Understanding Basic Statistics

Brase | Brase

Understanding Basic Statistics

Concepts and Methods

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This book is dedicated to the memory of a great teacher, mathematician, and friend

Burton W. Jones

Professor Emeritus, University of Colorado

Table of Prerequisite Material

Chapter		Prerequisite Sections
1	Organizing Data	None
2	Averages and Variation	1.1, 1.2, 1.4
3	Regression and Correlation	1.1, 1.2, 2.1, 2.2
4	Elementary Probability Theory	1.1, 1.2
5	The Binomial Probability Distribution	1.1, 1.2, 1.4, 2.1, 2.2, 4.1, 4.2
6	Normal Distributions	
	(omit 6.4)	1.1, 1.2, 1.4, 2.1, 2.2, 4.1, 4.2, 5.1
	(include 6.4)	5.2, 5.3 also
7	Introduction to Sampling Distributions	1.1, 1.2, 1.4, 2.1, 2.2, 4.1, 4.2, 5.1
8	Introduction to Estimation	
	(omit 8.3 and part of 8.4)	1.1, 1.2, 1.4, 2.1, 2.2, 4.1, 4.2, 5.1, 6.1, 6.2, 6.3, 7.1, 7.2
	(include 8.3 and all of 8.4)	5.2, 5.3, 6.4 also
9	Hypothesis Testing Involving One Population	
	(omit 9.5)	1.1, 1.2, 1.4, 2.1, 2.2, 4.1, 4.2, 5.1, 6.1, 6.2, 6.3, 7.1, 7.2
	(include 9.5)	5.2, 5.3, 6.4 also
10	Inferences About Differences	
	(omit 10.3)	1.1, 1.2, 1.4, 2.1, 2.2, 4.1, 4.2, 5.1, 6.1, 6.2, 6.3, 7.1, 7.2
	(include 10.3)	5.2, 5.3, 6.4, 9.5 also
11	Additional Topics Using Inference	
	11.1, 11.2, 11.3	1.1, 1.2, 1.4, 2.1, 2.2, 4.1, 4.2, 5.1, 6.1, 6.2, 6.3, 7.1, 7.2, 9.1, 9.2, 9.3
	11.4, 11.5	Chapter 3, 8.1, 8.2 also

PREFACE

This text is designed to enable students to grasp important concepts in statistics. For a *one-semester* course in statistics, the text contains basic and essential topics such as descriptive statistics, probability, estimation, hypothesis testing, and linear regression. Two years of high school algebra serve as a prerequisite.

Many students are apprehensive about their first course in statistics. *Understanding Basic Statistics* is written to help students learn and enjoy statistics. The writing style is friendly and informal with concepts demonstrated through well-chosen and carefully presented examples. Guided exercises within the reading material lead students through additional examples. These guided exercises ask students to respond to leading questions so that the students can begin to ask the right questions themselves as they analyze and solve problems.

Each section is followed by problems selected from a wide range of fields. Most of these problems are from referenced sources such as newspapers, journals, and reference books. In addition, there are problems using more comprehensive data sets. These data sets are listed in Appendix II and also are incorporated on data diskettes available for Minitab and ComputerStat. Finally, each chapter ends with a chapter summary, list of important words and symbols, comprehensive chapter problems, linking concepts questions that ask students to *write* about the relation among concepts from several chapters, and a Using Technology section. All of these features are designed to help students master the concepts, techniques, and applications of statistics appropriate to an introductory statistics course.

Key Pedagogical Features

- *Detailed Examples* show students how to select and use appropriate statistical procedures.
- *Guided Exercises* immediately follow an example. Each guided exercise gives the student a chance to *work* with a new concept before another is presented. The student must examine and analyze characteristic features of a problem similar to the preceding example. Complete worked out solutions appear beside each exercise to give immediate reinforcement to the learning process.
- *Calculator Notes* give a general discussion regarding appropriate calculator use or give sample screens from the Texas Instruments TI-82 graphics calculator, showing how this calculator performs designated operations. The calculator notes are general enough to apply to a wide variety of calculators.

- *Section Problems* require the student to use all the new concepts mastered in the preceding section. The section problems reinforce the material of the examples and exercises by providing additional work in practical applications. The applications in the section problems are drawn from a variety of actual data resources such as popular newspapers, research journals, archaeological field reports, reference books, sports encyclopedias, U.S. census data, and so forth. The applications illustrate connections of statistics to a wide range of fields including health, consumer issues, environmental issues, business applications, sports, weather, education, student life, natural and physical sciences, archaeology, and human interest. *Key steps* to solutions of odd-numbered problems are contained in the solutions section at the end of the text.
- *Data Disk Problems* designated by the icon  utilize real-world referenced data sets. The data are included in Minitab portable files on a data diskette and as class demonstrations in the software package *ComputerStat* that accompanies this text. These data are shown in Appendix II as well so that students can use other statistical software packages or calculators to process the data in an appropriate way.
- *Chapter Summaries* and *Important Words and Symbols* occur at the end of each chapter to help students review the concepts of the chapter.
- *Chapter Review Problems,* comprehensive problems that appear at the end of each chapter, cover each topic introduced in the chapter. Many chapter problems require material and concepts from several sections. Most important, the student must decide what technique to apply to a problem. As in actual applications, the position of the problem does not indicate which section the student should refer to for the method of solution.
- *Data Highlights* are problems based on general consumer questions or on real data from newspapers, magazines, and journals. Appearing at the end of each chapter, they ask the student to apply appropriate statistical methods from the chapter.
- *Linking Concepts* provide students the opportunity to extend their thinking and look at statistical concepts from a broader perspective. This feature includes problems that ask the student to discuss and write brief essays about main concepts from the chapter and related topics from prior chapters.
- *Using Technology sections* occur at the end of each chapter. In many institutions it is possible to introduce the beginning statistics student to statistical software packages. The Using Technology sections feature published raw data and situations from a variety of fields. The problems in these sections can be solved using almost any appropriate statistical computer software package, and in many cases, by using a *graphing calculator.* We have tailored the exercises so that they can be completed easily by utilizing the software supplement *ComputerStat* that accompanies this text. In addition, instructions for the popular commercial software package *Minitab* and for the TI-82 graphing calculator are also included. Displays from Minitab, the TI-82, and ComputerStat are also included so that students who do not have direct access to these computing tools can see how such tools can be used.

- *Four-color design* highlights the text's features, enhances its visual appeal, and provides additional strength to the text's pedagogy.

Using Tools from Technology

Understanding Basic Statistics supports student access to a wide range of activities for computers or graphing calculators. Students can simply look at displays of computer output and screens from the TI-82 graphing calculator contained in Using Technology sections, or they can solve problems or complete projects utilizing ComputerStat, Minitab, other statistical software packages, or a graphing calculator such as the TI-82. Technology-based supplement support includes the following:

- *ComputerStat* is a computer software package designed to accompany this text. Institutions adopting the text may have a complimentary license to the software. ComputerStat is an interactive computer package, and it is designed to be very user friendly. The output is compatible with the results that the students obtain when they do a problem with pencil, paper, and calculator. However, the computer handles larger data sets with relative ease. ComputerStat is available in MS-DOS, Windows, and Macintosh platforms.
- *Technology Guide* is a supplement that has activities and projects for students to explore utilizing the technology of computer software or graphing calculators. Specific instructions are given for using ComputerStat, Minitab, and the TI-82 graphing calculator.
- *Data Disk* has portable Minitab data files containing the data referenced in the Data Disk problems. These data sets are also included as class demonstrations in *ComputerStat*. In addition, the data files are listed in Appendix II of this text. The Data Disk is available in a Macintosh version and an MS-DOS version.

Supplements

- The *Instructor's Resource Guide* contains key steps and answers to even-numbered problems, transparency masters for use with overhead projectors, a guide for using the videotape series from the Annenberg/CBP project *Against All Odds Series* with sections and chapters of the text, and sample tests with solutions covering several chapters.
- *ComputerStat software* is a package of statistical programs designed to accompany this text and our text *Understandable Statistics,* Fifth Edition. This package is available in MS-DOS, Windows, and Macintosh platforms. It is available without charge to institutions adopting this text.
- The *Technology Guide* contains computer and graphing calculator activities coordinated with this text and with *Understandable Statistics,* Fifth Edition. Specific instructions for using ComputerStat, Minitab, and the TI-82 graphing calculator are included.

- The *Student Study and Solutions Guide,* by Elizabeth Farber, Bucks Community College, offers a comprehensive review per text section and additional practice. Thinking About Statistics questions with their solutions and detailed solutions to selected problems in the text are also included.
- *ESATESTIII Computerized Testing* is available in MS-DOS and Macintosh formats. Instructors can custom-design tests from items in the test bank, add their own test items to the bank, or edit existing items. The program offers pull-down menus, dialogue boxes, pop-up windows, functions keys, mouse support, and a graphical user interface.
- The *Test Item File* serves as a convenient printed guide of all items appearing in the computerized testing software package. It is organized by text chapter.
- *Data Disk* provides a useful bank of large data sets for additional experimentation with Minitab or ComputerStat. It comes in both MS-DOS and Macintosh formats. Data sets on the disk that are coordinated with this text are also included in Appendix II of this text.

Alternate Routes Through the Text

In many introductory statistics courses, most of the topics in this text will be presented. However, not every topic is required. A *Table of Prerequisite Material* precedes this preface to aid in topic selection.

Topics may also be rearranged. For instance, Chapter 3, Regression and Correlation, may be delayed until after Chapter 9. Then the descriptive topics of linear regression may be followed immediately by the inferential topics of linear regression presented in Chapter 11.

Custom Publishing Options

This text, *Understanding Basic Statistics,* contains the core topics for a one-semester course in introductory statistics. The descriptive components of the linear regression model are presented early with the inferential components discussed after estimation and hypothesis testing.

Our other statistics text, *Understandable Statistics: Concepts and Methods,* Fifth Edition, is written in the same style, with detailed examples, guided exercises, section problems, and similar chapter features. This text is more comprehensive and contains additional topics such as ANOVA, multiple regression, the Poisson distribution, the Geometric distribution, the Hypergeometric distribution, Bayes's Theorem, and more work with small samples. Both the descriptive and inferential aspects of linear regression models are presented after hypothesis testing.

Houghton Mifflin Publishing Company supports some custom publishing. If there are one or two topics contained in *Understandable Statistics,* Fifth Edition, that you wish to package with *Understanding Basic Statistics,* please contact the publisher or talk with your book representative to determine feasibility and cost.

Acknowledgments

It is our pleasure to acknowledge the prepublication reviewers of this text. All of their insights and comments have been very valuable to us. Reviewers of this text include Philip Beckman of Black Hawk Community College and Scott Community College, Carole Bernett of Harper College, Joseph Heffelfinger of Anne Arundel Community College, Gayle Kent of Florida Southern College, David McCormack of Minot State University, Eswar Phadia of William Paterson College, Rand Pittman of JS Reynolds Community College, Robert G. Pumford of Jamestown Community College, John Reeder of American River College, Norma Rueda of Merrimack College, Kenneth Schoen of Worcester State College, and Gwen Terwilliger of University of Toledo.

Much of the material in this text has been drawn from our other text, *Understandable Statistics: Concepts and Methods,* Fifth Edition. We appreciate reviewer and user comments and suggestions we received for that project. We especially want to thank Dr. Diane Wagner of Regis University, who reviewed the original manuscript for accuracy.

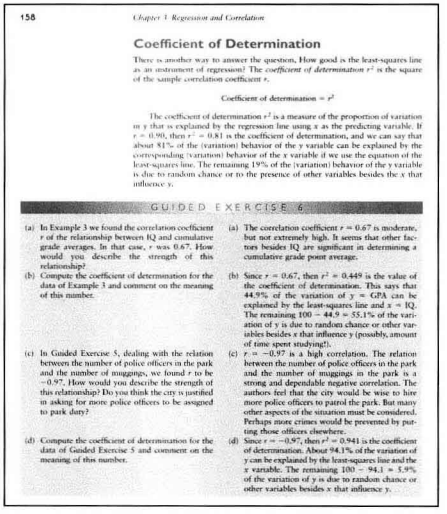
We also acknowledge the cooperation of Minitab, Inc., and Texas Instruments. The Minitab computer displays are from MINITAB release 10. The graphing calculator displays are from the TI-82.

Charles Henry Brase
Corrinne Pellillo Brase

A User's Guide to Features

Understanding Basic Statistics includes a variety of features designed to enhance a student's understanding by providing summaries of concepts and methods, interesting real-world problems using real data sets, and information on using technology. In addition, the text has a **four color design** which highlights important features and provides visual interest.

Key features of the text are listed below, along with brief descriptions of their purpose.



158 *Chapter 3: Regression and Correlation*

Coefficient of Determination

There is another way to answer the question, How good is the least-squares line as an instrument of regression? The *coefficient of determination* r^2 is the square of the sample correlation coefficient r.

Coefficient of determination = r^2

The coefficient of determination r^2 is a measure of the proportion of variation in y that is explained by the regression line using x as the predicting variable. If $r = 0.90$, then $r^2 = 0.81$ is the coefficient of determination, and we can say that about 81% of the (variation) behavior of the y variable can be explained by the corresponding (variation) behavior of the x variable if we use the equation of the least-squares line. The remaining 19% of the (variation) behavior of the y variable is due to random chance or to the presence of other variables besides the x that influence y.

GUIDED EXERCISE 6

(a) In Example 3 we found the correlation coefficient r of the relationship between IQ and cumulative grade averages. In that case, r was 0.67. How would you describe the strength of this relationship?

(b) Compute the coefficient of determination for the data of Example 3 and comment on the meaning of this number.

(c) In Guided Exercise 5, dealing with the relation between the number of police officers in the park and the number of muggings, we found r to be −0.97. How would you describe the strength of this relationship? Do you think the city is justified in asking for more police officers to be assigned to park duty?

(d) Compute the coefficient of determination for the data of Guided Exercise 5 and comment on the meaning of this number.

(a) The correlation coefficient $r = 0.67$ is moderate, but not extremely high. It seems that other factors besides IQ are significant in determining a cumulative grade point average.

(b) Since $r = 0.67$, then $r^2 = 0.449$ is the value of the coefficient of determination. This says that 44.9% of the variation of y = GPA can be explained by the least-squares line and x = IQ. The remaining 100 − 44.9 = 55.1% of the variation of y is due to random chance or other variables besides x that influence y (possibly, amount of time spent studying!).

(c) $r = -0.97$ is a high correlation. The relation between the number of police officers in the park and the number of muggings in the park is a strong and dependable negative correlation. The authors feel that the city would be wise to hire more police officers to patrol the park. But many other aspects of the situation must be considered. Perhaps more crimes would be prevented by putting those officers elsewhere.

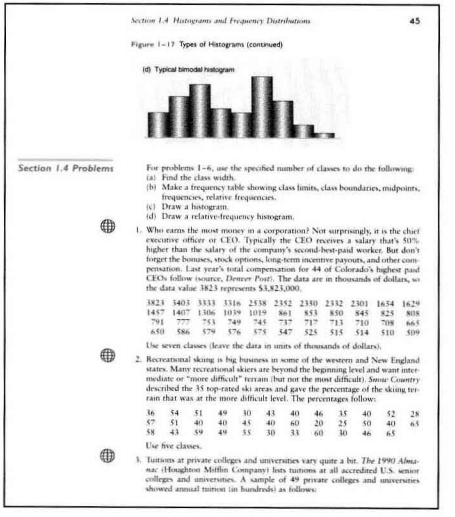
(d) Since $r = -0.97$, then $r^2 = 0.941$ is the coefficient of determination. About 94.1% of the variation of y can be explained by the least-squares line and the x variable. The remaining 100 − 94.1 = 5.9% of the variation of y is due to random chance or other variables besides x that influence y.

Guided Exercises

A special feature of *Understanding Basic Statistics* is the guided exercises following selected examples. Each guided exercise gives the student a chance to *work* with a new concept before another is presented by examining and analyzing a problem similar to the preceding example. Completely worked-out solutions occur beside each exercise to give immediate reinforcement in the learning process.

Real-World Exercises

Many interesting real-world problems lend themselves to the study of statistics. In this edition, great emphasis is placed on including interesting problems utilizing real data and real situations using identifiable sources. These problems come from a wide range of fields, including natural science, business, economics, medicine, social science, archaeology, and consumer interest. Real-World Exercises are identified with a distinctive icon.



Section 1.4 Histograms and Frequency Distributions 45

Figure 1–17 Types of Histograms (continued)

(d) Typical bimodal histogram

Section 1.4 Problems

For problems 1–6, use the specified number of classes to do the following:
(a) Find the class width.
(b) Make a frequency table showing class limits, class boundaries, midpoints, frequencies, relative frequencies.
(c) Draw a histogram.
(d) Draw a relative-frequency histogram.

1. Who earns the most money in a corporation? Not surprisingly, it is the chief executive officer or CEO. Typically the CEO receives a salary that's 50% higher than the salary of the company's second-best-paid worker. But don't forget the bonuses, stock options, long-term incentive payouts, and other compensation. Last year's total compensation for 44 of Colorado's highest paid CEOs follow (source, *Denver Post*). The data are in thousands of dollars, so the data value 3823 represents $3,823,000.

3823	3403	3333	3316	2538	2352	2350	2332	2301	1654	1629
1457	1407	1306	1039	1019	861	853	850	845	825	808
791	777	753	749	745	737	717	713	710	708	665
650	586	579	576	575	547	525	515	514	510	509

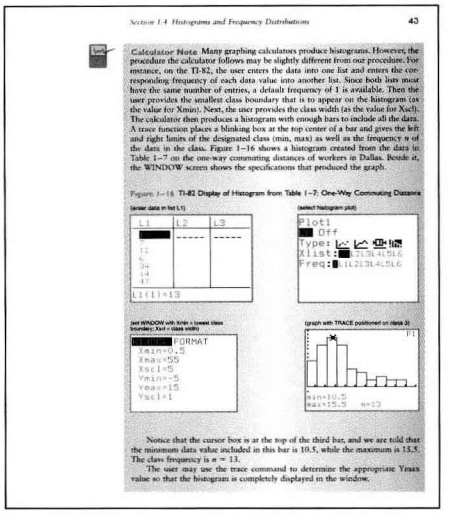
Use seven classes (leave the data in units of thousands of dollars).

2. Recreational skiing is big business in some of the western and New England states. Many recreational skiers are beyond the beginning level and want intermediate or "more difficult" terrain (but not the most difficult). *Snow Country* described the 35 top-rated ski areas and gave the percentage of the skiing terrain that was at the more difficult level. The percentages follow:

36	54	51	49	30	43	40	46	35	40	52	28
57	51	40	40	45	40	60	20	25	50	40	65
58	43	59	49	55	30	33	60	30	46	65	

Use five classes.

3. Tuitions at private colleges and universities vary quite a bit. *The 1990 Almanac* (Houghton Mifflin Company) lists tuitions at all accredited U.S. senior colleges and universities. A sample of 49 private colleges and universities showed annual tuition (in hundreds) as follows:



Section 1.4 Histograms and Frequency Distributions 43

Calculator Note Many graphing calculators produce histograms. However, the procedure the calculator follows may be slightly different from our procedure. For instance, on the TI-82, the user enters the data into one list and enters the corresponding frequency of each data value into another list. Since both lists must have the same number of entries, a default frequency of 1 is available. Then the user provides the smallest class boundary that is to appear on the histogram (as the value for Xmin). Next, the user provides the class width (as the value for Xscl). The calculator then produces a histogram with enough bars to include all the data. A trace function places a blinking box at the top center of a bar and gives the left and right limits of the designated class (min, max) as well as the frequency *n* of the data in the class. Figure 1–16 shows a histogram created from the data in Table 1–7 on the one-way commuting distances of workers in Dallas. Beside it, the WINDOW screen shows the specifications that produced the graph.

Figure 1–16 TI-82 Display of Histogram from Table 1–7: One-Way Commuting Distance

(enter data in list L1)

L1	L2	L3

L1(1)=13

(select histogram plot)

Plot1
Off
Type:
Xlist:L1
Freq:1

(set WINDOW with Xmin = lowest class boundary; Xscl = class width)

FORMAT
Xmin=0.5
Xmax=55
Xscl=5
Ymin=-5
Yscl=1

(graph with TRACE positioned on class 2)

P1
n=13
min=10.5
max=15.5

Notice that the cursor box is at the top of the third bar, and we are told that the minimum data value included in this bar is 10.5, while the maximum is 15.5. The class frequency is $n = 13$.

The user may use the trace command to determine the appropriate Ymax value so that the histogram is completely displayed in the window.

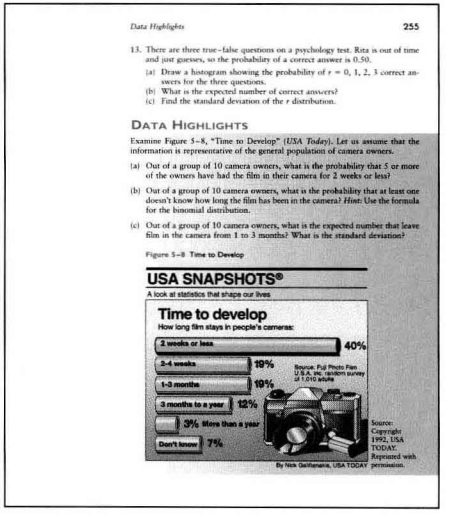
Calculator Notes

These notes are located throughout the book. They provide information regarding appropriate calculator use. Sample screens from the Texas Instruments TI-82 graphing calculator show how this calculator performs certain operations. The screen displays are similar to those found on other TI graphing calculators. The notes are general enough to apply to a wide variety of calculators.

End-of-Chapter Material includes a **Summary,** a listing of **Important Words and Symbols** with section references so that students who need additional review will be encouraged to read it in context, and **Chapter Review Problems.** Also included in the end-of-chapter presentation are the following features.

Data Highlights

These problems can be solved by the student's using appropriate methods from that chapter. **Data Highlights Problems** provide students with additional opportunity to put their skills into action. The sources for **Data Highlights Problems** include newspapers, magazines, and journals.



Data Highlights 255

13. There are three true–false questions on a psychology test. Rita is out of time and just guesses, so the probability of a correct answer is 0.50.
    (a) Draw a histogram showing the probability of $r = 0, 1, 2, 3$ correct answers for the three questions.
    (b) What is the expected number of correct answers?
    (c) Find the standard deviation of the r distribution.

DATA HIGHLIGHTS

Examine Figure 5–8, "Time to Develop" (*USA Today*). Let us assume that the information is representative of the general population of camera owners.

(a) Out of a group of 10 camera owners, what is the probability that 5 or more of the owners have had the film in their camera for 2 weeks or less?

(b) Out of a group of 10 camera owners, what is the probability that at least one doesn't know how long the film has been in the camera? *Hint:* Use the formula for the binomial distribution.

(c) Out of a group of 10 camera owners, what is the expected number that leave film in the camera from 1 to 3 months? What is the standard deviation?

Figure 5–8 Time to Develop

USA SNAPSHOTS®

A look at statistics that shape our lives

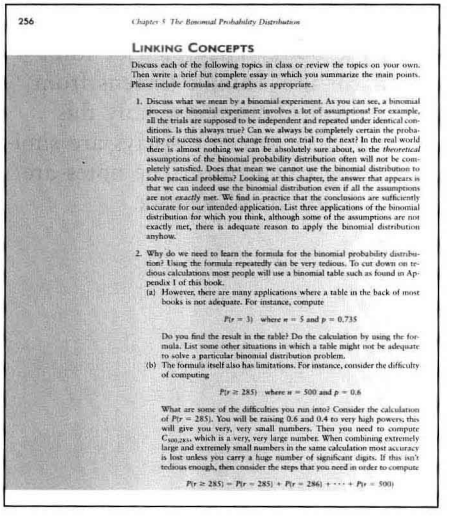
Time to develop

How long film stays in people's cameras:

2 weeks or less 40%
2–4 weeks 18%
1–3 months 19%
3 months to a year 12%
More than a year 3%
Don't know 7%

Source: Full Photo Film U.S.A. Inc. random survey of 1,010 adults

By Nick Gallanakis, USA TODAY



256 *Chapter 5 The Binomial Probability Distribution*

LINKING CONCEPTS

Discuss each of the following topics in class or review the topics on your own. Then write a brief but complete essay in which you summarize the main points. Please include formulas and graphs as appropriate.

1. Discuss what we mean by a binomial experiment. As you can see, a binomial process or binomial experiment involves a lot of assumptions! For example, all the trials are supposed to be independent and repeated under identical conditions. Is this always true? Can we always be completely certain the probability of success does not change from one trial to the next? In the real world there is almost nothing we can be absolutely sure about, so the *theoretical* assumptions of the binomial probability distribution often will not be completely satisfied. Does that mean we cannot use the binomial distribution to solve practical problems? Looking at this chapter, the answer that appears is that we can indeed use the binomial distribution even if all the assumptions are not *exactly* met. We find in practice that the conclusions are sufficiently accurate for our intended application. List three applications of the binomial distribution for which you think, although some of the assumptions are not exactly met, there is adequate reason to apply the binomial distribution anyhow.

2. Why do we need to learn the formula for the binomial probability distribution? Using the formula repeatedly can be very tedious. To cut down on tedious calculations most people will use a binomial table such as found in Appendix I of this book.
   (a) However, there are many applications where a table in the back of most books is not adequate. For instance, compute

   $$P(r = 3) \quad \text{where } n = 5 \text{ and } p = 0.735$$

   Do you find the result in the table? Do the calculation by using the formula. List some other situations in which a table might not be adequate to solve a particular binomial distribution problem.
   (b) The formula itself also has limitations. For instance, consider the difficulty of computing

   $$P(r \geq 285) \quad \text{where } n = 500 \text{ and } p = 0.6$$

   What are some of the difficulties you run into? Consider the calculation of $P(r = 285)$. You will be raising 0.6 and 0.4 to very high powers, this will give you very, very small numbers. Then you need to compute $C_{500,285}$, which is a very, very large number. When combining extremely large and extremely small numbers in the same calculation most accuracy is lost unless you carry a huge number of significant digits. If this isn't tedious enough, then consider the steps that you need in order to compute

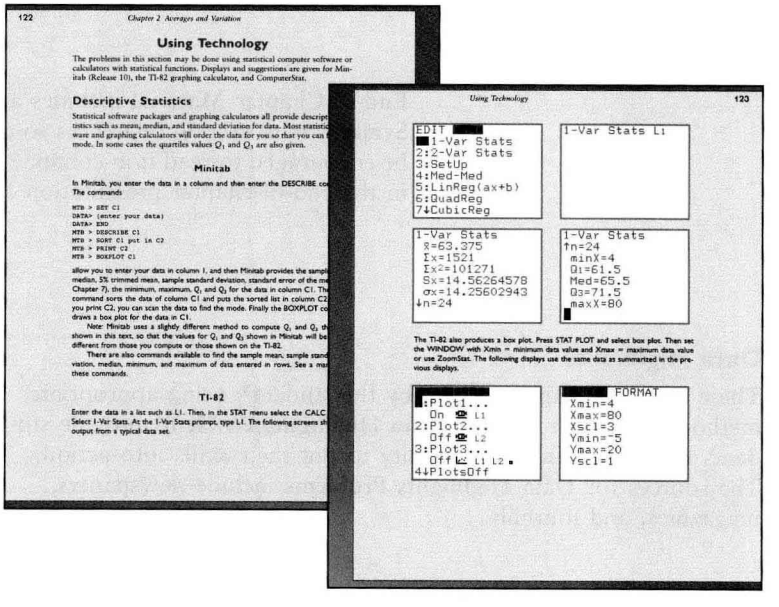
   $$P(r \geq 285) = P(r = 285) + P(r = 286) + \cdots + P(r = 500)$$

Linking Concepts

These questions help students extend and integrate their thinking, and develop a broader conceptual understanding of statistics. Students are asked to discuss and write about key concepts from the chapter and related topics from prior chapters.

Using Technology

All these sections include information on using Minitab, the TI-82 graphing calculator, and ComputerStat to solve statistical problems.



122 *Chapter 2 Averages and Variation*

Using Technology

The problems in this section may be done using statistical computer software or calculators with statistical functions. Displays and suggestions are given for Minitab (Release 10), the TI-82 graphing calculator, and ComputerStat.

Descriptive Statistics

Statistical software packages and graphing calculators all provide descriptive statistics such as mean, median, and standard deviation for data. Most statistical software and graphing calculators will order the data for you so that you can find the mode. In some cases the quartiles values Q_1 and Q_3 are also given.

Minitab

In Minitab, you enter the data in a column and then enter the DESCRIBE command. The commands

```
MTB > SET C1
DATA> (enter your data)
DATA> END
MTB > DESCRIBE C1
MTB > SORT C1 put in C2
MTB > PRINT C2
MTB > BOXPLOT C1
```

allow you to enter your data in column 1, and then Minitab provides the sample mean, median, 5% trimmed mean, sample standard deviation, standard error of the mean (Chapter 7), the minimum, maximum, Q_1, and Q_3 for the data in column C1. The SORT command sorts the data of column C1 and puts the sorted list in column C2. The PRINT C2 command will print C2, you can scan the data to find the mode. Finally the BOXPLOT command draws a box plot for the data in C1.

Note: Minitab uses a slightly different method to compute Q_1 and Q_3 than the one shown in this text, so that the values for Q_1 and Q_3 shown in Minitab will be slightly different from those you compute or those shown on the TI-82.

There are also commands available to find the sample mean, sample standard deviation, median, minimum, and maximum of data entered in rows. See a manual for these commands.

TI-82

Enter the data in a list such as L1. Then, in the STAT menu select the CALC menu. Select 1-Var Stats. At the 1-Var Stats prompt, type L1. The following screens show the output from a typical data set.

Using Technology 123

```
EDIT
1-Var Stats
2:2-Var Stats
3:SetUp
4:Med-Med
5:LinReg(ax+b)
6:QuadReg
7↓CubicReg
```

```
1-Var Stats L1
```

```
1-Var Stats
 x̄=63.375
 Σx=1521
 Σx²=101271
 Sx=14.56264578
 σx=14.25602943
↓n=24
```

```
1-Var Stats
↑n=24
 minX=4
 Q1=61.5
 Med=65.5
 Q3=71.5
 maxX=80
```

The TI-82 also produces a box plot. Press STAT PLOT and select box plot. Then set the WINDOW with Xmin = minimum data value and Xmax = maximum data value or use ZoomStat. The following displays use the same data as summarized in the previous displays.

```
:Plot1...
  On  L1
2:Plot2...
  Off  L2
3:Plot3...
  Off  L1 L2
4↓PlotsOff
```

```
FORMAT
Xmin=4
Xmax=80
Xscl=3
Ymin=-5
Ymax=20
Yscl=1
```

CONTENTS