Appendix A Using a Spreadsheet: Microsoft Excel

On the surface, an electronic spreadsheet looks like nothing more than a table with numerous rows and columns. But the typical features of spreadsheet software enable you to do many things with the data you put in the table. For example, you can recode your data, reorganize it in various ways, and perform simple calculations on subsets of data that you designate.

Here we look at one widely used spreadsheet, Microsoft Excel. We should point out that Excel's format may differ slightly depending on whether it is used with Microsoft Windows or a Macintosh operating system. Also, each new update of Excel tends to be slightly different from its predecessor in appearance and function. We are basing this discussion on the 2008 version of Excel for Macintosh computers.

Using Excel to Keep Track of Literature Resources

USING TECHNOLOGY

In any literature review, you are likely to draw on a variety of resources, probably including books, journal articles, and Internet websites. You need to keep track of and report different information about each kind of resource. For a book, you need to know the author(s) or editor(s), title, publication date, publisher, and the publisher's location; in order to find the book in the library stacks, you also need its call number. For a journal article, you need to know the author(s), titles of both the article and the journal, publication date, volume number (and perhaps issue number), and page numbers. The information you need for an Internet website is apt to vary depending on the nature of its content, but at a minimum you need to record the Internet address (uniform resource locator, or URL) and date on which you retrieved the document; or, for very recently posted documents, the document's digital object identifier (DOI).

Let's organize such information with Excel by going to the "File" menu and creating a "New Workbook." An empty two-dimensional table appears on the screen, with tabs labeled "Sheet 1" and "+" at the very bottom. We'll use Sheet 1 to keep track of books. By clicking on the top left-hand cell in the table, we can insert the word "BOOKS" in uppercase letters. Then, by hitting the *down* arrow key on the keyboard, we move to the cell just below, where we insert the words "Authors/Editors" (never mind for now that the words may appear to spill over into the second column—appearances to the contrary, all words typed in any single cell remain in that cell). Then, we hit the *right* arrow key on the keyboard, move to the cell to the right, and insert the word "Title." We continue moving to the right four more times, inserting the words and phrases "Date," "Call Number," "Publisher," and "Pub. Loc." (short for "Publisher's Location"). The words and phrases we have just entered in Row 2 will be our headings for the columns.

At this point some of our headings are too long for the cells, so let's do two things. First, let's go to the "File" menu and then to "Page Setup" and click on "Landscape" and "OK." By doing this, we turn the page sideways and give ourselves more room across the page. Second, let's now move the cursor to the very top of the screen, where we see alphabet letters labeling the columns. If we move the cursor to the line separating the A and B columns, a cross-with-arrow-points icon appears. By clicking on the mouse at this point, we can drag the line to the right to make the "Authors/Editors" column wider. We can do the same thing for the other columns as well, in each case adjusting column width to accommodate the column heading or kind of information we expect to insert in the column cells. To make our headings more visible, we'll also put them in boldface by going to the "Format" menu, then "Cells," and then "Font" and clicking on "Bold" and "OK." With such steps we've set up our list for keeping track of books.

Let's now click on the "+" tab at the very bottom of the page. Doing so gives us "Sheet 2," where we can follow a similar procedure for journal articles. Again let's set up the page in *landscape* mode. In Row 1 we can insert "ARTICLES" and then in the first six cells of Row 2 we can insert the headings "Authors," "Article Title," "Journal Title," "Date," "Vol/Iss" (for "volume and issue"), and "Pp." (for "page numbers"). As we did on Sheet 1, we can adjust the column widths and boldface our headings. If we create a Sheet 3 for Internet websites, we need columns labeled "Address" and "Date Retrieved," plus possibly additional columns in which to insert names of authors or organizations, titles, posting dates, DOIs (if available), and other pertinent information.

Our workbook of three spreadsheets is now ready for us to enter information about our various library and Internet resources. We can print out the sheets and add the necessary information in pen or pencil or, better still, we can take a laptop or tablet computer with us to the library and insert the information directly into a computer document. Figure A.1 shows how the three spreadsheets might look for a few resources on the topic of schizophrenia. Notice that some of

BOOKS					
Authors/Editors	**Title**	**Date**	**Call Number**	**Publisher**	**Pub. Loc.**
Noll, R.	Encyclopedia of Schizophrenia and Other Psychotic Di	2007	RC514 .N63 2007	Facts on File	New York
Walker, E. F. (Ed.)	Schizophrenia: A Life-Course Developmental Perspec	1991	RC514 .S3342 19	Academic Pre	San Diego
Frith, C., & Johnston	Schizophrenia: A Very Short Introduction	2003	RC514 .F755 200	Oxford U. Pre	Oxford, Er

ARTICLES					
Authors	**Article Title**	**Journal Title**	**Date**	**Vol/Iss**	**Pp.**
Lublin, H.,& Eberhard, J.	Content versus delivery: Challenges	European Neuropsychopharm	2008	18(Suppl 3)	v–vi
Tabarés-Seisdedos,R.	Neurocognitive and clinical predictors	Journal of Affective Disorders	2008	109(3)	286–299
Schwab, S. G., & Wilden	Research on causes for schizophrenia	Schizophrenia Research	2008	102(1–3)	29–30

WEBSITES					
Address	**Date Ret'd**	**Author/Org.**	**Title**	**Date Posted**	**Other Info.**
www.nimh.nih.gov/health/to	9/15/08	NIMH/	Schizophrenia	4/2/08	
www.nim.nih.gov/medlineplu	9/17/08	NIM/NIH	Schizophrenia	no date	
www.schizophrenia.com/diac	9/18/08	NARSAD	Schizophrenia sympt	no date	

FIGURE A.1

Using Excel to keep track of library and Internet resources the entries (e.g., some book titles) are too long for the column width. No matter, because the entries *are* recorded in their entirety in the spreadsheet document, and clicking on their particular cells will bring them into full view. Notice, too, that the entries in the "Address" column for the WEBSITES spreadsheet are in blue. When you type an Internet address into a cell, Excel automatically makes it a *hyperlink:* If your computer is currently online and you click on the cell, your computer will take you to that website.

Once you have entered various library and Internet resources into your spreadsheets, you can organize them in various ways, perhaps by call number (for books), journal title (for articles), or date retrieved (for websites). We will look at how to organize spreadsheet entries in an upcoming section. Although our focus at that point will be on organizing data, the same general organizational strategies apply to *any* kind of information.

Using Excel to Record and Recode Data

As you have seen in the preceding section, the data you enter in the cells of an electronic spreadsheet can take a variety of forms: text, numbers, dates, and so on. Thus you can use a spreadsheet to keep track of the information you collect from a qualitative study (provided that the text entries are relatively short), a quantitative study, or a mixed-methods design.

For illustrative purposes, we'll use hypothetical data from a descriptive quantitative study. We return to the four rating-scale items for risk taking presented in Chapter 8:

		Not at All True		*Somewhat True*		*Very True*
11.	I would prefer to teach in a way that is familiar to me rather than trying a teaching strategy that I would have to learn how to do.	1	2	3	4	5
16.	I like trying new approaches to teaching, even if I occasionally find they don't work very well.	1	2	3	4	5
39.	I would choose to teach something I knew I could do, rather than a topic I haven't taught before.	1	2	3	4	5
51.	I sometimes change my plan in the middle of a lesson if I see an opportunity to practice teaching skills I haven't yet mastered.	1	2	3	4	5

As you may recall from our discussion in that chapter, the researchers included these items in a longer list of items designed to assess a variety of traits in college education majors who were completing their teaching internship year (Middleton, Ormrod, & Abrams, 2007). Let's consider how we might create a spreadsheet to enter the data for participants' responses to the entire survey. The general convention is to assign each *row* in the spreadsheet to a particular participant and to assign each *column* to a particular variable that we have assessed for each participant. In this research project Middleton and his colleagues included several demographic variables (e.g., age, gender), supervisor ratings of teacher effectiveness, and participants' responses to 69 rating-scale items designed to measure several personality and motivational characteristics. For simplicity's sake, we'll limit ourselves to the 4 rating-scale items just presented plus 4 additional rating-scale items designed to measure perfectionism, as follows:

	Not at All True		Somewhat True		Very True
19. It is very important that I always appear to be "on top of things."	1	2	3	4	5
27. It does not bother me if I occasionally make mistakes in the classroom.	1	2	3	4	5
38. I do not want people to see me teaching unless I am very good at it.	1	2	3	4	5
60. I always try to present a picture of perfection in my teaching.	1	2	3	4	5

We'll create a spreadsheet for a sample of 10 hypothetical respondents to the questionnaire and their responses to the 4 risk-taking and 4 perfectionism items (see Figure A.2). Note that the labels "RISK-TAKING" and "PERFECTIONISM" are only in cells B1 and F1, respectively, but because cells to their immediate right are blank, we see the content of these cells in their entirety.

Can we add up the responses to the four risk-taking items to create an overall risk-taking score and, similarly, add up responses to the four perfectionism items to create an overall perfectionism score? No, not yet. If you look at the wordings for the eight items, you should notice that the self-descriptions in Items 16 and 51 are indicative of high risk taking but the self-descriptions in Items 11 and 39 are indicative of *low* risk taking. Similarly, Items 19, 38, and 60 reflect a desire for perfection, but Item 27 reflects comfort with *im*perfection. In order to have responses to all items for a particular characteristic reflect a high degree of that characteristic, we need to reverse, or *recode,* people's responses to Items 11, 39, and 27, changing 1s into 5s, 2s into 4s, 4s into 2s, and 5s into 1s, but leaving 3s as they are (e.g., in their recoded form, higher-number responses to Item 11 indicate high rather than low risk taking). The following simple formula makes this conversion for us:

$$6 - \text{Original response} = \text{Recoded response}$$

For example, if we want to recode a response of 5, then

$$6 - 5 = 1$$

Similarly, if we want to recode a response of 2, then

$$6 - 2 = 4$$

FIGURE A.2
Hypothetical data for 10 people responding to eight rating-scale items related to risk taking and perfectionism

	A	B	C	D	E	F	G	H	I
1		RISK-TAKING				PERFECTIONISM			
2	Person #	#11	#16	#39	#51	#19	#27	#38	#60
3	1	2	5	3	4	3	5	3	2
4	2	4	1	5	2	4	2	5	4
5	3	5	2	3	3	5	3	4	4
6	4	2	4	2	4	4	4	3	3
7	5	1	5	3	5	2	5	1	2
8	6	3	2	5	1	5	2	5	3
9	7	5	1	3	2	4	3	4	3
10	8	1	3	1	5	4	5	2	3
11	9	4	1	3	2	5	3	5	4
12	10	3	3	2	5	3	5	3	2
13									

In Column J of our spreadsheet, we will make a new column, which we'll label "Rev11" (for "Reverse of Response to #11"). We're going to use a *formula* to create the values in this column. In particular, let's click on the first cell below our "Rev11" column heading (this is the cell for Person #1). We type an equals sign (=), followed by a 6 and a minus sign. Before doing anything else, we move the cursor to the cell containing Person #1's response to Item #11 (where we see a response of "2" for the item) and click on that cell. What we see in the Rev11 cell for Person #1 is the following:

= 6 – B3

We immediately press the Enter or Return button on the keyboard—we must press this button before we do anything else—and Excel executes the formula to give us the desired value of 4. Now here's the cool part: We can click on the cell in which we've just entered a formula, "copy" its contents, and then "paste" the contents into the nine cells immediately below in the same column. What appears in each cell is the result of the same calculation *using the appropriate value for each person in our sample.* For example, Person #2's response of "4" has been recoded as "2," and Person #3's response of "5" has been recoded as "1."

Items 39 and 27 need to be recoded as well. Let's label Columns K and L "Rev39" and "Rev27" (for Items 39 and 27, respectively) and use the same procedure we used in the "Rev11" column. This time, however, after typing "=6–" in the cell below the new column heading, we click on the cell immediately below the heading "#39" or "#27," depending on which item responses we're recoding. The spreadsheet with the three new columns is shown in Figure A.3

We are now ready to compute overall scores for our risk-taking and perfectionism items. Let's create yet another column in the spreadsheet and label it "RtScore" (for "Risk-Taking Score"). We can again use the *formula* tool, this time adding together each person's responses in the #16, #51, Rev11, and Rev39 columns. We take the following steps:

1. Click on Person #1's cell in the new column.
2. Hit the equals sign key (=) on the keyboard.
3. Click on the first cell below the "#16" label.
4. Hit the plus sign key (+) on the keyboard.
5. Click on the first cell below the "#51" label.
6. Hit the plus sign key (+) on the keyboard.
7. Click on the first cell below the "Rev11" label.
8. Hit the plus sign key (+) on the keyboard.
9. Click on the first cell below the "Rev39" label.

At this point, the entry in the cell you're creating should look like this:

= C3 + E3 + J3 + K3

FIGURE A.3

Adding three columns for reversing people's responses to certain rating-scale items

	A	B	C	D	E	F	G	H	I	J	K	L
1		Risk Taking Items				Perf'ism Items						
2	Person #	#11	#16	#39	#51	#19	#27	#38	#60	Rev11	Rev39	Rev27
3	1	2	5	3	4	3	5	3	2	4	3	1
4	2	4	1	5	2	4	2	5	4	2	1	4
5	3	5	2	3	3	5	3	4	4	1	3	3
6	4	2	4	2	4	4	4	3	3	4	4	2
7	5	1	5	3	5	2	5	1	2	5	3	1
8	6	3	2	5	1	5	2	5	3	3	1	4
9	7	5	1	3	2	4	3	4	3	1	3	3
10	8	1	3	1	5	4	5	2	3	5	5	1
11	9	4	1	3	2	5	3	5	4	2	3	3
12	10	3	3	2	5	3	5	3	2	3	4	1
13												

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1		Risk Taking Items				Perf'ism Items								
2	Person #	#11	#16	#39	#51	#19	#27	#38	#60	Rev11	Rev39	Rev27	RtScore	PerfScore
3	1	2	5	3	4	3	5	3	2	4	3	1	16	9
4	2	4	1	5	2	4	2	5	4	2	1	4	6	17
5	3	5	2	3	3	5	3	4	4	1	3	3	9	16
6	4	2	4	2	4	4	4	3	3	4	4	2	16	12
7	5	1	5	3	5	2	5	1	2	5	3	1	18	6
8	6	3	2	5	1	5	2	5	3	3	1	4	7	17
9	7	5	1	3	2	4	3	4	3	1	3	3	7	14
10	8	1	3	1	5	4	5	2	3	5	5	1	18	10
11	9	4	1	3	2	5	3	5	4	2	3	3	8	17
12	10	3	3	2	5	3	5	3	2	3	4	1	15	9
13														

FIGURE A.4

Adding two columns with overall scores for risk taking and perfectionism

Immediately hit the Enter or Return button and—*voila!*—the value 16 should appear. Now copy the contents of this cell into the nine cells below it in the column, and you'll see totals ranging from 6 to 18 for the risk-taking items.

We can follow essentially the same procedure to create a total (which we'll call "PerfScore") for the perfectionism items, this time using the values in the #19, #38, #60, and Rev27 columns. The results of our calculations are shown in Figure A.4.

Reorganizing Data in Excel

An additional feature of virtually all spreadsheets is an ability to organize the data by one or more variables. Our current spreadsheet for responses to risk-taking and perfectionism items is organized by person number. But perhaps, instead, we want to organize it by risk-taking score, with the greatest risk takers listed first and the relatively nonrisk-taking people listed last. We first need to use the cursor to highlight all of the data we want to reorganize—in this case the 10 rows and 14 columns of numbers. We move the cursor to the third cell in the first column (for Person #1), click on the mouse, and then drag the mouse down and to the right until the 140 cells with numbers are all highlighted. We then move the cursor to the "Data" menu and select "Sort." A box appears in which we can sort by several variables in order of priority, but in this situation we want to sort only by risk-taking score. We type "RtScore" in the first box and, because we want to have the high risk takers appear at the top, we click "Descending" (for descending order). When we click on the "OK" button, the data rearrange themselves, with Persons #5 and #8 (with risk-taking scores of 18) appearing first and Person #2 (with a risk-taking score of 6) appearing last.

A word of caution, however. Be sure that you highlight *all* of the data columns in your spreadsheet before hitting the "OK" button. If you highlight only some of them (or perhaps only one or two), you will reorganize the data *only* in those columns, leaving the data in other columns untouched. The result will be a scrambled mess, with some numbers for, say, Person #8 moving to a new row and others staying where they were originally.

The *sort* tool isn't limited to numerical data. For example, let's return to the spreadsheets we created for the books, journal articles, and websites in our literature review. We could easily sort our books by call number or our journal articles alphabetically by journal title, thereby making our search for them in the library stacks more efficient.

Using Excel to Perform Simple Statistical Analyses

When we used formulas to recode some item responses and to compute overall scores for risk taking and perfectionism, we were using the *function* feature of Excel. Many functions are available in Excel, including numerous preprogrammed statistical analyses. For example, let's say that we want to compute basic descriptive statistics for the risk-taking and perfectionism scores for our hypothetical sample of 10 people. We begin by typing the labels "Mean," "SD" (for "Standard Deviation"), and "Corr" (for "Correlation") in Column A in the three cells immediately below our data set. (This step is not required to complete our mission, but it helps us keep track of which statistics we're putting where.)

The procedure we follow next depends somewhat on the particular version of Excel we are using. In Excel 2008 for Macintosh, we now click on the cell representing the intersection of the "Mean" row and the "RtScore" column, then go to the "Insert" pull-down menu at the top of the screen and click on "Function." An equals sign (=) appears in the table cell we've selected and a function box appears on the screen; this box includes many possible calculations we might perform. In the function box, we scroll down to "AVERAGE" (we may possibly have to scroll a long way until we reach the category "Statistical") and" *double*-click on AVERAGE. At this point we need to tell Excel *which* numbers—which in this case Excel calls "arguments"—to use in calculating the average (mean). The bottom portion of the function box presents two places where we can indicate the range of numbers we want to use in calculating the mean; for the mean, we want to use only the first of these two places. Excel may also "suggest" one or more table cells with a colored box; if it doesn't, we can create a box by clicking on one of the cells in our spreadsheet. Then, by clicking on various sides and/or corners of the box and dragging the box in appropriate directions, we can capture the numbers to be averaged—and *only* those numbers—at which point we again hit the Enter or Return button on the keyboard. In the example here, we capture the 10 RtScore values for our 10 people, and the mean risk-taking score (12) for our sample appears in the designated cell. We follow a similar procedure for the "PerfScore" column to obtain a mean Perfectionism score (12.7).

We do essentially the same thing to obtain a standard deviation for our two sets of scores, this time clicking on the appropriate cells in the "SD" row of our spreadsheet and double-clicking "STDEV" in the right-hand column in the function box. This procedure gives us standard deviations of 4.9889 and 4.056545 for the Risk-Taking and Perfectionism scores, respectively.

Finally, let's calculate a Pearson product-moment correlation coefficient between the Risk-Taking and Perfectionism scores. This calculation requires a slightly different procedure. We must first click on the cell where we want the r value to appear, so let's use the cell representing the intersection of the "Corr" row and the "PerfScore" column. We choose the function feature as we did for means and standard deviations, then double-click on "CORREL." At this point a box appears that asks for "Array1" and "Array2." With the Array1 subbox highlighted, we highlight the 10 data cells in the "RtScore" column of the spreadsheet (we must be sure *not* to highlight the mean and standard deviation we've already calculated). We then move the cursor to the Array2 subbox, click on it and then highlight the 10 data cells in the "PerfScore" column of the spreadsheet. What we will see in the two subboxes are the following:

M3:M12

N3:N12

We immediately hit the Enter or Return key, and a correlation coefficient of −0.91139 appears. In our hypothetical data set, then, risk taking and perfectionism are strongly and negatively correlated.

The statistics we've just calculated include more decimal places than we need and communicate a precision that really isn't warranted from such a small sample size. We can limit the number of decimal places to 2 by going to the "Format" menu, then to "Cells," then to "Number," and then, under "Category," to "Number" again. Our final calculations are shown in Figure A.5, along with the data as we previously reorganized them by risk-taking scores.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1		Risk Taking Items				Perf'ism Items								
2	Person #	#11	#16	#39	#51	#19	#27	#38	#60	Rev11	Rev39	Rev27	RtScore	PerfScore
3	5	1	5	3	5	2	5	1	2	5	3	1	18	6
4	8	1	3	1	5	4	5	2	3	5	5	1	18	10
5	1	2	5	3	4	3	5	3	2	4	3	1	16	9
6	4	2	4	2	4	4	4	3	3	4	4	2	16	12
7	10	3	3	2	5	3	5	3	2	3	4	1	15	9
8	3	5	2	3	3	5	3	4	4	1	3	3	9	16
9	9	4	1	3	2	5	3	5	4	2	3	3	8	17
10	6	3	2	5	1	5	2	5	3	3	1	4	7	17
11	7	5	1	3	2	4	3	4	3	1	3	3	7	14
12	2	4	1	5	2	4	2	5	4	2	1	4	6	17
13	Mean												12	12.7
14	SD												4.99	4.06
15	Corr													-0.91
16														

FIGURE A.5

The data set as reorganized, with descriptive statistics calculated

You can find other simple statistical tests in Excel, including *t*-tests and chi-square (χ^2) tests. For more sophisticated analyses, however, you will need statistical software such as SPSS, described in Appendix B.

Appendix B
Using SPSS

A complete explanation of how to use SPSS—short for Statistical Package for the Social Sciences—is well beyond the scope of a short appendix. However, a brief explanation of some of the basics can get you started. The version of SPSS we describe is PASW Statistics Student Version 18.0 for Macintosh.[1]

Creating a Data Set

USING TECHNOLOGY

Once you have loaded SPSS onto the hard drive of your computer (see the directions that come with the program for details), open the program. On your screen you will see a two-dimensional table that looks very much like a spreadsheet. Each row in the table designates a specific individual (human participant, animal subject, artifact, etc.) in your data set. Each column designates a specific variable in the data set. Once filled in, this table will provide the basis for your data analyses.

As an example, we use data from a pilot study that Dinah Jackson conducted in preparation for her dissertation study (1996; excerpts from her dissertation appear in Chapters 1 and 12). The data include the following information for 15 students in a college psychology class; (a) their gender; (b) their scores on three exams given during the semester; (c) the total of the three exam scores; (d) the quantity of class notes (i.e., number of pages) they took during the semester; and (e) the quality of their class notes. The last of these variables—quality of notes—is based on content analyses of students' notes; the numbers are proportions of notes that reflect an integration of two or more ideas rather than a single, isolated fact. In Jackson's study, better-integrated notes (reflected in higher numbers, such as .406 or .496) were theorized to facilitate better learning—and thus to be of better quality—than relatively non-integrated notes (reflected in lower numbers, such as .166 or .040). Jackson's pilot data are shown in Figure B.1

Notice that the seven columns in the table in Figure B.1 have short labels that tell us what each variable is. To insert such labels, we go down to the bottom of the screen, where there are two "buttons" called "Data View" and "Variable View." If we click on "Variable View," we get another table, which looks like Figure B.2. In this table, we have entered information about each of the variables in the data set. Here the variables are the rows (rather than the columns, as they are in the "Data" table), and the things we want to say about the variables are the columns. To keep our discussion simple, we describe only some of these columns:

- *Name:* Indicates the label that will appear for the variable in the "Data View" table. This label can include alphabet letters, numbers, and a few other meaningful symbols (e.g., "$").

[1]At the instructor's request, this book can be packaged with the Student Version of SPSS at a discount; the CD for the software provides versions for both Windows and Macintosh users. Please contact your local Pearson representative if you are an instructor who is interested in setting up such a package for your students.

FIGURE B.1
The "Data" table

	Gender	Exam1	Exam2	Exam3	TotalExam	NoteQuan	NoteQual	var
1	1	35.00	36.50	33.50	105.00	31	.315	
2	2	39.50	41.00	41.50	122.00	28	.384	
3	1	45.00	45.50	39.00	129.50	37	.381	
4	1	34.50	33.00	29.00	96.50	31	.251	
5	2	31.00	43.00	37.00	111.00	42	.305	
6	2	38.00	30.25	32.00	100.25	27	.190	
7	2	40.50	43.00	42.00	125.50	43	.350	
8	1	44.00	45.00	43.00	132.00	26	.166	
9	2	43.00	38.00	40.00	121.00	52	.406	
10	1	38.00	32.00	30.00	100.00	33	.208	
11	1	43.00	47.00	44.00	134.00	43	.496	
12	2	43.50	34.75	41.00	119.25	24	.201	
13	2	45.00	43.00	42.00	130.00	50	.321	
14	1	39.50	44.00	43.00	126.50	23	.179	
15	2	40.00	36.00	33.00	109.00	14	.040	
16								

Data View Variable View

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Gender	Numeric	8	0	Gender	{1, Male}...	None	8	Right	Nominal	Input
2	Exam1	Numeric	8	2	Exam 1 Score	None	None	8	Right	Scale	Input
3	Exam2	Numeric	8	2	Exam 2 Score	None	None	8	Right	Scale	Input
4	Exam3	Numeric	8	2	Exam 3 Score	None	None	8	Right	Scale	Input
5	TotalExam	Numeric	8	2	Exam Score Total	None	None	8	Right	Scale	Input
6	NoteQuan	Numeric	8	0	Quantity of No...	None	None	8	Right	Scale	Input
7	NoteQual	Numeric	8	3	Quality of Notes	None	None	8	Right	Scale	Input
8											
9											

Data View Variable View

FIGURE B.2
The "Variables" table

- *Type:* Indicates the type of data the variable represents, perhaps a number (numeric data), a letter string, a dollar amount, a date, or something else altogether.
- *Decimals:* Indicates an upper limit on the number of digits that will appear to the right of a decimal point.
- *Label:* Indicates the labels the variables will have when we create a table or graph—perhaps one to be included in a dissertation or research report.
- *Values:* Indicates labels that might be attached to particular values of a variable. For example, one of our variables is gender, a nominal scale. If we click on this "values" cell in the "Gender" row, a little button appears at the right side of the cell. We click on the button, and a box appears that allows us to tell the computer that a value of 1 means "male" and a value of 2 means "female." In Figure B.3, we show this box midway through the process: We've already told the software that a value of 1 means "Male," and we're in the process of telling it that 2 means "Female"; at this point, we click on "Add" and then on "OK" to say that we have labeled all possible values of the Gender variable.

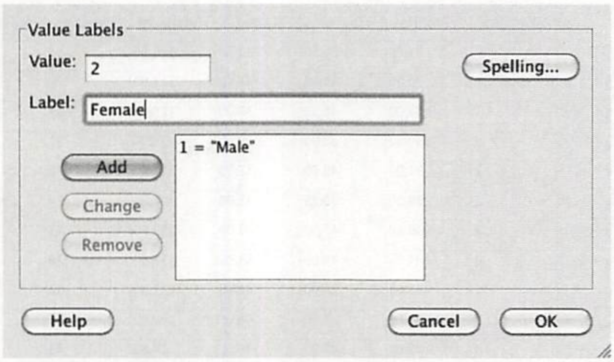

FIGURE B.3
The "Value Labels" box for the "Variable View" table

- *Measure:* Indicates whether the variable reflects a nominal scale or an ordinal scale; the category "ordinal scale" also encompasses interval and ratio scales (Chapters 4 and 11 describe the four kinds of scales). As you can see in Figure B.2, our sample data set consists of one variable (Gender) on a nominal scale and six variables that are on interval or ratio scales—hence also on an ordinal scale, which in the Variables table is simply called "scale."

Computing Basic Descriptive Statistics

Now that we have our data set, let's conduct some simple analyses. First, let's compute basic descriptive statistics for six of the seven variables (computing a mean and standard deviation for the "gender" variable would, of course, be meaningless). We move the cursor to the word "Analyze" at the top of the screen and click on the mouse. A pull-down menu appears, and we move the mouse down until the term "Descriptive Statistics" is highlighted, at which point another menu appears to its right. We click on "Descriptives" in the right-hand box. A new box appears in front of our data set. This box contains two smaller boxes, with all seven of our variables listed in the left box. To calculate descriptive statistics for the last six variables, we want to move them into the right box. We do this by highlighting each one and then clicking the right-arrow button between the two boxes. After we've moved the six variables, we click on the "OK" button (see Figure B.4). At this point, a table appears that lists the number of observations (*N*), minimum and maximum values, mean, and standard deviation for each variable. The final row in the table, "Valid N (listwise)," simply means that SPSS found all 15 numbers for each variable to be appropriate ones; in other words, it didn't omit any scores in doing the calculations.

Now let's suppose that we want to see how overall exam performance (Exam Score Total), quantity of notes (Quantity of Notes), and quality of notes (Quality of Notes) are intercorrelated. To do this, we can calculate Pearson *r* correlation coefficients for each possible pairing of these three variables. Once again, we go up to "Analyze" at the top of the screen and click on the mouse. When the pull-down menu appears, we move the cursor down until the word "Correlate" is highlighted, then move the cursor to the right to highlight "Bivariate," and then click on the mouse. Once again, the two-box box appears, and we must move the three variables we want to analyze to the right box and then click on "OK." We now have a table that gives us the intercorrelations among these variables, which we can print out by going to the "File" pull-down menu and then to "Print" (see Figure B.5). The first number in each cell of the table tells us the Pearson *r* for a particular pair of variables (this number is 1 when a variable is correlated with itself), and the third number tells us the number of people for whom the *r* has been calculated. The middle number tells us the probability (*p*) that we would obtain an *r* that high if the two variables were *not* correlated in the overall population from which the sample has been drawn.

The table in Figure B.5 marks with two asterisks (**) all *r*s that are significant at an α level of .01. But we don't necessarily have to use that alpha level. Imagine, instead, that we decide to

FIGURE B.4
Identifying variables for which we want basic descriptive statistics to be calculated

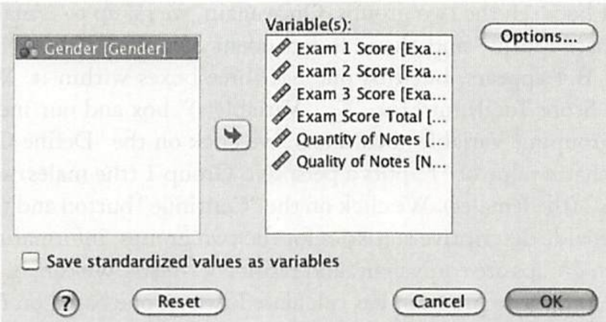

FIGURE B.5
Correlations among exam score total, quantity of notes, and quality of notes

Correlations

		Exam Score Total	Quantity of Notes	Quality of Notes
Exam Score Total	Pearson Correlation	1	.323	.425
	Sig. (2-tailed)		.241	.114
	N	15	15	15
Quantity of Notes	Pearson Correlation	.323	1	.777**
	Sig. (2-tailed)	.241		.001
	N	15	15	15
Quality of Notes	Pearson Correlation	.425	.777**	1
	Sig. (2-tailed)	.114	.001	
	N	15	15	15

**. Correlation is significant at the 0.01 level (2-tailed).

use a significance level (α) of 0.05 for all of our analyses. Any *p* value in the table that is *smaller* than 0.05 indicates that the variables probably *are* correlated in the population from which our sample has been drawn. For example, the correlations between Exam Score Total and the Quantity and Quality of Notes are .323 and .425, respectively. Although these correlations are in the low-to-moderate range, the *p* values associated with them (.241 and .114) tell us that we might get correlations this high *simply by chance* when the two variables are actually unrelated in the overall population. (With a much larger sample size, such correlations would be statistically significant. Our small sample size may be leading us to make Type I errors here.) Now let's look at the correlation between Quantity of Notes and Quality of Notes. This correlation is .777, which has an associated probability of 0.001. This *r* is statistically significant: Students who take more notes also take better notes. We must be careful, however, that we don't conclude that there is a causal relationship here: Taking more notes does not necessarily cause a student to take better ones, nor does taking better ones cause a student to take more of them. Correlational data alone *never* allows us to draw clear-cut conclusions about cause-and-effect relationships.

Computing Inferential Statistics

In the preceding section we already ventured into inferential statistics a bit. When we looked at the probabilities that our correlation coefficients occurred by chance for a set of possibly unrelated variables, we were drawing inferences. But now let's do so intentionally. Let's see if there are any gender differences in the test performance of males and females. To find out, we need to perform a *t*-test between the two groups. Once again, we go up to "Analyze," and this time we highlight "Compare Means" and then "Independent Samples T Test."[2] A box similar to that shown in Figure B.4 appears, but this one has three boxes within it. We move our dependent variable (Exam Score Total) into the "Test Variable(s)" box and our independent variable (Gender) into the "Grouping Variable" box. Next, we click on the "Define Groups" button and tell the computer that a value of "1" puts a person in Group 1 (the males) and a value of "2" puts a person in Group 2 (the females). We click on the "Continue" button and then click on "OK." We get tables that provide descriptive statistics for the two groups, information about whether the variances of the two groups are equivalent, and results of *t*-tests. We can, of course, print out these tables (see Figure B.6). The program has calculated two *t*s, one based on the assumption of equal variances and another based on the assumption of unequal variances. Given the unequal variances for the two groups (the *F* value for Levene's test has a probability of .013), we'll look at the second *t*, which is .055. This value indicates that the two groups are probably not different in their overall exam performance (the *p* value is .957). (You can find explanations for the other numbers in this table in many statistics textbooks or through an Internet search.)

We have room for one final statistical analysis. Let's say we want to know whether the students performed differently on the three exams they took during the semester. To compare three means for the same group of students, we would ideally want to conduct a repeated-measures analysis of variance. Unfortunately, the version of SPSS we are using here performs only between-subjects ANOVAs, so we will have to settle for three paired-samples *t*-tests.

To conduct our *t*-tests, we go back up to "Analyze," move the mouse down to highlight "Compare Means," and then move it to the right to highlight "Paired-Samples T Tests." We release the mouse. Once again, we see a two-box box, but in this one the second box includes three columns labeled "Pair," "Variable 1," and "Variable 2." When we click on Exam 1 in the left box and then click on the arrow, and then subsequently do the same thing for Exam 2, we get an Exam 1–Exam 2 pair in the right box. In a similar manner, we can form Exam1–Exam 3 and Exam 2–Exam 3 pairs. We now have three pairs of variables in the right-hand box. We click on "OK" and print out the three tables that the analysis generates (Figure B.7). The first table gives us descriptive statistics; we've seen most of these before, but the column for standard error

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Exam Score Total	Male	7	117.6429	16.38524	6.19304
	Female	8	117.2500	9.76418	3.45216

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Exam Score Total	Equal variances assumed	8.335	.013	.057	13	.955	.39286	6.85139	-14.40868	15.19439
	Equal variances not assumed			.055	9.520	.957	.39286	7.09022	-15.51373	16.29945

FIGURE B.6

Computing *t* to determine if males and females have different total exam scores

[2]As noted in Table 11.5 in Chapter 11, a *t*-test can take either of two basic forms. An *independent-samples t*-test enables a comparision of means for two separate, independent groups. For instance, an independent-samples *t*-test enables a comparison of males versus females, as in the example presented here. In contrast, a *dependent-samples t*-test—also known as a *paired samples t*-test—enables a comparison of means for a single group of individuals or, instead, for two related groups. For example, a researcher might obtain measures of two characteristics of a single group of students or, alternatively, might obtain measures of one particular characteristic both for a group of fathers and for their first-born sons.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Exam 1 Score	39.9667	15	4.15102	1.07179
	Exam 2 Score	39.4667	15	5.42388	1.40044
Pair 2	Exam 1 Score	39.9667	15	4.15102	1.07179
	Exam 3 Score	38.0000	15	5.15128	1.33006
Pair 3	Exam 2 Score	39.4667	15	5.42388	1.40044
	Exam 3 Score	38.0000	15	5.15128	1.33006

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Exam 1 Score & Exam 2 Score	15	.388	.153
Pair 2	Exam 1 Score & Exam 3 Score	15	.622	.013
Pair 3	Exam 2 Score & Exam 3 Score	15	.814	.000

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Exam 1 Score - Exam 2 Score	.50000	5.40089	1.39450	-2.49091	3.49091	.359	14	.725
Pair 2	Exam 1 Score - Exam 3 Score	1.96667	4.14241	1.06956	-.32732	4.26065	1.839	14	.087
Pair 3	Exam 2 Score - Exam 3 Score	1.46667	3.23329	.83483	-.32387	3.25720	1.757	14	.101

FIGURE B.7

Computing *t*s to determine if students performed differently on the three exams

of the mean is new. We also see Pearson *r*s for the three pairs. We are most interested in the *t* values for three pairs of exam scores, which are shown in the seventh column in the bottom table. None of these *t*s is statistically significant at our significance level of .05 (see the rightmost column), although the Exam 1–Exam 3 pair comes close, with a *p* value of .087.

We have merely scratched the surface of what SPSS can offer. We have ignored some of the values in the statistical tables we've presented. And we haven't even touched on SPSS's graphing capabilities. We urge you to explore SPSS for yourself to discover the many analyses it can perform and the many graphical displays it can create.

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