

## Introduction

### 1. STATISTICAL SOFTWARE PACKAGES

This workbook is intended to supplement the exercises in Frank and Althoen's *Statistics: Concepts and Applications*<sup>1</sup> with exercises that make use of personal computers.

There is a wide variety of statistical software packages available for all levels of user. In our own minds we separate the available systems into "student" systems (like STATSTAR®, MINITAB®, and MYSTAT®) intended primarily for instructional use and "professional" systems (including SPSS/PC®, SYSTAT®, and BMD®) that are serious research tools. Such professional systems as SPSS/PC® and SYSTAT® perform analyses that just a few years ago required a mainframe computer that—along with peripherals and the air conditioning equipment that such machines need—can occupy one or more floors of a large office building. Several of these professional systems began life as mainframe systems and are today available in both mainframe and personal computer versions. For the most part, the personal computer versions do everything that their brawnier cousins do, but they are slower and can handle fewer observations. With the new generation of 80386 and 80486 personal computers, and the expanded memory features of these machines, the advantages of the mainframe are diminishing rapidly.

The gap between professional and student statistical software, however, remains wide. Professional systems can cost in excess of 500 dollars, require 20 to 30 diskettes (5 1/4-inch, double density), and can be used only on machines equipped with a hard drive. Student systems are nominally priced, typically require only one or two diskettes, and can ordinarily be run on a machine equipped with two floppy drives. The trade-off is that most student systems allow only a limited variety of analyses.

The student version of ASP (A Statistical Package for Business, Economics, and the Social Sciences®), which accompanies this workbook, is a refreshing exception. It is powerful enough for serious research use, it is packaged on a single 5 1/4-inch diskette, and it offers the same menu of statistical options as the professional version. However, since it is written to accommodate older and lower-price computers, ASP limits the number of data entries (scores) to 5000, but even the professional user—much less the overworked student—is unlikely to find this a serious limitation.

### 2. FOR THE FIRST-TIME COMPUTER USER

If you have never used a computer before, you have two important things to learn right from the start. First, computer manufacturers have entered into a conspiracy to hide the on-off switch. Second, the monitor (the TV!) has its own switch. If you are in a class, get your instructor to help you. If you are in a statistics lab or a computer lab, get one of the user-services staff to help you. (Sometimes they wear laboratory coats, but if you don't see anyone with a lab coat, look for somebody with a pocket protector containing at least three different colors of pen. Even if this person is *not* the supervisor, chances are pretty good that he or she knows how to turn on your computer.)

---

<sup>1</sup> Cambridge University Press (1994). Cited throughout the remainder of *User Friendly* as "*Statistics*" or the "textbook."

## 2.1 Technical Terms, Notation, Etc.

Computer literacy is not yet universal, so if the word "default" conjures up the image of someone with a size 17 neck repossessing your car, you better read this section. Even if you are an experienced computer user, you should read this section, because it explains some of the notational conventions used in this workbook.

*ASCII.* American Standard Code for Information Interchange. A "universal" computer language for reading, writing and storing documents that contain only text.

*Buffer.* A buffer is a temporary storage area in computer memory. Material that is on your screen is stored in a "screen buffer"; when you start your printer, the material to be printed is stored in the "printer buffer," etc.

*Cursor.* (1) The novice computer user; one who curses a lot and is liable to take literally the instruction STRIKE ANY KEY. (2) The little rectangle █ that indicates where the next character will appear on the screen. (*Note:* Unless otherwise indicated, this book applies only the second definition.)

*Cursor controls.* The cursor controls are the keys marked with arrows

← ↑ → ↓

They make the cursor move around the screen without typing a character.

*Default.* A default option is the option that is executed if no other instruction is given. In ASP, most default options can be executed by pressing a single key (ordinarily Y for "Yes" or the ENTER key, which is sometimes marked ↵). When only *two* options are possible (e.g., "Yes" or "No") the *alternative* to the default option is ordinarily entered in ASP by pressing the SPACE BAR.

*Disks and disk drives.* Disks are pieces of mylar that contain magnetically coded information. Disks can be *hard* or *floppy*. A hard, or *fixed*, disk is built into the computer. A floppy disk (diskette) is portable and must be inserted into the computer in order for the computer to read information from the disk or write information onto the disk.

The *disk drive* is the apparatus that reads information from a disk and writes information onto a disk. (Think of it as a little bitty record player.) If your computer has a hard disk, the disk and drive are a single unit, which is completely enclosed in the computer. The floppy drive is necessarily accessible to the user. Look for the panel on the front of the computer with a slot (called a door) into which a disk is inserted and a light that goes on when the drive is reading from or writing to the disk. Most floppy disks come in one of two sizes, 5 1/4-inch or 3 1/2-inch. The door on a 5 1/4-inch floppy drive has a latch that must be closed before the drive can read or write to your disk.

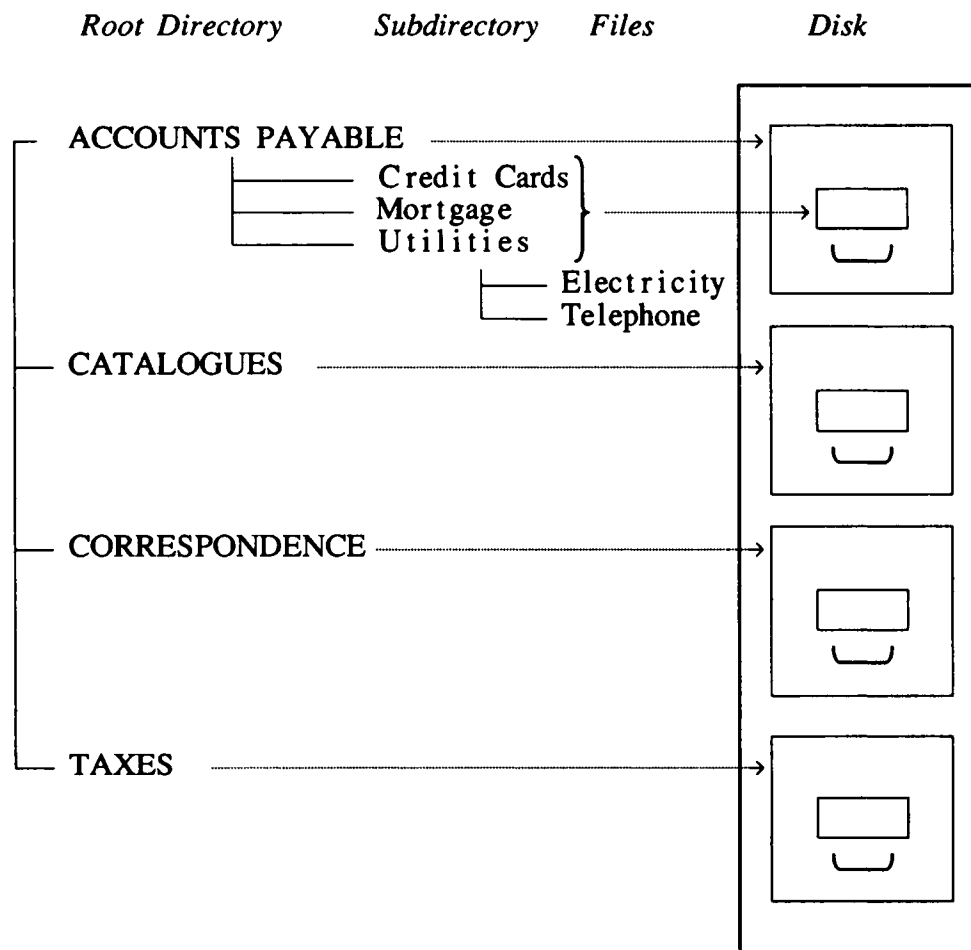
### WARNING:

**If the door on your disk drive is only about 3 inches wide and your disk is about 5 inches wide, do NOT cut your disk to fit the slot. You have the wrong size disk for your particular machine. Get your instructor (or someone with a pocket protector full of colored pens) to help you.**

Most personal computers have either one floppy drive (drive A) or two floppy drives (drives A and B) or one floppy and one hard drive. The hard drive is ordinarily designated drive C.

*DOS.* This is not Spanish for the number "2." It is an acronym for *Disk Operating System* and ordinarily refers to the basic program of instructions by which IBM-compatible personal computers interpret commands that the user types from a keyboard. When you first turn on a computer, you are "in" DOS. The commands you use to tell the computer to read information from a diskette or run a program (such as ASP) are DOS commands.

*Files and directories.* Information in a computer is organized like a file cabinet. The file cabinet in Figure 1 has four drawers labeled ACCOUNTS PAYABLE, CATALOGUES, CORRESPONDENCE, and TAXES. The ACCOUNTS PAYABLE drawer is separated into sections for Credit Card Accounts, Mortgage Payments, and Utilities, and the Utilities section contains one folder for electricity and another for telephone. The cabinet corresponds to a disk, and the list of "drawers" is called the *root directory*. The label on the first drawer that lists Credit Cards, Mortgage, and Utilities is the *subdirectory* of ACCOUNTS PAYABLE, and the two utilities accounts are *files*.



*Figure 1. Disks, directories, and files.*

Most of the files you will use in ASP are *data* files, which contain data *matrices*. A *matrix* is a rectangular arrangement of numbers. Rows correspond to *cases*, and columns are called *variables*. "Cases" are the objects, events, or persons on which observations are made, and "variables" are the scores or measurements that observations yield. For example, suppose our data are the height and weight of five individuals, Andrea, Barbara, Charles, David, and Edith.

	CASES ↓	Column 1 Height	Column 2 Weight	← VARIABLES
Row 1	Andrea	64 in	134 lbs	
Row 2	Barbara	68 in	160 lbs	
Row 3	Charles	72 in	195 lbs	
Row 4	David	60 in	145 lbs	
Row 5	Edith	74 in	210 lbs	

Then, case 1 is Andrea, variable 1 for case 1 is 64 (Andrea's height), and variable 2 for case 1 is 134 (Andrea's weight). The *data matrix* is

64	134
68	160
72	195
60	145
74	210

*Formatted disk.* A formatted disk is one that has been prepared to accept information from DOS and other programs (like ASP) that operate in the DOS environment.

*Function keys.* These are the keys marked F1, F2, and so on. They may be clustered at one side of your keyboard or they may be laid out in a row at the top of your keyboard. If you are instructed to press, say, F1, DO NOT press F and then press 1. Press the function key, F1.

*Highlight.* A "Highlighted" section of text appears on your screen much like a section of written text that has been highlighted with a felt-tipped marker. On a monochrome monitor, material is highlighted by reversing the shades of unhighlighted text and background **like this**. On a color monitor the highlighted characters are in a color that contrasts with the unhighlighted characters, and the highlighted section is surrounded by a bar or block that appears in a color that contrasts with the background of unhighlighted text.

The highlighted bar in ASP is sometimes called the *bounce bar*, because it can be "bounced" around the screen with the SPACE BAR or the cursor control keys.

*Memory.* The computer's electronic "working space," where instructions and information are kept while the computer is turned on.

*Monitor.* The TV.

*Prompts.* A "prompt" is a signal that the user should type an instruction. When you are in DOS, the prompt is usually the symbol >. If your screen shows

A:\>

the computer is reading drive A and you can type a command. If the screen shows

B:\>

the computer is reading drive B and you can type a command. If the screen shows

C:\>

the computer is reading the hard drive and you can type a command.

When ASP is running, most prompts are highlighted "windows" (see below) into which you can write a command or which contain a pre-written command (the *default* option) that you can confirm by pressing a single key.

*Space Bar.* (1) Setting of the best scene in the movie STAR WARS. (2) The long skinny key at the bottom of your keyboard, ordinarily pressed with one's thumb.

*Status Line.* The status line is a highlighted strip at the bottom of some ASP screens and provides a brief menu of frequently used keys or tells you the "status" of various ASP features, such as whether or not the automatic print switch is on or off.

*Window.* (1) An architectural feature through which a novice user throws a computer when cursing doesn't relieve the frustration. (2) A box on the screen that either gives you information or provides a space (usually highlighted) for you to write something.

*Workbook notation.* In this workbook you are often instructed to type something (e.g., a series of DOS commands or an ASP label). The material you are to type will appear in the following type face:

ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz1234567890

In addition, there are several keys on your keyboard that have labels instead of letters or numbers. For example, the big fat key that corresponds to the carriage return on an electric typewriter is probably labeled "Enter" or "Return." When you are to press one of these keys, the label will appear in capital letters. If we are illustrating a series of commands as they are to appear on the screen, the label will be enclosed in brackets. Hence, the notation

[ENTER]

means that you are to press the key labeled "Enter." The notation

[Any Key]

means that you are to press any key on the keyboard. This is to make certain that you don't type out, for example, E-N-T-E-R or A-N-Y K-E-Y.

Sometimes, you will have to press two keys simultaneously, for example the key marked SHIFT and the number 8 to type an asterisk (\*). This will be denoted [SHIFT-8] or the text may say something like, "Press SHIFT-8."

Occasionally we will also use the symbols <>. This notation is used to indicate a name or label that *you* have specified. For example, if a series of DOS commands requires you to type the name of the directory that contains your data (see section 5 below), we might write <ASP DIRECTORY>. *YOU* will type the name you have chosen for your ASP directory (but *not* the symbols < and >).

ASP prompts, menu options, and answers that are incorporated into the narrative of the text usually appear in **Boldface**. The names of ASP menus are usually **CAPITALIZED**.

### 3. GETTING STARTED IN ASP

First, make a backup copy of the ASP disk. If you are using 5 1/4-inch disks, put a write-protect tab over the small notch on the right-hand edge of the ASP disk; if you are using 3 1/2-inch disks, click the plastic write-protect switch in the corner of the ASP disk to the open position.

Turn on the computer and the monitor. Your screen should show a DOS prompt, that is, A:> or B:> or C:>.

If your computer has two floppy drives, put the ASP disk in drive A and a blank formatted disk in drive B. At the DOS prompt, type

```
A: [ENTER]
COPY A:*.* B: [ENTER]
```

When the little light on the disk drive goes out, take the ASP disk out of drive A and put it away in a safe place.

If your computer has only one floppy drive, insert the ASP disk and type

```
A: [ENTER]
DISKCOPY [ENTER]
```

Then, follow the directions on your screen. Your ASP disk is the **SOURCE** diskette and your backup is the **TARGET** diskette.

From now on you will work with the backup disk. (When you get a moment, it's a good idea to put a stick-on label on your backup disk, and just to be safe, write only with a felt-tipped pen.)

#### 3.1 Starting ASP from a Floppy Disk

Put the ASP (backup!) disk in drive A and type

```
A: [ENTER]
ASP [ENTER]
```

Leave the ASP disk in drive A. If you have two floppy drives and you are going to enter data from another disk, always put the data disk in drive B. If you have only one drive, you will have to keep your data on the ASP (backup) disk.

### 3.2 Starting ASP from a Hard Disk

If your computer has one floppy drive and one hard drive, you will have to install ASP on your hard drive. Place the ASP (backup!) disk in drive A and type

```
C: [ENTER]
MD \ASP [ENTER]
CD \ASP [ENTER]
COPY A: *.* [ENTER]
```

These commands make a subdirectory called ASP under the root directory on drive C: and copy the contents of your ASP diskette into this subdirectory. (If your hard drive is *not* drive C, substitute the appropriate letter, e.g., D, M, J, or whatever.) You will not have to install ASP again. Put your backup diskette away.

To run ASP from your hard drive, enter the following commands at the DOS prompt:

```
C: [ENTER]
CD \ASP [ENTER]
ASP [ENTER]
```

## 4. USING THE ASP MENUS

ASP begins by presenting the reader with a screen filled with all sorts of vital and fascinating information about copyrights, license limitations, and so on. You ought to read it the first time you use ASP. Then press any key.

### 4.1 The MAIN MENU

You should now see the MAIN MENU shown in Figure 2. Many of the items on this menu sound rather forbidding right now, but they will become more familiar as you proceed

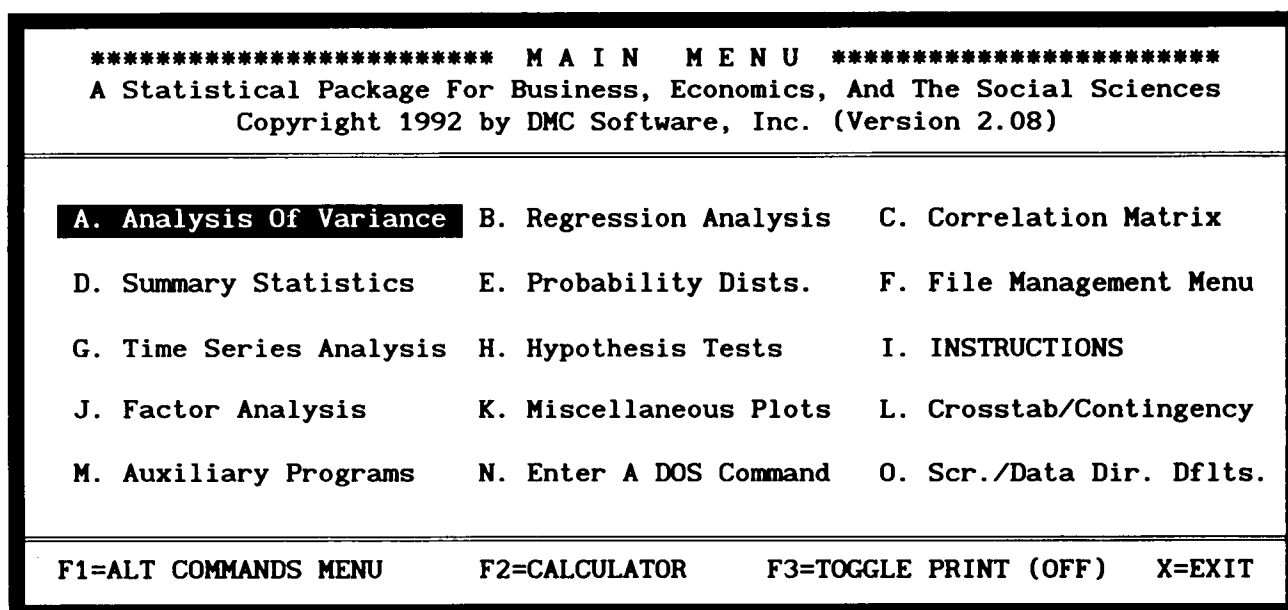


Figure 2. The MAIN MENU screen in ASP.



through your textbook. For the moment, we'll treat the main menu like the menu in a foreign restaurant. Unless you want a dirty screen, you probably shouldn't run your finger down the menu, but you can accomplish the same thing with the cursor controls on your keyboard.

When the MAIN MENU first appears, you will note that item **A. Analysis of Variance** is highlighted. Use the cursor keys to move the highlight bar to menu item

#### I. INSTRUCTIONS

Now, press ENTER.

This document contains a good bit of information about ASP, but it is very condensed and assumes that the reader is an experienced computer user. If you are new to computers, it will be more useful as a quick "on-screen" reference source *after* you have gone through this workbook. You can move down the page with either the cursor control keys or the key marked "PgDn" or "Page Down." Return to the MAIN MENU by pressing ESC. Now press I. You should have the INSTRUCTIONS again. All of the menus in ASP work the same way. You can use the cursor controls and ENTER or the letter code of the menu item.

#### 4.2 The ALT COMMANDS MENU

Except for the MAIN MENU, the menu you will use most often is the ALT COMMANDS MENU, which can be brought to the screen by pressing the key labeled F1. (This is what is meant by the notation in the status line, **F1=ALT COMMANDS MENU**.) The ALT COMMANDS MENU includes all operations for creating and managing data files.

Press F1. Your screen should now show the ALT COMMANDS MENU superimposed over the MAIN MENU, as illustrated in Figure 3. Options listed on the ALT COMMANDS MENU can be selected by moving the bounce bar to the option and pressing ENTER or by pressing the index code for that option (**E** for **Edit or Create Data Matrix**, **G** for **Get Data Matrix From ASP File**, etc.). In addition, you can choose any of the ALT commands from *any screen in ASP that displays the legend F1=ALT COMMANDS MENU* by holding down the ALT key and pressing the index code for the desired option.



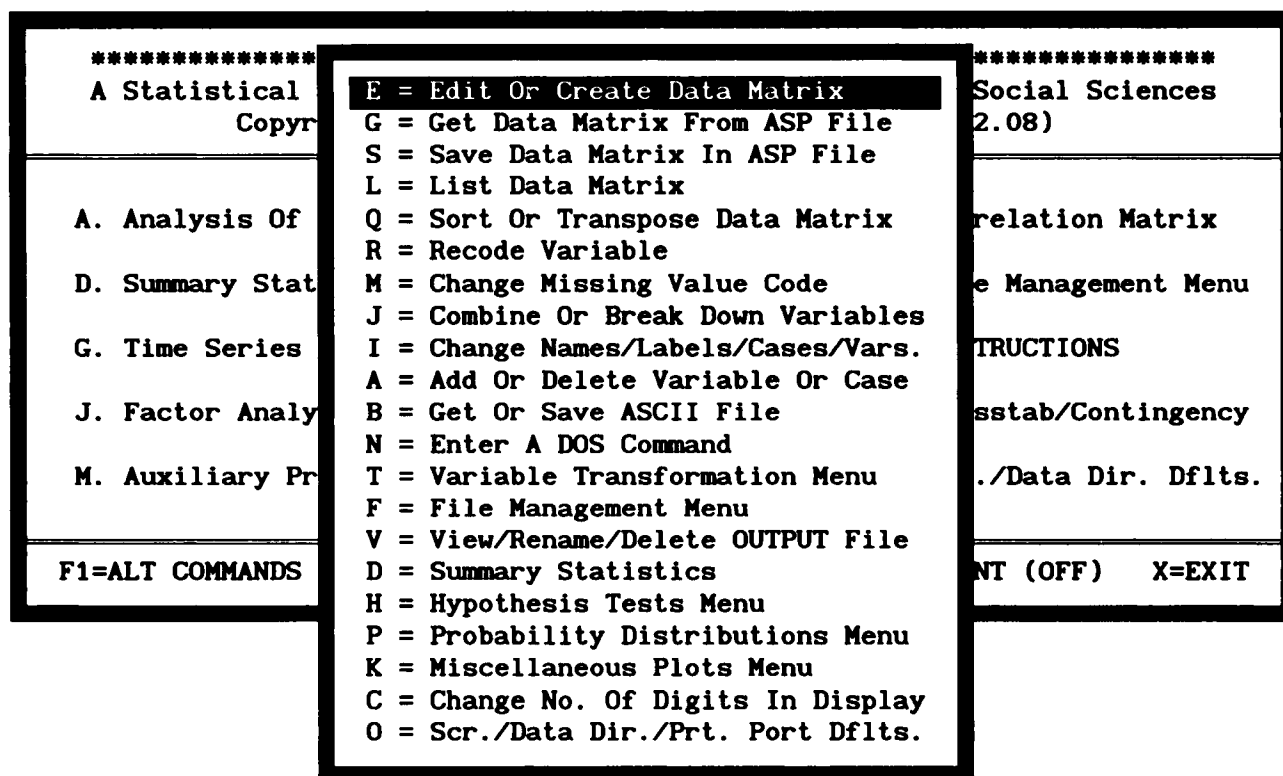


Figure 3. ALT COMMANDS MENU.

## 5. CREATING A DATA DIRECTORY AND A DATA FILE

In *Statistics*, we say that data are the results of observations and that data must be expressed in numerical form before they can be treated statistically. It hardly seemed necessary to point out that an experimenter must first find a piece of paper and then write the numbers down on the piece of paper (or record them in some other way) before starting the business or organizing data into frequency tables, drawing histograms, and so on. Nonetheless, these "obvious" steps are necessary if you are going to perform statistical operations with a hand calculator, and very similar steps are likewise essential to performing statistical operations with a computer package like ASP.

The computer equivalent of a collection of numbers written on a pad of writing paper is called a *data file*. The computer reads the numbers from the data file and then uses them in various mathematical formulas. A *data directory* is the computer equivalent of the drawer where the pad is filed. The data directory is where ASP stores the data on which you perform analyses and also where it stores the output of these analyses.

If your computer has two floppy drives (and no hard drive), use the cursor keys to bring the highlight bar down to the last line of the ALT COMMANDS MENU,

O = Scr./Data Dir./Prt. Port Dflts

and press ENTER. Since the menu opens with the highlight bar on first item, the quickest way to move it to the *last* item is to "bounce" *up* one line. (Or, just press O—that's the letter "oh," not the number zero, which is denoted  $\emptyset$ .)

Press **D** to choose the option

**D DATA DIRECTORY**

and you will get the following prompt

**DATA DIRECTORY? B:\**

ASP's default setting assumes that you will use the disk in drive B as the data directory. This is rather like stacking your file folders in one big box instead of organizing them in various drawers. If you don't intend to have anything except data files on the disk in drive B, this will work out just fine, and you don't have to do anything else. Later examples in this workbook will use B:\ whenever we display a prompt that includes the data directory.

If your computer has a hard drive, you may want to make a data subdirectory under ASP. To do this, press **N** at the MAIN MENU or the ALT COMMANDS MENU. This option allows you enter a DOS command as if you were still at the DOS prompt and not in ASP. To create a subdirectory called **DATA**, type the following commands:

```
C: [ENTER]
MD \ASP\DATA[ENTER]
[Any Key][ESCAPE]
[F1]
[O]
[D]
C:\ASP\DATA[ENTER]
[S]
```

The colon (:) identifies C as a drive, and the backslashes (\) identify ASP as a subdirectory on drive C and DATA as a subdirectory in ASP. The line

**C:\ASP\DATA**

is the *path* that ASP will follow when it looks for data files, stores data files, or stores output. (This assumes, of course, that your hard drive is designated drive C. If not, substitute the appropriate letter.) Whenever ASP prompts you to confirm the name of your data directory, the prompt includes the entire path.

If you are using a computer in a school statistics laboratory, and each student has his or her own data directory, your instructor will assign you a name for your data directory.

Now that you have someplace to put some data, we will create a data file using the following numbers, which are the total points on three hourly examinations, seven quizzes, and the final examination obtained by 54 students in an introductory psychology course.