER that contains the following two items in each dataset:

1) Account numbers from BUSINESS INVENTORY file (a four-character string).
2) The record number (a numeric value) corresponding to the record location of each account number.

The program should read the first data item from each record in BUSINESS INVENTORY and write the account number (4 character string) and the record count number for that record into the sequential file called POINTER

```
100  REM    CREATE SEQ POINTER FILE FROM BUSINESS INVENTORY R-A FILE
110  :
120  REM      VARIABLES USED
130  REM        D$=CONTROL D
140  REM        N$=PRODUCT #(4 CHAR.)
160  REM        R1=RECORD COUNT
170  REM        X=FOR-NEXT CONTROL VARIABLE
180  REM      FILES USED
190  REM        R-A FILE NAME:BUSINESS INVENTORY
195  REM        FILE LENGTH:75 BYTES
200  REM        SEQ FILE NAME:POINTER
210  REM        DATASET FORMAT:N$,X
220  :
```

1d. Write a program to read and display the data items in POINTER.

2. Write a program to make a copy of the random access file named R-A CREDIT that you transferred from a sequential file in the last example program in Chapter 6. The copy should be another random access file named R-A CREDIT COPY.

Here is the introductory module:

```
100  REM   SOLUTION CH6 SELFTEST PROB 2
110  :
120  REM     VARIABLES USED:
130  REM       N$=CUSTOMER NUMBER(5 CHAR)
140  REM       C$=CUST. NAME (20 CHAR.MAX.)
150  REM       R=CREDIT RATING
160  REM       D$=CONTROL D
170  REM       X=FOR NEXT LOOP VARIABLE
180  REM       R1=RECORD COUNTER VARIABLE
190  REM     FILES USED
200  REM       R-A SOURCE FILE NAME: R-A CREDIT
210  REM       R-A COPY FILE NAME: R-A CREDIT COPY
220  REM       RECORD LENGTH: 29
230  REM       DATASET FORMATS: N$,C$,R
240  :
```

3. Write a program to display the contents of the original data file and the copy in the previous problem (2), for verification of the completeness and accuracy of the copy. The program should display the data in record 1 of the original file, and then the data from record 1 in the file copy, then the data from record 2 in the original file, followed by the data from record 2 in the copy, and so on to the end of the files.

```
100  REM     SOLUTION, CH6 SELFTEST PROB 3
110  REM     READ & DISPLAY TWO R-A FILES
120  :
130  REM      VARIABLES USED
140  REM        N$,N1$=CUST.#(5 CHAR)
150  REM        C$,C1$=CUST.NAME(20 CHAR.MAX.)
160  REM        C,C1=CREDIT RATING(1 CHAR)
170  REM        R,R1=RECORD COUNTS
180  REM        X=FOR NEXT LOOP VARIABLE
190  REM        D$=CONTROL D
200  :
210  REM      FILES USED
220  REM        R-A FILE NAMES: R-A CREDIT, R-A CREDIT COPY
230  REM        RECORD LENGTH: 29 BYTES
240  REM        DATASET FORMAT: N$,C$,C
250  :
```

```
]RUN
ORIGINAL FILE REPORTS 3 RECORDS.
COPY FILE REPORTS 3 RECORDS.

ORIG: 12345PAUL ARMITIGE5
COPY: 12345PAUL ARMITIGE5

PRESS 'RETURN' TO DISPLAY NEXT DATASETS.
ORIG: 12346MISS PIGGY1
COPY: 12346MISS PIGGY1

PRESS 'RETURN' TO DISPLAY NEXT DATASETS.
ORIG: 12347SIR GALAHAD3
COPY: 12347SIR GALAHAD3

PRESS 'RETURN' TO DISPLAY NEXT DATASETS.

COMPARISON COMPLETE.
```

Answer Key

1a.

```
100  REM   SOLUTION, CH6 SELFTEST PROB 1A
110  :
120  REM    VARIABLES USED
130  REM     N$=PROD.NUMBER(4)
140  REM     P$=DESCRIPTION(20)
150  REM     S$=SUPPLIER(20)
160  REM     L=REORDER POINT(3)
170  REM     Y=REORDER QUANTITY(4)
180  REM     Q=QUANTITY IN STOCK(4)
190  REM     C=COST(TO RETAILER)(6)
200  REM     U=UNIT(RETAIL)PRICE(6)
210  REM     R$=USER RESPONSE
220  REM     D$=CONTROL D
230  REM     R1=RECORD COUNT
240  REM    FILES USED
250  REM      RA FILE NAME: BUSINESS INVENTORY
260  REM      RECORD LENGTH: 75 BYTES
270  REM      DATASET FORMAT:N$,P$,S$,L,Y,Q,C,U
280  :
290  REM    INITIALIZE
300  :
310  LET D$ =  CHR$ (4)
320  LET R1 = 1
330  PRINT D$;"OPEN BUSINESS INVENTORY,L75"
340  :
350  REM   DATA ENTRY MODULE-DATA ENTRY TESTS OMITTED
360  :
370  INPUT "ENTER PRODUCT NUMBER(4 DIGITS):";N$
380  REM -DATA ENTRY TESTS GO HERE
390  INPUT "ENTER PRODUCT DESCRIPTION(20 CHAR.MAX.):";P$
400  REM -DATA ENTRY TESTS GO HERE
410  INPUT "ENTER NAME OF SUPPLIER(20 CHAR.MAX.):";S$
420  REM -DATA ENTRY TESTS GO HERE
430  INPUT "REORDER POINT:";L
440  REM -DATA ENTRY TESTS GO HERE
450  INPUT "REORDER QUANTITY:";Y
460  REM -DATA ENTRY TESTS GO HERE
470  INPUT "QUANTITY NOW IN STOCK:";Q
480  REM -DATA ENTRY TESTS GO HERE
490  INPUT "WHOLESALE COST:";C
500  REM -DATA ENTRY TESTS GO HERE
510  INPUT "UNIT SELLING PRICE:";U
520  REM -DATA ENTRY TESTS GO HERE
530  :
540  REM    WRITE DATASET TO FILE
550  :
560  PRINT D$;"WRITE BUSINESS INVENTORY,R"R1
570  PRINT N$: PRINT P$: PRINT S$: PRINT L: PRINT Y: PRINT Q: PRINT C:
     PRINT U
580  PRINT D$
590  :
600  REM    MORE DATA REQUEST
610  :
620  INPUT "MORE DATA(TYPE 'Y' FOR YES OR 'N' FOR NO)?";R$
630  REM -Y OR N ENTRY TEST
640  IF R$ = "Y" THEN R1 = R1 + 1: HOME : GOTO 370
650  :
660  REM -PRINT RECORD COUNTER VALUE & CLOSE FILE
670  :
680  PRINT D$;"WRITE BUSINESS INVENTORY,R0"
690  PRINT R1
700  PRINT D$
710  PRINT D$;"CLOSE"
720  PRINT : PRINT R1;" TOTAL DATASETS. FILE CLOSED."
730  END
```

1b.

```
100  REM    BUSINESS INVENTORY READER
110  :
120  REM    VARIABLES USED
130  REM     N$=PROD.NUMBER(4)
140  REM     P$=DESCRIPTION(20)
150  REM     S$=SUPPLIER(20)
160  REM     L=REORDER POINT(3)
170  REM     Y=REORDER QUANTITY(4)
180  REM     Q=QUANTITY IN STOCK(4)
190  REM     C=COST(TO RETAILER)(6)
200  REM     U=UNIT(RETAIL)PRICE(6)
210  REM     R$=USER RESPONSE
220  REM     D$=CONTROL D
230  REM     R1=RECORD COUNT
240  REM    FILES USED
250  REM      RA FILE NAME: BUSINESS INVENTORY
260  REM      RECORD LENGTH: 75 BYTES
270  REM      DATASET FORMAT:N$,P$,S$,L,Y,Q,C,U
280  :
290  REM    INITIALIZE
300  :
310 D$ =  CHR$ (4)
320  PRINT D$;"OPEN BUSINESS INVENTORY,L75"
330  PRINT D$;"READ BUSINESS INVENTORY,R0"
340  INPUT R1
350  PRINT D$
360  PRINT R1;" TOTAL DATASETS.": PRINT
370  :
380  REM    READ AND DISPLAY
390  :
400  FOR X = 1 TO R1
410  PRINT D$;"READ BUSINESS INVENTORY,R"X
420  INPUT N$,P$,S$,L,Y,Q,C,U
430  PRINT D$
440  PRINT N$: PRINT P$: PRINT S$: PRINT L: PRINT Y: PRINT Q: PRINT C:
     PRINT U: PRINT
450  PRINT : INPUT "PRESS RETURN FOR NEXT DISPLAY.";R$
460  HOME
470  NEXT X
480  :
490  REM   CLOSE FILE
500  :
510  PRINT D$;"CLOSE"
520  PRINT : PRINT "ALL DATASETS DISPLAYED."
```

1c.

```
100  REM   CREATE SEQ POINTER FILE FROM BUSINESS INVENTORY R-A FILE
110  :
120  REM     VARIABLES USED
130  REM       D$=CONTROL D
140  REM       N$=PRODUCT #(4 CHAR.)
160  REM       R1=RECORD COUNT
170  REM       X=FOR-NEXT CONTROL VARIABLE
180  REM     FILES USED
190  REM       R-A FILE NAME:BUSINESS INVENTORY
195  REM       FILE LENGTH:75 BYTES
200  REM       SEQ FILE NAME:POINTER
210  REM       DATASET FORMAT:N$,X
220  :
230  REM    INITIALIZE
240  :
245  HOME : PRINT "WORKING"
250  LET D$ =  CHR$ (4)
260  PRINT D$;"OPEN BUSINESS INVENTORY,L75"
270  PRINT D$;"OPEN POINTER"
280  :
290  REM    READ FIRST DATA ITEM FROM R-A FILE AND WRITE THAT ITEM+RECORD
     COUNT TO SEQ. FILE

300  :
310  PRINT D$;"READ BUSINESS INVENTORY,R0"
320  INPUT R1
325  PRINT D$
330  FOR X = 1 TO R1
340  PRINT D$;"READ BUSINESS INVENTORY,R"X
350  INPUT N$
360  PRINT D$
380  PRINT D$;"WRITE POINTER"
390  PRINT N$: PRINT X
400  PRINT D$
410  NEXT X
420  :
430  REM     CLOSE FILES
440  :
450  PRINT D$;"CLOSE"
460  PRINT : PRINT "FILES CLOSED."
470  END
```

1d.

```
100  REM    POINTER FILE READER
110  :
120  REM    VARIABLES USED
130  REM      D$=CONTROL D
140  REM      N$=ACCOUNT #
150  REM      R1=RECORD COUNT
160  REM      R$=USER RESPONSE VARIABLE
170  REM   FILE USED
180  REM      SEQ. FILE NAME: POINTER
190  REM      DATASET FORMAT: N$,R1
200  :
210  REM    INITIALIZE
220  :
230  LET D$ =  CHR$ (4)
240  PRINT D$;"OPEN POINTER"
250  :
260  REM    READ AND DISPLAY
270  :
280  ONERR  GOTO 400
290  PRINT D$;"READ POINTER"
300  INPUT N$,R1
310  PRINT D$
320  PRINT N$,R1
330  PRINT
340  INPUT "PRESS RETURN KEY TO DISPLAY NEXT DATA.";R$
350  PRINT
360  GOTO 290
370  :
380  REM    CLOSE FILE
390  :
400  PRINT D$;"CLOSE"
410  PRINT : PRINT "CONTENTS DISPLAYED & FILE CLOSED."
420  END
```

2.
```
100  REM    SOLUTION CH6 SELFTEST PROB 2
110  :
120  REM      VARIABLES USED:
130  REM        N$=CUSTOMER NUMBER(5 CHAR)
140  REM        C$=CUST. NAME (20 CHAR.MAX.)
150  REM        R=CREDIT RATING
160  REM        D$=CONTROL D
170  REM        X=FOR NEXT LOOP VARIABLE
180  REM        R1=RECORD COUNTER VARIABLE
190  REM      FILES USED
200  REM        R-A SOURCE FILE NAME: R-A CREDIT
210  REM        R-A COPY FILE NAME: R-A CREDIT COPY
220  REM        RECORD LENGTH: 29
230  REM        DATASET FORMATS: N$,C$,R
240  :
250  REM     INITIALIZE
260  :
270  HOME
280  PRINT "WORKING"
290  LET D$ =  CHR$ (4)
300  PRINT D$;"OPEN R-A CREDIT,L29"
310  PRINT D$;"OPEN R-A CREDIT COPY,L29"
320  PRINT D$;"DELETE R-A CREDIT COPY"
330  PRINT D$;"OPEN R-A CREDIT COPY,L29"
340  :
350  REM     COPY ROUTINE
360  :
370  PRINT D$;"READ R-A CREDIT,R0"
380  INPUT R1
390  PRINT D$
400  FOR X = 1 TO R1
410  PRINT D$;"READ R-A CREDIT,R"X
420  INPUT N$,C$,R
430  PRINT D$
440  PRINT D$;"WRITE R-A CREDIT COPY,R"X
450  PRINT N$: PRINT C$: PRINT R
460  PRINT D$
470  NEXT X
480  :
490  REM     WRITE RECORD COUNT & CLOSE
500  :
510  PRINT D$;"WRITE R-A CREDIT COPY,R0"
520  PRINT R1
530  PRINT D$;"CLOSE"
540  PRINT : PRINT "FILE DUPLICATED AND CLOSED."
550  END
```

3.
```
100  REM    SOLUTION, CH6 SELFTEST PROB 3
110  REM    READ & DISPLAY TWO R-A FILES
120  :
130  REM     VARIABLES USED
140  REM       N$,N1$=CUST.#(5 CHAR)
150  REM       C$,C1$=CUST.NAME(20 CHAR.MAX.)
160  REM       C,C1=CREDIT RATING(1 CHAR)
170  REM       R,R1=RECORD COUNTS
180  REM       X=FOR NEXT LOOP VARIABLE
190  REM       D$=CONTROL D
200  :
210  REM     FILES USED
220  REM       R-A FILE NAMES: R-A CREDIT, R-A CREDIT COPY
230  REM       RECORD LENGTH: 29 BYTES
240  REM       DATASET FORMAT: N$,C$,C
250  :
260  REM    INITIALIZE
270  :
280  LET D$ =  CHR$ (4)
290  PRINT D$;"OPEN R-A CREDIT,L29"
300  PRINT D$;"OPEN R-A CREDIT COPY,L29"
310  :
320  REM    READ & DISPLAY RECORD COUNTS
330  :
340  PRINT D$;"READ R-A CREDIT,R0"
350  INPUT R
360  PRINT D$
370  PRINT D$;"READ R-A CREDIT COPY,R0"
380  INPUT R1
390  PRINT D$
400  PRINT "ORIGINAL FILE REPORTS ";R;" RECORDS."
410  PRINT "COPY FILE REPORTS ";R1;" RECORDS."
415  PRINT
420  :
430  REM    READ & DISPLAY ONE DATASET AT A TIME FROM EACH FILE
440  :
450  FOR X = 1 TO R
460  PRINT D$;"READ R-A CREDIT,R"X
470  INPUT N$,C$,C
480  PRINT D$
490  PRINT D$;"READ R-A CREDIT COPY,R"X
500  INPUT N1$,C1$,C1
510  PRINT D$
520  PRINT "ORIG: ";N$;C$;C
530  PRINT "COPY: ";N1$;C1$;C1
540  PRINT
550  INPUT "PRESS 'RETURN' TO DISPLAY NEXT DATASETS.";R$
560  HOME
570  NEXT X
580  :
590  REM    CLOSE FILES
600  :
610  PRINT D$;"CLOSE"
620  PRINT : PRINT "COMPARISON COMPLETE."
630  END
```

CHAPTER SEVEN
Random Access File Applications

Objectives: In this chapter you will learn expanded techniques for random access data file applications and how to use sequential "pointer" data files as an index for a random access data file.

SEQUENTIAL POINTER FILES FOR RANDOM ACCESS FILES

Two file applications are designed to be somewhat typical of the programs you might encounter as you design your own computer software systems and write your own programs. The programs are not really long, as you might expect, but they are only one component of a larger software system composed of many programs.

The first exercise is an inventory control application that uses both a sequential file and a random access file in the same program. The objective is to show how to use a sequential "pointer" file and how to change data located in a random access file record. The application could as well have been a mailing list, a credit information file, or any sort of master file application. While a pointer file may be superfluous in our simple example, the technique may be valuable in more complex software systems.

In this case, all the data regarding the inventory of products carried are stored in a random access file named BUSINESS INVENTORY. Each random access record contains the following data for one item of inventory in the order shown below:

```
N$ = PROD # (4)
P$ = DESCRIPTION (20)
S$ = SUPPLIER (20)
L  = REORDER POINT (3)
Y  = REORDER QUANTITY (4)
Q  = QUANTITY AVAILABLE (4)
C  = COST (6)
U  = UNIT SELLING PRICE (6)
```

If you wanted to change some data from product number 9827, you would have to search through the random access file records one at a time, until you found product number 9827. Alternatively you could add a sequential "pointer" file that contains the product numbers (in a string variable) followed by the record number where the proper dataset is located in the random access file. To change the cost and selling price data in the random access file, follow these steps:

1. Enter product number.
2. Quickly search the sequential pointer file for the product number and corresponding record location.
3. Access the correct random access record.
4. Make the changes in the random access file record.

It looks easy, but there are a few "tricks." Here is the first part of the program. Read it through carefully.

```
100  REM    SEQ.POINTER FILE USED WITH R-A FILE 'BUSINESS INVENTORY'
110  REM      THIS PROGRAM PERMITS THE USER TO CHANGE THE COST AND
120  REM      UNIT SELLING PRICE FOR AN EXISTING INVENTORY ITEM IN FILE
130  :
140  REM      VARIABLES USED
150  REM       R$ = DATA ENTRY STRING
160  REM       R1=RECORD COUNT
170  REM       N$=N1$=N2$=PROD.# (4 CHAR)
180  REM       P$=PROD.DESCRIPTION(20 CHAR)
190  REM       S$ = SUPPLIER (20)
200  REM       L = REORDER POINT (3)
210  REM       Y = REORDER QUANTITY (3)
220  REM       Q=QUANTITY IN STOCK (3 CHAR)
230  REM       C=C1=COST (6 CHAR)
240  REM       U=U1=UNIT SELLING PRICE (6 CHAR)
250  :
260  REM      FILES USED
270  REM       SEQ. FILE NAME: POINTER
280  REM       DATASET FORMAT: N$,R1
290  REM       R-A FILE NAME: BUSINESS INVENTORY
300  REM       FILE LENGTH: 75 BYTES
310  REM       DATASET FORMAT: N$,P$,S$,L,Y,Q,C,U
320  :
330  REM      INITIALIZE
340  :
350  LET D$ =  CHR$ (4)
360  REM    'POINTER' OPENED AT TIME OF FILE SEARCH
370  PRINT D$;"OPEN BUSINESS INVENTORY,L75"
380  :
390  REM      DATA ENTRY MODULE
400  :
410  INPUT "ENTER PRODUCT # (4 CHAR):";N2$
420  REM      DATA ENTRY TESTS
430  :
```

This segment provides for entry and testing of the product number. It is time to search the sequential file for the record location for this product number in the random access file. On chance that the operator made an entry error that escaped the error tests, include an error trap in case you read all the way to the end of the sequential file and find no matching product number. This error message routine is shown below in lines 560 through 610. You fill in lines 460, 480, 490, and 500.

(a)
```
440  REM     SEARCH POINTER FILE
450  :
460
470  ONERR  GOTO 560
480
490
500
510  IF N1$ = N2$ THEN  PRINT D$;"CLOSE POINTER": GOTO 650
520  GOTO 480
530  :
540  REM     ERROR TRAP
550  :
560  IF  PEEK (222) = 5 THEN 580
570  PRINT : PRINT  CHR$ (7);"UNUSUAL ERROR. PROGRAM TERMINATED.": PRINT :
     GOTO 940
580  PRINT D$;"CLOSE POINTER"
590  PRINT "THIS PRODUCT # IS NOT IN OUR FILE"
600  PRINT "CHECK YOUR NUMBERS AND REENTER"
610  GOTO 410
620  :
```

(b) In which variable is the record number of the random access file located? ______

(c) Under what conditions is the POINTER file closed? ______

(a)
```
440  REM     SEARCH POINTER FILE
450  :
460  PRINT D$;"OPEN POINTER"
470  ONERR  GOTO 560
480  PRINT D$;"READ POINTER"
490  INPUT N1$,R1
500  PRINT D$
510  IF N1$ = N2$ THEN  PRINT D$;"CLOSE POINTER": GOTO 650
520  GOTO 480
530  :
540  REM     ERROR TRAP
550  :
560  IF  PEEK (222) = 5 THEN 580
570  PRINT : PRINT  CHR$ (7);"UNUSUAL ERROR. PROGRAM TERMINATED.": PRINT :
     GOTO 940
580  PRINT D$;"CLOSE POINTER"
590  PRINT "THIS PRODUCT # IS NOT IN OUR FILE"
600  PRINT "CHECK YOUR NUMBERS AND REENTER"
610  GOTO 410
620  :
```

(b) R1

(c) If the account number entered by the user is found (line 510), or if the end of file is encountered (lines 500 to 610)

Next the correct dataset is accessed from the random access file. Fill in lines 650, 660, and 670.

(a)
```
630  REM     READ RECORD FROM R-A FILE
640  :
650
660
670
680  :
```

(a)
```
630  REM    READ RECORD FROM R-A FILE
640  :
650  PRINT D$;"READ BUSINESS INVENTORY,R"R1
660  INPUT N$,P$,S$,L,Y,Q,C1,U1
670  PRINT D$
680  :
```

Complete lines 820, 830, and 840 below.

(a)
```
690  REM    ENTER DATA CHANGES
700  :
710  PRINT : PRINT "OLD COST: ";C1
720  PRINT "OLD UNIT SELLING PRICE: ";U1
730  PRINT
740  INPUT "ENTER NEW COST:";C
750  REM    DATA ENTRY TESTS GO HERE
760  INPUT "ENTER NEW SELLING PRICE:";U
770  REM    DATA ENTRY TESTS GO HERE
780  :
790  :
800  : REM     REPLACE WITH NEW DATA
810  :
820
830
840
850  :
```

(a)
```
690  REM    ENTER DATA CHANGES
700  :
710  PRINT : PRINT "OLD COST: ";C1
720  PRINT "OLD UNIT SELLING PRICE: ";U1
730  PRINT
740  INPUT "ENTER NEW COST:";C
750  REM    DATA ENTRY TESTS GO HERE
760  INPUT "ENTER NEW SELLING PRICE:";U
770  REM    DATA ENTRY TESTS GO HERE
780  :
790  :
800  : REM     REPLACE WITH NEW DATA
810  :
820  PRINT D$;"WRITE BUSINESS INVENTORY,R"R1
830  PRINT N$: PRINT P$: PRINT S$: PRINT L: PRINT Y: PRINT Q: PRINT C:
     PRINT U
840  PRINT D$
850  :
```

The remainder of the program looks like this:

```
860  REM      MORE?
870  :
880  INPUT "MORE ENTRIES?";R$
890  REM     DATA ENTRY CHECK GOES HERE
900  IF  LEFT$ (R$,1) = "Y" THEN 410
910  :
920  REM      CLOSE
930  :
940  PRINT D$;"CLOSE"
950  END
```

This completes the first random access file application—one part of an entire product inventory application. Now enter and RUN the program. After that, display the contents of BUSINESS INVENTORY to verify the changes.

```
100  REM   SEQ.POINTER FILE USED WITH R-A FILE 'BUSINESS INVENTORY'
110  REM     THIS PROGRAM PERMITS THE USER TO CHANGE THE COST AND
120  REM     UNIT SELLING PRICE FOR AN EXISTING INVENTORY ITEM IN FILE
130  :
140  REM     VARIABLES USED
150  REM      R$ = DATA ENTRY STRING
160  REM      R1=RECORD COUNT
170  REM      N$=N1$=N2$=PROD.# (4 CHAR)
180  REM      P$=PROD.DESCRIPTION(20 CHAR)
190  REM      S$ = SUPPLIER (20)
200  REM      L = REORDER POINT (3)
210  REM      Y = REORDER QUANTITY (3)
220  REM      Q=QUANTITY IN STOCK (3 CHAR)
230  REM      C=C1=COST (6 CHAR)
240  REM      U=U1=UNIT SELLING PRICE (6 CHAR)
250  :
260  REM     FILES USED
270  REM      SEQ. FILE NAME: POINTER
280  REM      DATASET FORMAT: N$,R1
290  REM      R-A FILE NAME: BUSINESS INVENTORY
300  REM      FILE LENGTH: 75 BYTES
310  REM      DATASET FORMAT: N$,P$,S$,L,Y,Q,C,U
320  :
330  REM     INITIALIZE
340  :
350  LET D$ =  CHR$ (4)
360  REM   'POINTER' OPENED AT TIME OF FILE SEARCH
370  PRINT D$;"OPEN BUSINESS INVENTORY,L75"
380  :
390  REM     DATA ENTRY MODULE
400  :
410  INPUT "ENTER PRODUCT # (4 CHAR):";N2$
420  REM     DATA ENTRY TESTS
430  :
440  REM     SEARCH POINTER FILE
450  :
460  PRINT D$;"OPEN POINTER"
470  ONERR  GOTO 560
480  PRINT D$;"READ POINTER"
490  INPUT N1$,R1
500  PRINT D$
510  IF N1$ = N2$ THEN  PRINT D$;"CLOSE POINTER": GOTO 650
520  GOTO 480
530  :
540  REM     ERROR TRAP
550  :
560  IF  PEEK (222) = 5 THEN 580
570  PRINT : PRINT  CHR$ (7);"UNUSUAL ERROR. PROGRAM TERMINATED.": PRINT :
     GOTO 940
580  PRINT D$;"CLOSE POINTER"
590  PRINT "THIS PRODUCT # IS NOT IN OUR FILE"
600  PRINT "CHECK YOUR NUMBERS AND REENTER"
610  GOTO 410
620  :
630  REM    READ RECORD FROM R-A FILE
640  :
650  PRINT D$;"READ BUSINESS INVENTORY,R"R1
660  INPUT N$,P$,S$,L,Y,Q,C1,U1
670  PRINT D$
680  :
690  REM   ENTER DATA CHANGES
700  :
710  PRINT : PRINT "OLD COST: ";C1
720  PRINT "OLD UNIT SELLING PRICE: ";U1
730  PRINT
740  INPUT "ENTER NEW COST:";C
750  REM   DATA ENTRY TESTS GO HERE
760  INPUT "ENTER NEW SELLING PRICE:";U
```

continued on next page

```
770  REM    DATA ENTRY TESTS GO HERE
780  :
790  :
800  : REM      REPLACE WITH NEW DATA
810  :
820  PRINT D$;"WRITE BUSINESS INVENTORY,R"R1
830  PRINT N$: PRINT P$: PRINT S$: PRINT L: PRINT Y: PRINT Q: PRINT C:
     PRINT U
840  PRINT D$
850  :
860  REM      MORE?
870  :
880  INPUT "MORE ENTRIES?";R$
890  REM     DATA ENTRY CHECK GOES HERE
900  IF  LEFT$ (R$,1) = "Y" THEN 410
910  :
920  REM      CLOSE
930  :
940  PRINT D$;"CLOSE"
950  END
```

(a) What other programs are needed to complete this series of application programs?

____

____

____

- - - - - - - - - - - - - - - -

(a) 1) Add new inventory items. 2) Delete inventory items. 3) Change supplier and/ or description. 4) Change reorder point, etc., to name a few.

PERSONAL MONEY MANAGEMENT APPLICATION

The second example program in this chapter could form part of a large home financial management software package. The example gives some hints for setting up your own home finance programs. The objectives of this application are to show you how to process a "transaction" file and to demonstrate how account numbers can be used to point out the file and record in a random access file.

The first step is to decide exactly what expenditures you want to computerize. Record all income and all expenditures into particular accounts. Include the capability to discern taxable from non-taxable items so these records can be used as data for your income tax returns. To keep things simple, the following chart of accounts has been prepared for this application:

1001	TAXABLE SALARIES
1002	TAXABLE INTEREST
1003	TAXABLE DIVIDENDS
1004	TAXABLE OTHER INCOME
1005	NON-TAXABLE INCOME
1006	MISC. NON-TAXABLE MONEYS
2001	GROCERIES
2002	NON FOOD STAPLES
2003	MORTGAGE
2004	GAS/ELECTRICITY
2005	WATER & GARBAGE
2006	TELEPHONE
2007	HOME INSURANCE
2008	PROPERTY TAXES
2009	FURNITURE
2010	AUTO PAYMENTS
2011	GAS AND OIL
2012	AUTO REPAIR
2013	PARKING/TOLLS
2014	AUTO INSURANCE
2015	FATHER'S CLOTHES
2016	MOTHER'S CLOTHES
2017	SON'S CLOTHES
2018	DAUGHTER'S CLOTHES
2019	CLOTHING REPAIR/CLEANING
2020	SPORTS FEES/TICKETS
2021	SPORTS EQUIPMENT
2022	MAGAZINES/BOOKS
2023	MOVIES/PLAYS
2024	ALCOHOL
2025	DINING OUT
2026	VACATION EXPENSES
2027	POSTAGE
2028	SCHOOL/HOUSEHOLD SUPPLIES
3001	LEGAL/ACCTG. FEES
3002	LIFE INSURANCE
3003	MEDICAL INSURANCE
3004	DENTAL INSURANCE
3005	UNREIMBURSED MEDICAL EXPENSES
3006	DRUG EXPENSES
3007	EDUCATIONAL FEES AND TUITIONS
3008	BOOKS AND SUPPLIES
3009	EXCESS SALES TAXES PAID
3010	CONTRIBUTIONS
3011	SAVINGS DEPOSITS
3012	INVESTMENTS

The account number has important significance. The first digit of the account number is the number of the random access file in which the account details can be found. All random access files are called BUDGET #. The details of the taxable salaries account are found in file BUDGET1 (account number 1001). The details of the telephone account are in file BUDGET2 (account number 2008).

(a) Which file contains the details of the dining out account? __________________

(a) BUDGET2 (account number 2006)

The last three digits of the account number indicate the record number of the random access file containing the account details. The investment account (3010) will be found in the file BUDGET3, record number 10.

(a) The legal/accounting account details are found in file ________________________

record number ________________________.

(a) BUDGET2, record 30

For convenience, the account number is always entered as a string variable so that you can use the LEFT$ and RIGHT$ functions to separate the file number and record number.

To demonstrate the file number concept, we use three separate files (BUDGET1, BUDGET2, and BUDGET3) for this small list of accounts. Of course, all these accounts could be placed in one file, but that will not be the case when your account list grows. At that point you may want to use this scheme.

The random access files (BUDGET#) contain the details of each account. Each record contains the following information in the order shown.

```
N$ = ACCOUNT # (4)
A$ = ACCOUNT NAME (20)
B$ = BUDGETED AMOUNT (8). ANNUAL BUDGET
E$ = EXPENDED/EARNED AMOUNT (8). YEAR-TO-DATE
```

Write one program that you can use to create three random access file named BUDGET1, BUDGET2, and BUDGET3, using the dataset shown above as the format in each record. Using the chart of accounts we have provided, enter the correct number of datasets (one per record) for each file; i.e., six records in BUDGET1, twenty-eight records in BUDGET2, and twelve records in BUDGET3. Use the value of the right-most three digits of the account chart number (N$) to determine the record number into which each dataset will be placed. You decide on the value for BUDGETED AMOUNT in each record, and enter zero (0) as the value for EXPENDED/EARNED amount in all records in all files (happy new fiscal year). Also write the companion program to display the contents of the file one dataset at a time.

(a)
```
100  REM    CREATE BUDGET# R-A FILES
110  :
120  REM     VARIABLES USED
130  REM       N$ = ACCOUNT CHART NUMBER (4)
140  REM       A$ = ACCOUNT NAME (20)
150  REM       B$ = BUDGETED AMOUNT (8)
160  REM       E$ = EXPENDED/EARNED AMOUNT (8)
170  REM       R1 = RECORD NUMBER (EXTRACTED FROM N$)
171  REM       N = USER ENTERED NUMBER FOR BUDGET# FILE NAME
172  REM       F1$ = BUDGET FILE NAME
180  REM       D$ = CONTROL D
190  REM       R$ = USER RESPONSE
200  REM    FILE USED
210  REM     R-A FILE NAMES: BUDGET1,2,3
220  REM     DATASET FORMAT:N$,A$,B$,E$
230  REM     RECORD LENGTH: 44
```

(a)

```
100  REM      CREATE BUDGET# R-A FILES
110  :
120  REM      VARIABLES USED
130  REM        N$ = ACCOUNT CHART NUMBER (4)
140  REM        A$ = ACCOUNT NAME (20)
150  REM        B$ = BUDGETED AMOUNT (8)
160  REM        E$ = EXPENDED/EARNED AMOUNT (8)
170  :
180  :
190  :
200  REM    FILE USED
210  REM      R-A FILE NAMES: BUDGET1,2,3
220  REM      DATASET FORMAT:N$,D1$,B,E
230  REM      RECORD LENGTH: 44
240  :
250  REM    INITIALIZE
260  :
270  LET D$ =  CHR$ (4)
280  LET R1 = 1
290  INPUT "WHICH BUDGET FILE(1,2, OR 3)?";F2$
300  REM  DATA ENTRY TESTS GO HERE
310  LET F1$ = "BUDGET" + F2$
320  PRINT D$;"OPEN"F1$",L44"
330  :
340  REM    READ FILE
350  :
360  ONERR  GOTO 470
370  PRINT D$;"READ"F1$",R"R1
380  INPUT N$,A$,B$,E$
390  PRINT D$
400  PRINT : PRINT N$: PRINT A$: PRINT B$: PRINT E$: PRINT
410  PRINT : PRINT : INPUT "PRESS RETURN TO CONTINUE.";R$
420  LET R1 = R1 + 1
430  GOTO 370
440  :
450  REM   CLOSE FILE
460  :
470  PRINT D$;"CLOSE"
480  PRINT : PRINT "FILE DISPLAYED AND CLOSED."
```

You have now created the budget files for the personal money management system of programs. A second set of files is needed to store data on all money transactions. Each month a new sequential transaction file is created containing the information found in your checking account check register. For the month of January, the file is called MONTH1. March is MONTH3, etc. You may keep "old" files on your disk for other analyses you may want to do. Each month you will create a transaction file, then process or "post" it to the BUDGET # file. Each sequential transaction file entry includes the following information in the order shown:

```
C = CHECK #/DEPOSIT SLIP #
Y$ = DATE (6)
W$ = PARTY TO WHOM CHECK IS DRAWN/SOURCE OF FUNDS (20)
A$ = ACCOUNT # (4)
D = DOLLAR AMOUNT
```

Notice that the format is set up to be used with deposits and payments and that the transaction file includes more information than you will actually be using. This file, however, can be used for other things as well, so all this information is included.

(a) Using the dataset information above as a guide, write a program that allows you to create the sequential monthly transaction file. Use your checkbook register or your imagination for the monthly checks and deposits to enter in the file. Then write the companion program to display MONTH#, using the "PRESS RETURN TO CONTINUE" technique.

```
100  REM    CREATE A SEQ.FILE OF CHECKBOOK TRANSACTIONS FOR EACH MONTH OF YEAR
110  :
120  REM    VARIABLES USED
130  REM      D$=CONTROL D
140  REM      C=CHECK # OR DEPOSIT SLIP # (3 CHAR)
150  REM      Y$=DATE (XX-XX-XX) (8)
160  REM      W$=PARTY TO WHOM CHECK IS WRITTEN OR SOURCE OF FUNDS FOR
     DEPOSIT (20 CHAR.MAX.)
170  REM      N$=ACCOUNT NUMBER (4 CHAR)
180  REM      D=DOLLAR AMOUNT
190  REM      M = USER ENTERED MONTH NUMBER FOR FILE NAME
200  REM      F$=FILE NAME
210  REM      R$=USER RESPONSE VARIABLE
220  REM    SEQ.FILE NAME:MONTH#
230  REM    DATASET FORMAT: C,Y$,W$,N$,D
```

(a)

```
100  REM    READ MONTHLY TRANSACTION FILES
110  :
120  REM    VARIABLES USED
130  REM      D$=CONTROL D
140  REM      C=CHECK # OR DEPOSIT SLIP # (3 CHAR)
150  REM      Y$=DATE (8 CHAR)
160  REM      W$=PARTY TO WHOM CHECK IS WRITTEN OR SOURCE OF FUNDS FOR
     DEPOSIT (20 CHAR.MAX.)
170  REM      A$=ACCOUNT # (4 CHAR)
180  REM      D=DOLLAR AMOUNT
190  REM      M=USER ENTERED MONTH NUMBER
200  REM      F$=FILE NAME
210  REM      R$=INPUT VARIABLE FOR PRESS RETURN TO CONTINUE
220  REM    SEQ.FILE NAME:MONTH#
230  REM    DATASET FORMAT:C,Y$,W$,A$,D
240  :
250  REM    INITIALIZE
260  :
270  LET D$ =  CHR$ (4)
280  INPUT "WHAT MONTH #(1=JAN,2=FEB,ETC)?";M
290  IF M < 1 OR M > 12 THEN  PRINT "ENTER 1 TO 12 ONLY.": GOTO 280
300  REM    OTHER DATA ENTRY TESTS GO HERE
310  LET F$ = "MONTH" +  STR$ (M)
320  PRINT D$;"OPEN"F$
330  :
340  REM    READ AND DISPLAY
350  :
360  ONERR  GOTO 470
370  PRINT D$;"READ"F$
380  INPUT C,Y$,W$,A$,D
390  PRINT D$
400  PRINT C: PRINT Y$: PRINT W$: PRINT A$: PRINT D
410  PRINT : PRINT
420  INPUT "PRESS RETURN FOR NEXT DISPLAY";R$
430  HOME : GOTO 370
440  :
450  REM   CLOSE FILE
460  :
470  PRINT D$;"CLOSE"
480  PRINT : PRINT "ALL TRANSACTIONS DISPLAYED."
```

Let's review the application. Each year, create random access files (BUDGET#) that contain the beginning status of all your personal accounts. This status includes a yearly budget estimate. Each month create a sequential file (MONTH#) using the information found in your checkbook register. After the MONTH# file is completed, process or post it to the BUDGET# files. Periodically, you can print a status report of the BUDGET# files.

The task is to write the program that processes the monthly transaction file. Here is the introductory module with the file initialization module:

```
100  REM    PERSONAL MONEY MANAGEMENT
110  REM     SEQ/RA FILE APPLICATION
120  :
130  REM     VARIABLES USED
140  REM      N$=N1$=ACCOUNT CHART NUMBER(4)
150  REM      A$ = ACCOUNT NAME (20)
160  REM      Y$ = DATE (8)
170  REM      W$ = CHECK WRITTEN TO/SOURCE OF DEPOSIT (20)
180  REM      M = USER ENTERED MONTH NUMBER (USE 1 FOR JAN, 2 FOR FEB, ETC)
190  REM      N = BUDGET FILE NUMBER (EXTRACTED FROM N$)
200  REM      C = CHECK # OR DEPOSIT SLIP #
210  REM      D = DOLLAR AMT. OF CHECK OR DEPOSIT
220  REM      B$ = BUDGETED AMT. (8)
230  REM      E$ = AMT. EXPENDED OR EARNED TO DATE (8)
240  REM      F$ = SEQ FILE NAME
250  REM      F1$ = R-A FILE NAME
260  REM      R1 = RECORD NUMBER (EXTRACTED FROM N$)
270  REM      D$ = CONTROL D
280  :
290  REM     FILES USED
300  REM      MONTH# = SEQ/TRANSACTION FILE. # IS USER SELECTED
310  REM      DATASET FORMAT: C,Y$,W$,A$,D
320  REM      BUDGET# = R-A FILE. # IS EXTRACTED FROM N$
330  REM       AND CHANGES WITH EACH TRANSACTION
340  REM      DATASET FORMAT: N$,A$,B$,E$
350  REM      RECORD LENGTH: 44 BYTES
360  :
370  REM     FILE INITIALIZATION
380  :
390  LET D$ =  CHR$ (4)
400  INPUT "WHAT IS THE MONTH NUMBER TO BE PROCESSED?";M
410  REM     DATA ENTRY TESTS
420  LET F$ = "MONTH" +  STR$ (M)
430  PRINT : PRINT "WORKING"
440  :
```

(a) In lines 400 through 420, if the user enters 3 for M, what is the file name F$ in line 420? ____________________

(a) MONTH3.

```
450  REM      READ SEQ FILE TRANSACTIONS
460 :
470  PRINT D$;"OPEN"F$
480  ONERR  GOTO 920
490  PRINT D$;"READ"F$
500  INPUT C,Y$,W$,N$,D
510  PRINT D$
520  POKE 216,0: REM     TURN OFF ERROR TRAP
530 :
540  REM      EXTRACT FILE #/INITIALIZE R-A FILE
550 :
560
570  LET F1$ = "BUDGET" +  STR$ (N)
580  PRINT D$;"OPEN"F1$",L44"
590 :
```

Line 480 tests for the end of the transaction file. When all datasets in that file have been read, the program terminates. Line 500 reads an entire dataset from the transaction file. Then the file number is "extracted" from the account number, to be used in line 570 to make the complete BUDGET file name. Complete line 560, extracting the file number from the account number (it's the first digit of N$).

(a) 560 ____

- - - - - - - - - - - - - - - -

(a) `560  LET N =  VAL ( LEFT$ (N$,1))`

The next operation extracts the record number from the account number (the last three digits of N$).
Fill in line 620.

(a)
```
600  REM      EXTRACT/CONVERT RECORD #
610 :
620
630 :
```

- - - - - - - - - - - - - - - -

(a)
```
600  REM      EXTRACT/CONVERT RECORD #
610 :
620  LET R1 =  VAL ( RIGHT$ (N$,3))
630 :
```

(Warning: Don't forget the double closing parentheses.)

The remaining modules accesses the proper random access file and record, updates the amount expended/earned, and prints the new value back to the file.

Complete this module (lines 660, 670, 680, 720, 740, 780, 790, and 800.)

(a)

```
640  REM      READ R-A FILE RECORD
650  :
660
670
680
690  :
700  REM      MAKE CHANGES TO DATA
710  :
720
730  LET E = E + D
740
750  :
760  REM     UPDATE BUDGET# FILE
770  :
780
790
800
810  :
820  REM      CLOSE BUDGET FILE
830  :
840  PRINT D$;"CLOSE"F1$
850  :
860  REM      RETURN FOR NEXT TRANSACTION
870  :
880  GOTO 480
890  :
900  REM      CLOSE FILE
910  :
920  PRINT D$;"CLOSE"
930  PRINT : PRINT "TRANSACTIONS POSTED"
```

(a)

```
640  REM      READ R-A FILE RECORD
650  :
660  PRINT D$;"READ"F1$",R";R1
670  INPUT N1$,A$,B$,E$
680  PRINT D$
690  :
700  REM      MAKE CHANGES TO DATA
710  :
720  LET E =  VAL (E$)
730  LET E = E + D
740  LET E$ =  STR$ (E)
750  :
760  REM     UPDATE BUDGET# FILE
770  :
780  PRINT D$;"WRITE"F1$",R"R1
790  PRINT N1$: PRINT A$: PRINT B$: PRINT E$
800  PRINT D$
810  :
820  REM      CLOSE BUDGET FILE
830  :
840  PRINT D$;"CLOSE"F1$
850  :
860  REM      RETURN FOR NEXT TRANSACTION
870  :
880  GOTO 480
890  :
900  REM      CLOSE FILE
910  :
920  PRINT D$;"CLOSE"
930  PRINT : PRINT "TRANSACTIONS POSTED"
```

This completes the program. It will continue reading checking transactions and processing them until the end of the transaction file is reached, at which point files are closed and the program ends. This program keeps your disk drive working, but does nothing on your screen or printer.

Enter and RUN the program, then read and display the BUDGET# files to see the posted and updated accounts.

```
100  REM     PERSONAL MONEY MANAGEMENT
110  REM      SEQ/RA FILE APPLICATION
120  :
130  REM      VARIABLES USED
140  REM       N$=N1$=ACCOUNT CHART NUMBER(4)
150  REM       A$ = ACCOUNT NAME (20)
160  REM       Y$ = DATE (8)
170  REM       W$ = CHECK WRITTEN TO/SOURCE OF DEPOSIT (20)
180  REM       M = USER ENTERED MONTH NUMBER (USE 1 FOR JAN, 2 FOR FEB, ETC)
190  REM       N = BUDGET FILE NUMBER (EXTRACTED FROM N$)
200  REM       C = CHECK # OR DEPOSIT SLIP #
210  REM       D = DOLLAR AMT. OF CHECK OR DEPOSIT
220  REM       B$ = BUDGETED AMT. (8)
230  REM       E$ = AMT. EXPENDED OR EARNED TO DATE (8)
240  REM       F$ = SEQ FILE NAME
250  REM       F1$ = R-A FILE NAME
260  REM       R1 = RECORD NUMBER (EXTRACTED FROM N$)
270  REM       D$ = CONTROL D
280  :
290  REM      FILES USED
300  REM       MONTH# = SEQ/TRANSACTION FILE. # IS USER SELECTED
310  REM       DATASET FORMAT: C,Y$,W$,A$,D
320  REM       BUDGET# = R-A FILE. # IS EXTRACTED FROM N$
330  REM        AND CHANGES WITH EACH TRANSACTION
340  REM       DATASET FORMAT: N$,A$,B$,E$
350  REM       RECORD LENGTH: 44 BYTES
360  :
370  REM      FILE INITIALIZATION
380  :
390  LET D$ =  CHR$ (4)
400  INPUT "WHAT IS THE MONTH NUMBER TO BE PROCESSED?";M
410  REM      DATA ENTRY TESTS
420  LET F$ = "MONTH" +  STR$ (M)
430  PRINT : PRINT "WORKING"
440  :
450  REM      READ SEQ FILE TRANSACTIONS
460  :
470  PRINT D$;"OPEN"F$
480  ONERR  GOTO 920
490  PRINT D$;"READ"F$
500  INPUT C,Y$,W$,N$,D
510  PRINT D$
520  POKE 216,0: REM    TURN OFF ERROR TRAP
530  :
540  REM      EXTRACT FILE #/INITIALIZE R-A FILE
550  :
560  LET N =  VAL ( LEFT$ (N$,1))
570  LET F1$ = "BUDGET" +  STR$ (N)
580  PRINT D$;"OPEN"F1$",L44"
590  :
600  REM      EXTRACT/CONVERT RECORD #
610  :
620  LET R1 =  VAL ( RIGHT$ (N$,3))
630  :
640  REM      READ R-A FILE RECORD
650  :
660  PRINT D$;"READ"F1$",R";R1
670  INPUT N1$,A$,B$,E$
680  PRINT D$
690  :
```

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```
700  REM     MAKE CHANGES TO DATA
710  :
720  LET E =  VAL (E$)
730  LET E = E + D
740  LET E$ =  STR$ (E)
750  :
760  REM    UPDATE BUDGET# FILE
770  :
780  PRINT D$;"WRITE"F1$",R"R1
790  PRINT N1$: PRINT A$: PRINT B$: PRINT E$
800  PRINT D$
810  :
820  REM     CLOSE BUDGET FILE
830  :
840  PRINT D$;"CLOSE"F1$
850  :
860  REM     RETURN FOR NEXT TRANSACTION
870  :
880  GOTO 480
890  :
900  REM     CLOSE FILE
910  :
920  PRINT D$;"CLOSE"
930  PRINT : PRINT "TRANSACTIONS POSTED"
```

(a) Only one small component of this application has been completed. List the other programs you would need to make a complete personal finance management system?

(a) Programs:
1. Edit MONTH# file for entry errors
2. Print BUDGET# file accounts
3. "Exception report" showing over budget accounts or projected over budget accounts

We have found random access files much easier to use than sequential files. But let's not forget that sequential files have their place in computing. With the knowledge gained from this book, you should now be able to read the reference manual for your computer with new understanding. You should also be able to write your own data file programs and read programs written by others.

CHAPTER 7 SELF-TEST

1. The first application in this chapter was an inventory control system. Before you continue you may want to review the system description so you are familiar with the contents of BUSINESS INVENTORY and POINTER.

   To this system is added a third file; a sequential transaction file in which is placed the data regarding each transaction that affects the inventory. Two types of transactions will affect inventory:

   Type 1 – units are added to inventory.
   Type 2 – units are taken from inventory.

   Data is recorded in the sequential transaction file in this format.

   T = TRANSACTION TYPE (1 OR 2)
   Y$ = DATE
   I$ = INVOICE # OR RECEIPT #
   N$ = PROD # (4)
   Q1 = QUANTITY ADDED OR DEDUCTED

   Write a program to create the transaction file described above. Name this sequential file BUSINVTRANSACT.

```
100  REM     PROGRAM CREATES A SEQ FILE
110  REM     OF INVENTORY CHANGES FOR FILE
120  REM     NAMED 'BUSINESS IVENTORY'
130  :
140  REM      VARIABLE LIST
150  REM        T=TRANSACTION TYPE(1 OR 2)
160  REM        Y$=DATE (XX-XX-XX)
170  REM        I$=INVOICE OR RECEIPT NUMBER
180  REM        N$=PRODUCT # (4 CHAR)
190  REM        Q1=QUANTITY ADDED OR SUBTRACTED FROM INVENTORY (3 CHAR MAX)
200  REM        D$=CONTROL D
210  REM     FILES USED
220  REM        SEQ FILE NAME: BUSINVTRANSACT
230  REM        DATASET FORMAT: T,Y$,I$,N$,Q1
240  :
```

2. Write the companion program to display the contents of BUSINVTRANSACT.

```
100  REM  DISPLAY CONTENTS OF BUSINVTRANSACT
110  :
120  REM    VARIABLES USED
130  REM     T=TRANSACTION TYPE
140  REM     Y$=DATE
150  REM     I$=INVOICE OR RECEIPT #
160  REM     N$=ACCOUNT NUMBER
170  REM     Q1=QUANTITY ADDED OR SUBTRACTED
180  REM     D$=CONTROL D
190  REM     R$=USER RESPONSE VARIABLE
200  REM    SEQ FILE USED:BUSINVTRANSACT
210  REM       DATASET FORMAT:T,Y$,I$,N$,Q1
220  :
```

```
]RUN
TRANSACTION TYPE: 2
DATE: 2-22-83
INVOICE OR RECEIPT #: S73846
ACCOUNT #: 1234
QUANTITY ADDED OR SUBTRACTED: 10

PRESS RETURN TO CONTINUE
```

3. Write a program to post the inventory changes in BUSINVTRANSACT to BUSINESS INVENTORY.

```
100  REM  PROCESS BUSINVTRANSACT FILE TO BUSINESS INVENTORY FILE
110 :
120  REM   VARIABLE LIST
130  REM     D$=CONTROL D
140  REM     R$=USER RESPONSE VARIABLE
150  REM     N$=N1$=N2$=PRODUCT # (4 CHAR)
160  REM     P$=PROD.DESCRIPT. (20 CHAR MAX)
170  REM     S$=SUPPLIER NAME (20 CHAR MAX)
180  REM     L=REORDER POINT (3 CHAR)
190  REM     Y=REORDER QUANTITY (3 CHAR)
200  REM     Q=QUANITIY IN STOCK (3 CHAR)
210  REM     Q1=QUANTITY ADDED OR SUBTRACTED FROM STOCK (3 CHAR)
220  REM     C=COST (6 CHAR)
230  REM     U=UNIT SELLING PRICE (6 CHAR)
240  REM     R1=RECORD COUNT
250  REM     T=TRANSACTION TYPE
260  REM     Y$=TRANSACTION DATE (XX-XX-XX)
270  REM     I$=INVOICE OR RECEIPT NUMBER
280 :
290  REM   FILES USED
300  REM      SEQ FILE NAME:POINTER
310  REM       DATASET FORMAT:N$,R1
320  REM      R-A FILE NAME:BUSINESS INVENTORY
330  REM       DATASET FORMAT:N$,P$,S$,L,Y,Q,C,U
340  REM       FILE LENGTH:75 BYTES
350  REM      SEQ FILE NAME:BUSINVTRANSACT
360  REM       DATASET FORMAT:T,Y$,I$,N1$,Q1
370 :
```

4. Write a program that, after all the transactions have been processed, will search the entire BUSINESS INVENTORY file and display a report of products that have fallen below the reorder point and need reordering.

```
100  REM    SEARCH BUSINESS INVENTORY FILE FOR REORDERS AND DISPLAY REPORT
110  :
120  REM  VARIABLES USED
130  REM     N$=PRODUCT # (4 CHAR)
140  REM     P$=PROD.DESCRIPT.(20 CHAR MAX)
150  REM     S$=SUPPLIER (20 CHAR MAX)
160  REM     L=REORDER POINT (3 CHAR)
170  REM     Y=REORDER QUANITIY
180  REM     Q=QUANTITY IN STOCK
190  REM     C=COST
200  REM     U=UNIT SELLING PRICE
210  REM     D$=CONTROL D
220  REM     X=FOR NEXT LOOP CONTROL VARIABLE
230  REM     R1=RECORD COUNT
240  REM     R$=USER RESPONSE VARIABLE
250  REM   FILES USED
260  REM     R-A FILE NAME:BUSINESS INVENTORY
270  REM     DATASET FORMAT:N$,P$,S$,L,Y,Q,C,U
280  REM     FILE LENGTH:75 BYTES
290  :
```

```
]RUN

ACCOUNT #: 1234
SUPPLIER: COVEN INC
REORDER POINT: 35
REORDER QUANTITY: 50
QUANITIY NOW IN STOCK: 30
COST: .45
UNIT SELLING PRICE: 1.375

PRESS RETURN TO CONTINUE.
```

Answer Key

1.

```
100  REM    PROGRAM CREATES A SEQ FILE
110  REM    OF INVENTORY CHANGES FOR FILE
120  REM    NAMED 'BUSINESS IVENTORY'
130  :
140  REM     VARIABLE LIST
150  REM      T=TRANSACTION TYPE(1 OR 2)
160  REM      Y$=DATE (XX-XX-XX)
170  REM      I$=INVOICE OR RECEIPT NUMBER
180  REM      N$=PRODUCT # (4 CHAR)
190  REM      Q1=QUANTITY ADDED OR SUBTRACTED FROM INVENTORY (3 CHAR MAX)
200  REM      D$=CONTROL D
210  REM    FILES USED
220  REM      SEQ FILE NAME: BUSINVTRANSACT
230  REM      DATASET FORMAT: T,Y$,I$,N$,Q1
240  :
250  REM    INITIALIZE
260  :
270  LET D$ =  CHR$ (4)
280  PRINT D$;"OPEN BUSINVTRANSACT"
290  PRINT D$;"DELETE BUSINVTRANSACT"
300  PRINT D$;"OPEN BUSINVTRANSACT"
310  :
320  REM    DATA ENTRY
330  :
340  PRINT "TRANSACTION CODES:"
350  PRINT "  ENTER '1' FOR UNITS ADDED TO INVENTORY."
360  PRINT "  ENTER '2' FOR UNITS TAKEN FROM INVENTORY."
370  INPUT "ENTER TRANSACTION TYPE: ";T
380  IF T <  > 1 AND T <  > 2 THEN  PRINT : PRINT  CHR$ (7);"ENTER THE
     DIGITS 1 OR 2 ONLY.": PRINT : GOTO 370
390  INPUT "ENTER TRANSACTION DATE:";Y$
400  REM    DATA ENTRY TESTS GO HERE
410  INPUT "ENTER INVOICE OR RECEIPT #:";I$
420  REM    DATA ENTRY TESTS GO HERE
430  INPUT "ENTER PRODUCT # (4 CHAR):";N$
440  REM    DATA ENTRY TESTS GO HERE
450  INPUT "ENTER QUANTITY:";Q1
460  REM    DATA ENTRY TESTS GO HERE
470  :
480  REM    WRITE TO FILE
490  :
500  PRINT D$;"WRITE BUSINVTRANSACT"
510  PRINT T: PRINT Y$: PRINT I$: PRINT N$: PRINT Q1
520  PRINT D$
530  INPUT "MORE TRANSACTIONS(Y OR N)?";R$
540  IF R$ <  > "Y" AND R$ <  > "N" THEN  PRINT  CHR$ (7);"PLEASE ENTER 'Y'
     FOR YES OR 'N' FOR NO.": PRINT : GOTO 530
550  IF R$ = "Y" THEN  HOME : GOTO 340
560  :
570  REM   CLOSE FILES
580  :
590  PRINT D$;"CLOSE"
600  PRINT : PRINT "FILE CLOSED."
610  END
```

2.

```
100  REM  DISPLAY CONTENTS OF BUSINVTRANSACT
110 :
120  REM    VARIABLES USED
130  REM      T=TRANSACTION TYPE
140  REM      Y$=DATE
150  REM      I$=INVOICE OR RECEIPT #
160  REM      N$=ACCOUNT NUMBER
170  REM      Q1=QUANTITY ADDED OR SUBTRACTED
180  REM      D$=CONTROL D
190  REM      R$=USER RESPONSE VARIABLE
200  REM    SEQ FILE USED:BUSINVTRANSACT
210  REM      DATASET FORMAT:T,Y$,I$,N$,Q1
220 :
230  REM    INITIALIZE
240 :
250  LET D$ =  CHR$ (4)
260  PRINT D$;"OPEN BUSINVTRANSACT"
270 :
280  REM    READ & DISPLAY
290 :
300  ONERR  GOTO 440
310  PRINT D$;"READ BUSINVTRANSACT"
320  INPUT T,Y$,I$,N$,Q1
330  PRINT D$
340  PRINT "TRANSACTION TYPE: ";T
350  PRINT "DATE: ";Y$
360  PRINT "INVOICE OR RECEIPT #: ";I$
370  PRINT "ACCOUNT #: ";N$
380  PRINT "QUANTITY ADDED OR SUBTRACTED: ";Q1
390  PRINT : INPUT "PRESS RETURN TO CONTINUE";R$
400  PRINT : GOTO 310
410 :
420  REM    END OF FILE ERROR TRAP
430 :
440  IF  PEEK (222) = 5 THEN  PRINT : PRINT "CONTENTS DISPLAYED": GOTO 490
450  PRINT : PRINT "UNUSUAL ERROR. PROGRAM TERMINATED.": GOTO 490
460 :
470  REM    CLOSE FILE
480 :
490  PRINT D$;"CLOSE"
500  PRINT "FILE CLOSED"
510  END
```

3.
```
100  REM  PROCESS BUSINVTRANSACT FILE TO BUSINESS INVENTORY FILE
110  :
120  REM   VARIABLE LIST
130  REM     D$=CONTROL D
140  REM     R$=USER RESPONSE VARIABLE
150  REM     N$=N1$=N2$=PRODUCT # (4 CHAR)
160  REM     P$=PROD.DESCRIPT. (20 CHAR MAX)
170  REM     S$=SUPPLIER NAME (20 CHAR MAX)
180  REM     L=REORDER POINT (3 CHAR)
190  REM     Y=REORDER QUANTITY (3 CHAR)
200  REM     Q=QUANITIY IN STOCK (3 CHAR)
210  REM     Q1=QUANTITY ADDED OR SUBTRACTED FROM STOCK (3 CHAR)
220  REM     C=COST (6 CHAR)
230  REM     U=UNIT SELLING PRICE (6 CHAR)
240  REM     R1=RECORD COUNT
250  REM     T=TRANSACTION TYPE
260  REM     Y$=TRANSACTION DATE (XX-XX-XX)
270  REM     I$=INVOICE OR RECEIPT NUMBER
280  :
290  REM   FILES USED
300  REM      SEQ FILE NAME:POINTER
310  REM       DATASET FORMAT:N$,R1
320  REM      R-A FILE NAME:BUSINESS INVENTORY
330  REM       DATASET FORMAT:N$,P$,S$,L,Y,Q,C,U
340  REM       FILE LENGTH:75 BYTES
350  REM      SEQ FILE NAME:BUSINVTRANSACT
360  REM       DATASET FORMAT:T,Y$,I$,N1$,Q1
370  :
380  REM     INITIALIZE
390  :
400  HOME : PRINT "WORKING"
410  LET D$ =  CHR$ (4)
420  PRINT D$;"OPEN BUSINESS INVENTORY,L75"
430  PRINT D$;"OPEN BUSINVTRANSACT"
440  :
450  REM   READ ONE BUSINVTRANSACT DATASET AND FIND CORRESPONDING RECORD #
     FROM POINTER
460  :
470  ONERR  GOTO 790
480  PRINT D$;"READ BUSINVTRANSACT"
490  INPUT T,Y$,I$,N1$,Q1
500  PRINT D$
510  ONERR  GOTO 770
520  PRINT D$;"OPEN POINTER"
530  PRINT D$;"READ POINTER"
540  INPUT N$,R1
550  PRINT D$
560  IF N$ = N1$ THEN  PRINT D$;"CLOSE POINTER": GOTO 610
570  GOTO 530
580  :
590  REM    FIND AND CHANGE Q IN R-A FILE
600  :
610  POKE 216,0: REM  TURN OFF ERROR TRAP
620  PRINT D$;"READ BUSINESS INVENTORY,R"R1
630  INPUT N2$,P$,S$,L,Y,Q,C,U
640  PRINT D$
650  IF T = 1 THEN  LET Q = Q + Q1: GOTO 700
660  IF T = 2 THEN  LET Q = Q - Q1: GOTO 700
670  :
680  REM    WRITE UPDATED DATASET TO R-A FILE
690  :
700  PRINT D$;"WRITE BUSINESS INVENTORY,R"R1
710  PRINT N2$: PRINT P$: PRINT S$: PRINT L: PRINT Y: PRINT Q: PRINT C:
     PRINT U
720  PRINT D$
730  GOTO 470
740  :
750  REM    ERROR TRAPS FOR SEQ FILES
760  :
770  IF  PEEK (222) = 5 THEN  PRINT : PRINT  CHR$ (7);"ACCOUNT # REFERENCED
     IN BUSINVTRANSACT FILE NOT FOUND IN POINTER FILE. PROGRAM TERMINATED.":
     PRINT : GOTO 830
780  PRINT : PRINT  CHR$ (7);"UNUSUAL ERROR. PROGRAM TERMINATED.": GOTO 830
790  IF  PEEK (222) = 5 THEN  PRINT : PRINT "ALL TRANSACTIONS POSTED.":
     GOTO 830
800  :
810  REM    CLOSE FILES
820  :
830  PRINT D$;"CLOSE"
840  PRINT "FILES CLOSED"
850  END
```

4.

```
100  REM    SEARCH BUSINESS INVENTORY FILE FOR REORDERS AND DISPLAY REPORT
110  :
120  REM  VARIABLES USED
130  REM      N$=PRODUCT # (4 CHAR)
140  REM      P$=PROD.DESCRIPT.(20 CHAR MAX)
150  REM      S$=SUPPLIER (20 CHAR MAX)
160  REM      L=REORDER POINT (3 CHAR)
170  REM      Y=REORDER QUANITIY
180  REM      Q=QUANTITY IN STOCK
190  REM      C=COST
200  REM      U=UNIT SELLING PRICE
210  REM      D$=CONTROL D
220  REM      X=FOR NEXT LOOP CONTROL VARIABLE
230  REM      R1=RECORD COUNT
240  REM      R$=USER RESPONSE VARIABLE
250  REM   FILES USED
260  REM      R-A FILE NAME:BUSINESS INVENTORY
270  REM      DATASET FORMAT:N$,P$,S$,L,Y,Q,C,U
280  REM      FILE LENGTH:75 BYTES
290  :
300  REM    INITIALIZE
310  :
320  LET D$ =  CHR$ (4)
330  PRINT D$;"OPEN BUSINESS INVENTORY,L75"
340  :
350  REM    READ ONE DATASET, DETERMINE IF INVENTORY IS BELOW REEORDER
     POINT
360  :
370  PRINT D$;"READ BUSINESS INVENTORY,R0"
380  INPUT R1
390  PRINT D$
400  FOR X = 1 TO R1
410  PRINT D$;"READ BUSINESS INVENTORY,R"X
420  INPUT N$,P$,S$,L,Y,Q,C,U
430  PRINT D$
440  IF Q < L THEN  GOSUB 500
450  NEXT X
460  GOTO 620
470  :
480  REM    SUBROTUINE TO PRINT REPORT
490  :
500  PRINT : PRINT "ACCOUNT #: ";N$
510  PRINT "SUPPLIER: ";S$
520  PRINT "REORDER POINT: ";L
530  PRINT "REORDER QUANTITY: ";Y
540  PRINT "QUANITIY NOW IN STOCK: ";Q
550  PRINT "COST: ";C
560  PRINT "UNIT SELLING PRICE: ";U
570  PRINT : INPUT "PRESS RETURN TO CONTINUE.";R$
580  HOME : RETURN
590  :
600  REM     CLOSE FILES
610  :
620  PRINT D$;"CLOSE"
630  PRINT : PRINT "REORDER DISPLAY COMPLETED AND FILE CLOSED."
640  END
```

Final Self-Test

1. Write a program to create a sequential disk file named PHONE1, containing the following data concatenated into one string in fields as indicated:

   Last name (fifteen character maximum)
   first name (fifteen character maximum)
   area code (three digits)
   phone number (eight characters, including hyphen between third and fourth character)

```
100  REM   CREATE SEQ FILE PHONE1(NAME&# DIRECTORY)
110  :
120  REM    VARIABLES USED
130  REM      L$=LAST NAME (15 CHAR FIELD)
140  REM      F$=FIRST NAME (15 CHAR FIELD)
150  REM      A$=AREA CODE (3 CHAR FIELD)
160  REM      N$=PHONE # (8 CHAR CODE)
170  REM       C$=L$+F$+A$+N$ (CONCATENATED DATASET)
180  REM      D$=CONTROL D
190  REM      R$=USER RESPONSE VARIABLE
200  REM    FILE USED
210  REM      SEQ FILE NAME:PHONE1
220  REM      DATASET FORMAT:C$
230  :
```

```
]RUN
TYPE 'STOP' IF NO MORE ENTRIES.

ENTER LAST NAME:BROWNING
ENTER FIRST NAME:MAXWELL
ENTER AREA CODE:440
PHONE NUMBER FORMAT: 999-9999
WHAT IS THE NUMBER?123-4321
CHECK FOR MISTAKES!
LAST NAME: BROWNING
FIRST NAME: MAXWELL
PHONE NUMBER: (440) 123-4321

IS THE INFO CORRECT(Y OR N)?
```

2. Write a program to display all the datasets in PHONE1, with the data items separated (undo concatenation) and displayed.

```
100  REM    DISPLAY PHONE1 FILE CONTENTS
110  :
120  REM    VARIABLES USED
130  REM      C$=DATASET
140  REM      R$=USER RESPONSE VARIABLE
150  REM      D$=CONTROL D
160  REM    SEQ FILE NAME: PHONE1
170  REM      DATASET FORMAT: C$
180  :
```

3. Write a program that will select and display all names and numbers in a user-selected area code from PHONE1, with the option to continue or STOP when the display is complete.

```
100  REM    SELECT PHONE1 NUMBERS BY AREA CODE AND DISPLAY
110  :
120  REM    VARIABLES USED
130  REM      C$=DATASET
140  REM      R$=USER RESPONSE VARIABLE
150  REM      A$=USER SELECTED AREA CODE
160  REM    SEQ FILE NAME: PHONE1
170  REM      DATASET FORMAT:C$ (FIELDED STRING 15+15+3+8 CHARACTERS)
180  :
```

4. Write a program to change each dataset in BUSINESS INVENTORY by increasing the unit sales price of each item by 10 percent. The program should display the product number, the old price, and the new price.

```
100  REM    INCREASE UNIT SELLING PRICE IN BUSINESS INVENTORY FILE &
     DISPLAY OLD AND NEW PRICE
110  :
120  REM    VARIABLES USED
130  REM      N$=ACCOUNT NUMBER
140  REM      P$=PROD.DESCRIPT.
150  REM      S$=SUPPLIER NAME
160  REM      L=REORDER POINT
170  REM      Y=REORDER AMOUNT
180  REM      Q=QUANTITY IN STOCK
185  REM      C=COST
190  REM      U=OLD UNIT SELLING PRICE
200  REM      U1=NEW UNIT SELLING PRICE
210  REM      R$=USER RESPONSE VARIABLE
220  REM      D$=CONTROL D
230  REM      R1=RECORD COUNT
240  REM      X=FOR NEXT LOOP CONTROL VARIABLE
245  REM    R-A FILE NAME: BUSINESS INVENTORY
250  REM      DATASET FORMAT: N$,P$,S$,L,Y,Q,C,U
260  REM      FILE LENGTH: 75 BYTES
270  :


]RUN
PROD#           OLD $           NEW $
1234            1.5125          1.66375
1235            .9559           1.05149

CHANGES DISPLAYED AND FILE CLOSED
```

Answer Key

1.

```
100  REM   CREATE SEQ FILE PHONE1(NAME&# DIRECTORY)
110  :
120  REM    VARIABLES USED
130  REM      L$=LAST NAME (15 CHAR FIELD)
140  REM      F$=FIRST NAME (15 CHAR FIELD)
150  REM      A$=AREA CODE (3 CHAR FIELD)
160  REM      N$=PHONE # (8 CHAR CODE)
170  REM       C$=L$+F$+A$+N$ (CONCATENATED DATASET)
180  REM      D$=CONTROL D
190  REM      R$=USER RESPONSE VARIABLE
200  REM    FILE USED
210  REM      SEQ FILE NAME:PHONE1
220  REM      DATASET FORMAT:C$
230  :
240  REM    INITIALIZE
250  :
260  LET D$ =  CHR$ (4)
270  PRINT D$;"OPEN PHONE1"
280  PRINT D$;"DELETE PHONE1"
290  PRINT D$;"OPEN PHONE1"
300  :
310  REM    DATA ENTRY
320  :
330  HOME : PRINT "TYPE 'STOP' IF NO MORE ENTRIES.": PRINT
340  INPUT "ENTER LAST NAME:";L$
350  IF L$ = "STOP" THEN 760
360  IF  LEN (L$) = 0 THEN  PRINT  CHR$ (7);"NO ENTRY MADE. PLEASE ENTER AS
     INDICATED.": PRINT: GOTO 340
370  IF  LEN (L$) > 15 THEN  PRINT  CHR$ (7);"LIMIT NAME TO 15 CHAR. AND

     REENTER.": PRINT : GOTO 340
380  IF  LEN (L$) < 15 THEN  LET L$ = L$ + " ": GOTO 380
390  :
400  INPUT "ENTER FIRST NAME:";F$
410  IF  LEN (L$) = 0 THEN  PRINT  CHR$ (7);"NO ENTRY MADE. PLEASE ENTER AS
     REQUESTED.": PRINT : GOTO 400
420  IF  LEN (F$) > 15 THEN  PRINT  CHR$ (7);"LIMIT NAME TO 15 CHAR. AND

     REENTER.": PRINT : GOTO 400
430  IF  LEN (F$) < 15 THEN  LET F$ = F$ + " ": GOTO 430
440  :
450  INPUT "ENTER AREA CODE:";A$
460  IF  LEN (A$) <  > 3 THEN  PRINT  CHR$ (7);"PLEASE ENTER 3 DIGIT AREA
     CODE ONLY.": PRINT : GOTO 450
470  :
480  PRINT "PHONE NUMBER FORMAT: 999-9999"
490  INPUT "WHAT IS THE NUMBER?";N$
500  IF  LEN (N$) <  > 8 THEN  PRINT  CHR$ (7);"ENTRY ERROR.": PRINT : GOTO
     480
510  IF  ASC ( MID$ (N$,4,1)) <  > 45 THEN  PRINT  CHR$ (7);"ENTRY ERROR.
     USE HYPHEN AFTER FIRST 3 DIGITS.": PRINT : GOTO 480
520  :
530  REM   DISPLAY DATA FOR VERIFICATION BEFORE WRITING TO FILE
540  :
550  HOME : PRINT "CHECK FOR MISTAKES!"
560  PRINT "LAST NAME: ";L$
570  PRINT "FIRST NAME: ";F$
580  PRINT "PHONE NUMBER: (";A$;") ";N$
590  PRINT : INPUT "IS THE INFO CORRECT(Y OR N)?";R$
600  IF R$ <  > "Y" AND R$ <  > "N" THEN  PRINT  CHR$ (7);"PLEASE ENTER 'Y'
     FOR YES OR 'N' FOR NO.": PRINT : GOTO 590
610  IF R$ = "Y" THEN 680
620  IF R$ = "N" THEN  PRINT : PRINT "PLEASE REENTER THE ENTIRE DATASET."
630  INPUT "PRESS 'RETURN' WHEN READY.";R$
640  GOTO 330
650  :
```

```
660  REM   CONCATENATE & WRITE DATASET
670  :
680  LET C$ = L$ + F$ + A$ + N$
690  PRINT D$;"WRITE PHONE1"
700  PRINT C$
710  PRINT D$
720  GOTO 330
730  :
740  REM   CLOSE FILE
750  :
760  PRINT D$;"CLOSE"
770  PRINT : PRINT "FILE CLOSED"
780  END
```

2.

```
100  REM    DISPLAY PHONE1 FILE CONTENTS
110  :
120  REM    VARIABLES USED
130  REM      C$=DATASET
140  REM      R$=USER RESPONSE VARIABLE
150  REM      D$=CONTROL D
160  REM    SEQ FILE NAME: PHONE1
170  REM      DATASET FORMAT: C$
180  :
190  :
200  REM    INITIALIZE
210  :
220  LET D$ =  CHR$ (4)
230  PRINT D$;"OPEN PHONE1"
240  :
250  REM    READ AND DISPLAY
260  :
270  ONERR  GOTO 370
280  PRINT D$;"READ PHONE1"
290  INPUT C$
300  PRINT D$
305  PRINT "NAME: "; LEFT$ (C$,30)
310  PRINT "PHONE: ("; MID$ (C$,31,3);") "; RIGHT$ (C$,8)
320  PRINT : INPUT "PRESS RETURN FOR NEXT DISPLAY";R$
330  PRINT : GOTO 280
340  :
350  REM    ERROR TRAP
360  :
370  IF  PEEK (222) = 5 THEN  PRINT : PRINT "ALL NUMBERS DISPLAYED.": GOTO
     420
380  PRINT  CHR$ (7);"UNUSUAL ERROR. PROGRAM TERMINATED.": GOTO 420
390  :
400  REM    CLOSE FILE
410  :
420  PRINT D$;"CLOSE"
430  PRINT "FILE CLOSED"
440  END
```

3.

```
100  REM    SELECT PHONE1 NUMBERS BY AREA CODE AND DISPLAY
110  :
120  REM    VARIABLES USED
130  REM      C$=DATASET
140  REM      R$=USER RESPONSE VARIABLE
150  REM      A$=USER SELECTED AREA CODE
160  REM    SEQ FILE NAME: PHONE1
170  REM      DATASET FORMAT:C$ (FIELDED STRING 15+15+3+8 CHARACTERS)
180  :
190  :
200  REM    INITIALIZE
210  :
220  LET D$ =  CHR$ (4)
230  PRINT D$;"OPEN PHONE1"
240  :
250  REM    USER SELECTS AREA CODE
260  :
270  INPUT "ENTER AREA CODE FOR THIS DISPLAY:";A$
280  REM   DATA ENTRY TESTS GO HERE
290  :
300  HOME : PRINT "AREA CODE SELECTED: ";A$
310  PRINT : PRINT "PRESS RETURN FOR NEXT DISPLAY"
320  :
330  REM    READ AND DISPLAY SELECTED #'S
340  :
350  ONERR  GOTO 470
360  PRINT D$;"READ PHONE1"
370  INPUT C$
380  PRINT D$
390  IF A$ <  >  MID$ (C$,31,3) THEN 360
400  PRINT  LEFT$ (C$,30)
410  PRINT "("; MID$ (C$,31,3);") "; RIGHT$ (C$,8)
420  INPUT "";R$
430  GOTO 360
440  :
450  REM     ERROR TRAP
460  :
470  IF  PEEK (222) = 5 THEN  PRINT : PRINT "ALL DISPLAYED.": GOTO 520
480  PRINT : PRINT "UNUSUAL ERROR. PROGRAM TERMINATED.": GOTO 520
490  :
500  REM    CLOSE FILE
510  :
520  PRINT D$;"CLOSE"
530  PRINT "FILE CLOSED"
540  END
```

4.

```
100  REM    INCREASE UNIT SELLING PRICE IN BUSINESS INVENTORY FILE &
     DISPLAY OLD AND NEW PRICE
110  :
120  REM    VARIABLES USED
130  REM      N$=ACCOUNT NUMBER
140  REM      P$=PROD.DESCRIPT.
150  REM      S$=SUPPLIER NAME
160  REM      L=REORDER POINT
170  REM      Y=REORDER AMOUNT
180  REM      Q=QUANTITY IN STOCK
185  REM      C=COST
190  REM      U=OLD UNIT SELLING PRICE
200  REM      U1=NEW UNIT SELLING PRICE
210  REM      R$=USER RESPONSE VARIABLE
220  REM      D$=CONTROL D
230  REM      R1=RECORD COUNT
240  REM      X=FOR NEXT LOOP CONTROL VARIABLE
245  REM    R-A FILE NAME: BUSINESS INVENTORY
250  REM      DATASET FORMAT: N$,P$,S$,L,Y,Q,C,U
260  REM      FILE LENGTH: 75 BYTES
270  :
280  REM    INITIALIZE
290  :
300  LET D$ =  CHR$ (4)
310  PRINT D$;"OPEN BUSINESS INVENTORY,L75"
320  :
330  REM    READ DATA, INCREASE PRICE, DISPLAY PRICES, WRITE NEW DATA TO
     FILE
340  :
350  :
360  PRINT "PROD#","OLD $","NEW $"
370  PRINT D$;"READ BUSINESS INVENTORY,R0"
380  INPUT R1
390  PRINT D$
400  FOR X = 1 TO R1
410  PRINT D$;"READ BUSINESS INVENTORY,R"X
420  INPUT N$,P$,S$,L,Y,Q,C,U
430  PRINT D$
440  LET U1 = U + U * .1
450  PRINT N$,U,U1
460  PRINT D$;"WRITE BUSINESS INVENTORY,R"X
470  PRINT N$: PRINT P$: PRINT S$: PRINT L: PRINT Y: PRINT Q: PRINT C:
     PRINT U1
475  PRINT D$
480  NEXT X
490  :
500  REM    CLOSE FILE
510  :
610  PRINT D$;"CLOSE"
620  PRINT : PRINT "CHANGES DISPLAYED AND FILE CLOSED"
630  END
```

APPENDIX A

ASCII CHARACTER CODES

DEC = ASCII decimal code
CHAR = ASCII character name
n/a = not accessible directly from the APPLE II keyboard

DEC	CHAR	WHAT TO TYPE
Ø	NULL	ctrl @
1	SOH	ctrl A
2	STX	ctrl B
3	ETX	ctrl C
4	ET	ctrl D
5	ENQ	ctrl E
6	ACK	ctrl F
7	BEL	ctrl G
8	BS	ctrl H *or* ←
9	HT	ctrl I
1Ø	LF	ctrl J
11	VT	ctrl K
12	FF	ctrl L
13	CR	ctrl M *or* RETURN
14	SO	ctrl N
15	SI	ctrl O
16	DLE	ctrl P
17	DC1	ctrl Q
18	DC2	ctrl R
19	DC3	ctrl S
2Ø	DC4	ctrl T
21	NAK	ctrl U *or* →
22	SYN	ctrl V
23	ETB	ctrl W
24	CAN	ctrl X
25	EM	ctrl Y
26	SUB	ctrl Z
27	ESCAPE	ESC
28	FS	n/a
29	GS	ctrl shift-M
3Ø	RS	ctrl ^
31	US	n/a
32	SPACE	space
33	!	!
34	"	"
35	#	#
36	$	$
37	%	%
38	&	&
39	'	'
4Ø	(	(
41	)	)
42	*	*
43	+	+
44	,	,
45	—	—
46	.	.
47	/	/
48	Ø	Ø
49	1	1
5Ø	2	2

DEC	CHAR	WHAT TO TYPE
51	3	3
52	4	4
53	5	5
54	6	6
55	7	7
56	8	8
57	9	9
58	:	:
59	;	;
60	<	<
61	=	=
62	>	>
63	?	?
64	@	@
65	A	A
66	B	B
67	C	C
68	D	D
69	E	E
70	F	F
71	G	G
72	H	H
73	I	I

DEC	CHAR	WHAT TO TYPE
74	J	J
75	K	K
76	L	L
77	M	M
78	N	N
79	O	O
80	P	P
81	Q	Q
82	R	R
83	S	S
84	T	T
85	U	U
86	V	V
87	W	W
88	X	X
89	Y	Y
90	Z	Z
91	[	n/a
92	\	n/a
93	]	] (shift-M)
94	^	^
95	_	n/a

APPENDIX B

LIST OF PROGRAMS

Chapter 4

Page 89 First example program to create a sequential data file.
SEQ file name: DEMO1
dataset format: N$, G$, N

Page 92 This program creates a sequential file inventory of personal property items.
SEQ file name: PROPERTY
dataset format: T$, N, V

Page 96 Read/display the contents of PROPERTY.

Page 101 Program creating a sequential file of statistical data reflecting the quality of goods coming out of some manufacturing process. Program then summarizes data and displays results.
SEQ file name: QUALITY ASSURANCE
dataset format: N, V

Pages 103-104 This program creates within the program a set of data in a sequential file without user data entry, then reads/displays the contents of the file.
SEQ file name: TEST
dataset format: A$

Chapter 4 Self-Test

Page 123, prob. 1a A general format program to create a file whose dataset is two strings of data followed by two numeric data values. User decides what the data should represent.
SEQ file name: CUST
dataset format: A$, B$, M, N

Page 124, prob. 1b Read/display CUST.

Page 125, prob. 2a Creates a shopping list sequential file.
SEQ file name: GROCERY
dataset format: N$, Q

Page 126, prob. 2b Read/display GROCERY.

Page 127, prob. 3a Creates a file of customer credit information.
SEQ file name: CREDIT
dataset format: C$, N$, R

Page 128, prob. 3b Read/display CREDIT.

Page 129, prob. 4a Program to create files of checkbook, bank, or retail sales transaction information. Account number data is provided for the creation of two different files with the same dataset formats.
SEQ file names: TRANSACTION–1 and TRANSACTION–2
dataset format: A$, T$, C$i

Page 130, prob. 4b Read/display any file with TRANSACTION dataset format.

Page 131, prob. 5a Creates a file of names and addresses, where name, street address, city, state, and zip code are concatenated into one fielded string.
SEQ file name: ADDRESS
dataset format: E$ (one fielded string)

Page 132, prob. 5b Read/display ADDRESS

Page 132, prob. 6a Program to create files whose data are texts of short form letters.
SEQ file names: LETTER1, LETTER2, LETTER3
dataset format: T$ (one string, 255 characters maximum length)

Page 133, prob. 6b Read/display any LETTER# file.

Chapter 5

Page 138 This program will append data to an existing file named GROCERY, or create the file if no file by that name already exists.
SEQ file name: GROCERY (from page 125)
dataset format: N$, Q

Page 142 Program to make a copy of the file CUST.
SEQ source file name: CUST (from page 123)
SEQ copy file name: CUST COPY
dataset format: A$, B$, A, B

Pages 150–151 Credit File Changer program to search CREDIT for a user-selected customer number and make changes in the dataset for that customer. A temporary file is used, and after all changes to the datasets in the file are made, the source file is deleted and the temporary file renamed CREDIT.
SEQ source file name: CREDIT (from page 127)
SEQ temporary file name: TEMP, renamed CREDIT

Page 153 Program called Credit File Editor (Version 1).
SEQ source file: CREDIT (from page 127)
SEQ temporary file name: TEMPFIL, renamed CREDIT
dataset format: C$, N$, R

Pages 158–159 Credit File Editor (Version 2)
SEQ source file name: CREDIT (from page 127)
SEQ temporary file name: TEMPFIL, renamed CREDIT
dataset format: C$, N$, r

Pages 161–162 Credit File Editor (Version 3) allows user to delete complete datasets, change any data item in a dataset, or insert a new dataset.
SEQ source file name: CREDIT (from page 127)
SEQ temporary file name: TEMPFIL, renamed CREDIT

Pages 173–174 Program called Merge which merges the contents of two separate files into one, maintaining numeric order of account numbers.
SEQ source files: TRANSACTION1 and TRANSACTION2 (from page 129)
SEQ merged file name: TRANSACTIONMERGE
dataset format: A$, T$, C$

Pages 183–184 This program writes (prints) form letters (each was stored as a sequential data file), personalized with names and address information from ADDRESS.
SEQ source file names: LETTER1, LETTER2, LETTER3 (from page 132)
dataset format: T$ (one string)
SEQ source file name: ADDRESS (from page S4–5A
dataset format: A$ (one fielded string)

Chapter 5 Self-Test

Page 193, prob. 1 Program to make a copy of ADDRESS.
SEQ source file name: ADDRESS (from page 131)
SEQ copy file name: ADDRESSCOPY
dataset format: T$ (one fielded string)

Page 194, prob. 2a Program to create files of magazine titles. Two alphabetized lists of titles are provided for the creation of two files.
SEQ file names: MAGLIST1 and MAGLIST2
dataset format: T$

Page 194, prob. 2b Read/display files with MAGLIST# format.

Page 195, prob. 2c Program to merge MAGLIST1 and MAGLIST2, maintaining alphabetized order in merged file.

Page 197, prob. 3 Program to create or add to or delete from a file of reminders for household or office tasks.
SEQ original or source file name: WORK REMINDER
SEQ temporary file name: TEMPFILE, renamed WORK REMINDER
dataset format: one string (255 characters maximum)

Chapter 6

Page 204 First demonstration program to create a random access file whose data is simplified business inventory information.

R–A (Random Access) file name: INVEN
dataset format: N$, P$, Q
record length: 32 bytes

Pages 204–207 Same as above, except the number of records existing in the file is written in record number zero.
R–A file name: INVEN

Page 208 Reads/displays INVEN using a FOR NEXT loop and the record count stored in record zero.

Page 211 This program creates a file of customer phone numbers, using a customer ID number, name, and phone number as data.
R–A file name: PHONE
dataset format: C$, N$, P$
record length: 36 bytes

Page 213 Reads/displays PHONE.

Page 216 Program that allows user to add datasets to PHONE.

Pages 217–219 Program to create a "master" file for user-determined data.
R–A file name: MASTER
dataset format: G$, S, Q, M$
record length: 66 bytes

Pages 220–222 Reads/displays MASTER.

Page 230 Program to make a random access file copy of MASTER.
R–A source file name: MASTER
R–A copy file name: STORE1
dataset format: G$, S, Q, M$
record length: 66 bytes

Page 224 This program uses INVEN in an example of how to change data in a random access file.
R–A source file name: INVEN (from pages 204–207)
dataset format: N$, P$, Q
record length: 32 bytes

Page 231 Program to convert (copy) a sequential file to a random access file.
SEQ file name: CREDIT (from page 127)
R–A converted file name: R–A CREDIT
dataset formats: N$, C$, R
record length: 29 bytes

Pages 232–234 Reads/displays random access file R–A CREDIT (but not the sequential source file from which it was copied or converted).
R–A file name: R–A CREDIT

Chapter 6 Self-Test

Page 247, prob. 1a Program to create a somewhat realistic file of business inventory data.
R–A file name: BUSINESS INVENTORY
dataset format: N$, P$, S$, L, Y, Q, C, U
record length: 75 bytes

Page 248, prob. 1b Read/display BUSINESS INVENTORY.

Page 249, prob. 1c Program to create a sequential pointer file using data from a random access file. Pointer file's two data items are the customer number and the record in which that customer number appears in the random access file.
SEQ. pointer file namer: POINTER
dataset format: N$, R
R–A source file name: BUSINESS INVENTORY
dataset format: N$, P$, S$, L, Y, Q, C, U
record length: 75 bytes

Page 249, prob. 1d Read/display POINTER.
SEQ file name: POINTER
dataset format: N$, R

Page 250, prob. 2 Program to make a copy of a random access file.
R–A source file name: R–A CREDIT (from page 231)
R–A copy file name: R–A CREDIT COPY
dataset formats: N$, C$, R
record lengths: 29 bytes

Page 251, prob. 3 Program to read/display the contents of both R–A CREDIT and R–A CREDIT COPY to verify a correct copy.

Chapter 7

Pages 256-257 This program permits the user to change the cost and unit selling price for an existing dataset in BUSINESS INVENTORY, using POINTER to identify the record for the dataset to be modified.
SEQ file name: POINTER (from page 249)
dataset format: N$, R1
R–A file name: BUSINESS INVENTORY (from page 247)
dataset format: N$, P$, S$, L, Y, Q, C, U
record length: 75 bytes

Page 261 This program is used to create three random access files of year to date budget information, based on the categories in the Chart of Accounts (page 258).
R–A file name: BUDGET# (where # is 1, 2, or 3)
dataset format: N$, A$, B$, E$
record length: 44 bytes

Page 261 Read/display BUDGET# files.

Pages 263-265 This program is used to create a sequential data file of checkbook transactions (checks and deposits) at the end of each month.
SEQ file name: MONTH# (where # corresponds to months, 1 to 12)
dataset format: C, Y$, W$, N$, D

Pages 264-265 Read/display MONTH# files.

Page 268 This Personal Money Management program uses the Chart of Accounts number in the MONTH# dataset to locate the correct BUDGET# file and record in that file and posts the checkbook transaction to that record.
SEQ. file name: MONTH#
dataset format: C, Y$, W$, N$, D
R–A file name: BUDGET#
dataset format: N$, A$, B$, E$
record length: 44 bytes

Chapter 7 Self-Test

Page 271, prob. 1 Program to create a sequential transaction file of items taken from or added to stock of products on hand, corresponding to data items in BUSINESS INVENTORY.
SEQ file name: BUSINVTRANSACT
dataset format: T, Y$, I$, N$, Q1

Page 278, prob. 2 Read/display BUSINVTRANSACT.

Page 279, prob. 3 This program processes or posts BUSINVTRANSACT data to BUSINESS INVENTORY, to maintain up-to-date information on products in stock.
SEQ file name: BUSINVTRANSACT
R–A file name: BUSINESS INVENTORY.

Page 280, prob. 4 This program searches through BUSINESS INVENTORY after transaction posting and generates a report showing all items which have fallen below the reorder point. R–A file name: BUSINESS INVENTORY

Final Self-Test

Pages 290-291, prob. 1 This program creates a sequential file of names and phone numbers, including separate entry of first and last names, and area code, and redisplays data entered (for visual error-checking) before writing to the file.
SEQ file name: PHONE1
dataset format: C$ (one fielded string)

Page 291, prob. 2 Read/display PHONE1.

Page 306, prob. 3 This program finds and displays all names and phone numbers with a user-selected area code.
SEQ file name: PHONE1

Page 293, prob. 4 This program goes through the BUSINESS INVENTORY file and increases the unit selling price of all items by 10%; and it displays the product number as well as the old and new selling prices.
R–A file name: BUSINESS INVENTORY

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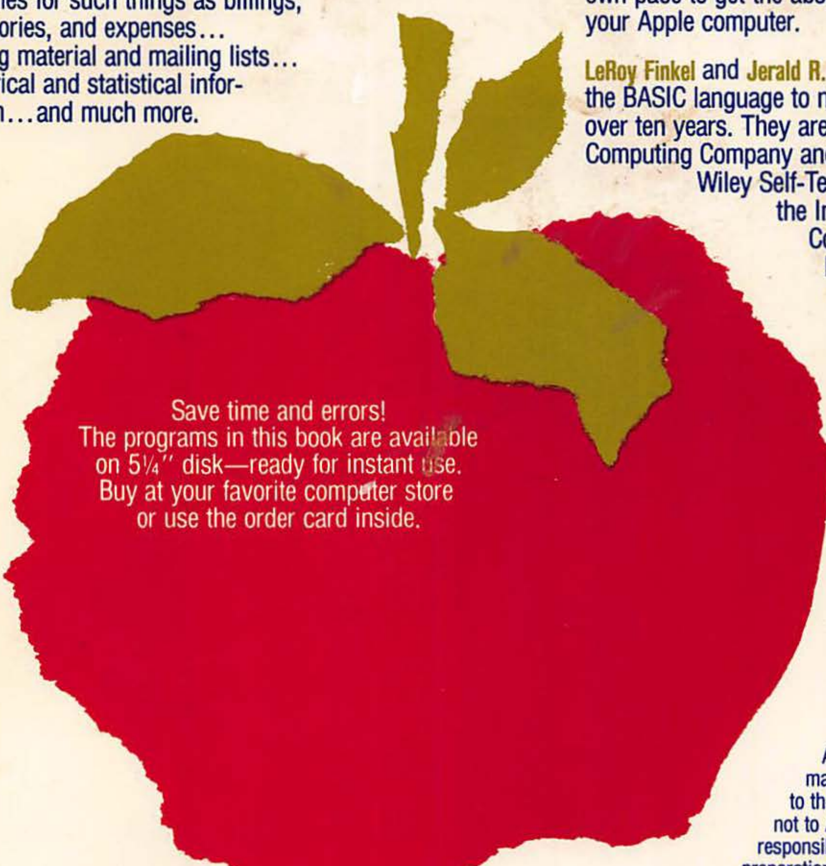

JOHN WILEY & SONS, INC.
605 Third Avenue,
New York, N.Y. 10158
New York • Chichester • Brisbane • Toronto
Singapore

ISBN 0 471-09157-X

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