Solutions for Statistics for Managers Using Microsoft Excel 9th Edition by Levine

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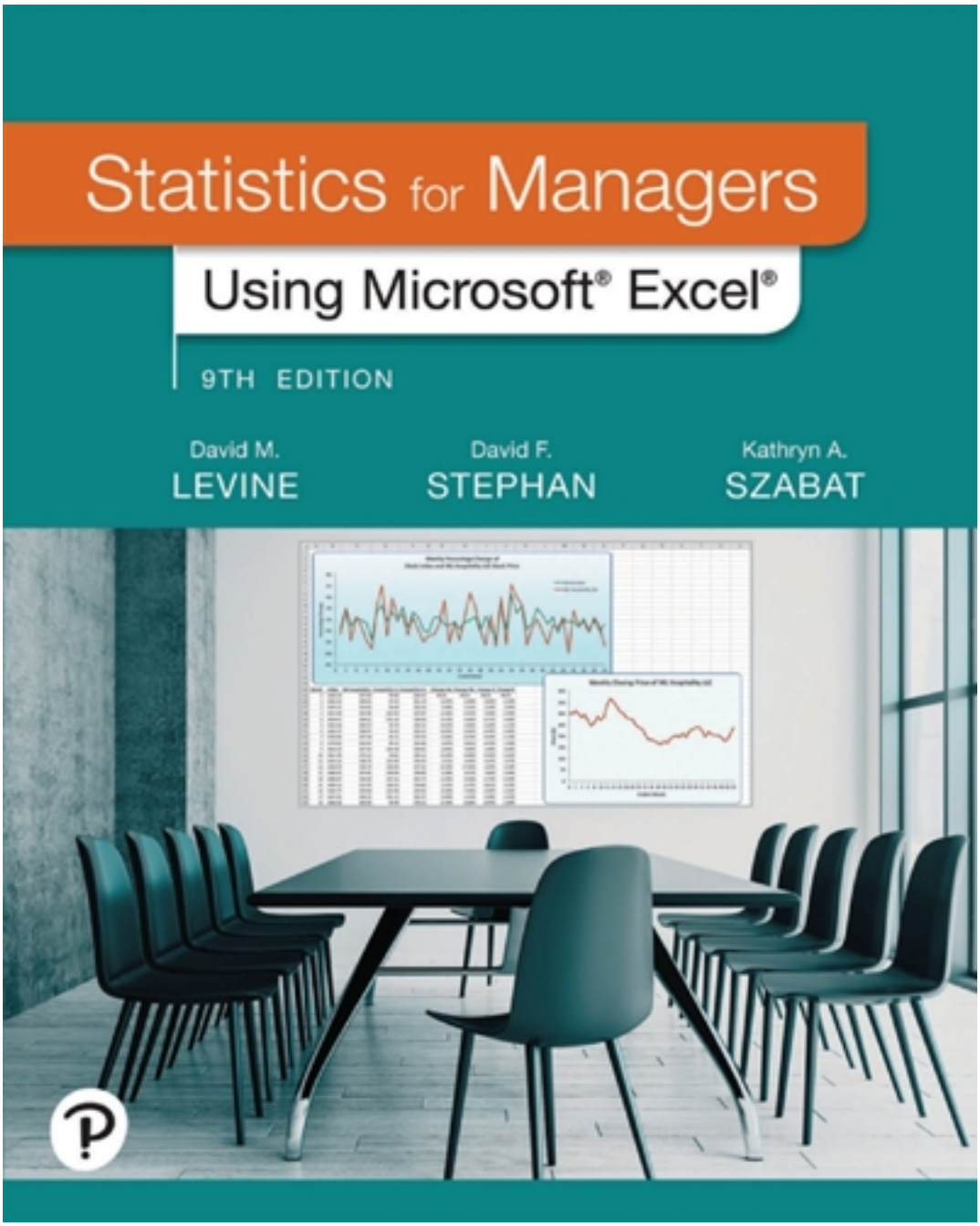

Solutions

INSTRUCTOR'S SOLUTIONS MANUAL

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STATISTICS FOR MANAGERS
USING MICROSOFT® EXCEL®
NINTH EDITION

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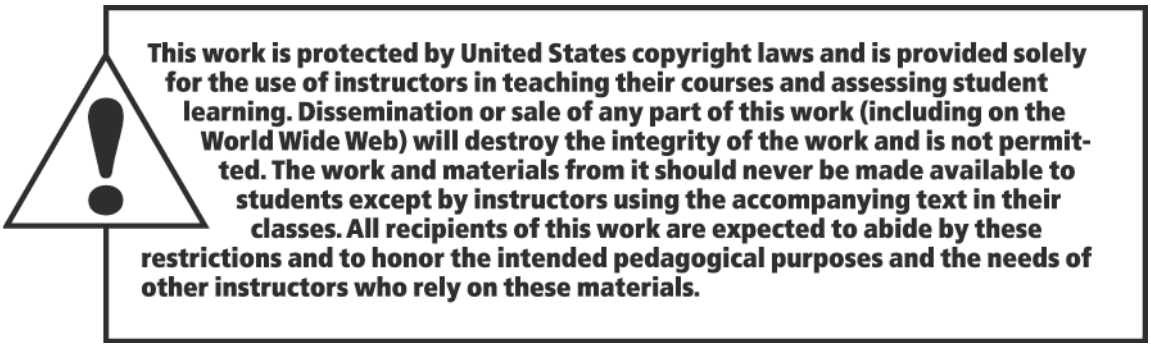

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Preface

The first part of the ***Instructor's Solutions Manual*** contains our educational philosophy and teaching tips for each chapter of the text. Solutions to End-of-Section Problems and Chapter Review Problems in each chapter follow. Instructional tips and solutions for the digital cases are included next. Answers to the *Brynne Packaging* Case, the *CardioGood Fitness* Case, the *Choice Is Yours/More Descriptive Choices Follow-up Case*, the *Clear Mountain State Student Surveys Case,* the *Craybill Instrumentation Company* Case, the *Managing Ashland MultiComm Services* Case, the *Mountain States Potato Company Case* and the *Sure Value Convenience Stores* Case are included last.

The purpose of this ***Instructor's Solutions Manual*** is to facilitate grading of assignments or exams by instructors and/or teaching assistants. Screen shots using output from PHStat are integrated throughout. Most of the problems are solved using PHStat. To present the steps involved in solving a problem, some intermediate numerical results are presented accurate to only a reasonable number of significant digits. Hence, instructors are reminded that the final results presented in this manual that are obtained using PHStat can sometimes be different from those obtained with a hand calculator computed using the intermediate values due to rounding.

Teaching Tips for
Statistics for Managers using Microsoft® Excel 9th Ed.

Our Starting Point

Over a generation ago, advances in "data processing" led to new business opportunities as first centralized and then desktop computing proliferated. The Information Age was born. Computer science became much more than just an adjunct to a mathematics curriculum, and whole new fields of studies, such as computer information systems, emerged.

More recently, further advances in information technologies have combined with data analysis techniques to create new opportunities in what is more data *science* than data *processing* or *computer* science. The world of business statistics has grown larger, bumping into other disciplines. And, in a reprise of something that occurred a generation ago, new fields of study, this time with names such as informatics, data analytics, and decision science, have emerged.

This time of change makes what is taught in business statistics and how it is taught all the more critical. These new fields of study all share statistics as a foundation for further learning. We are accustomed to thinking about change, as seeking ways to continuously improve the teaching of business statistics have always guided our efforts. We actively participate in Decision Sciences Institute (DSI), American Statistical Association (ASA), and Making Statistics More Effective in Schools and Business (MSMESB) conferences. We use the ASA's Guidelines for Assessment and Instruction (GAISE) reports and combine them with our experiences teaching business statistics to a diverse student body at several large universities.

What to teach and how to teach it are particularly significant questions to ask during a time of change. As an author team, we bring a unique collection of experiences that we believe helps us find the proper perspective in balancing the old and the new. Our lead author, David M. Levine, was the first educator, along with Mark L. Berenson, to create a business statistics textbook that discussed using statistical software and incorporated "computer output" as illustrations—just the first of many teaching and curricular innovations in his many years of teaching business statistics. Our second author, David F. Stephan, developed courses and teaching methods in computer information systems and digital media during the information revolution, creating, and then teaching in, one of the first personal computer *classrooms* in a large school of business along the way. Early in his career, he introduced spreadsheet applications to a business statistics faculty audience that included David Levine, an introduction that would eventually led to the first edition of this textbook. Our newest co-author, Kathryn A. Szabat, has provided statistical advice to various business and non-business communities. Her background in

statistics and operations research and her experiences interacting with professionals in practice have guided her, as departmental chair, in developing a new, interdisciplinary academic department, Business Systems and Analytics, in response to the technology- and data-driven changes in business today.

All three of us benefit from our many years teaching undergraduate business subjects and the diversity of interests and efforts of our past co-authors, Mark Berenson and Timothy Krehbiel. Two of us (Stephan and Szabat) also benefit from formal training and background in educational methods and instructional design.

Educational Philosophy

As in prior editions of *Statistics for Managers Using Microsoft Excel*, we are guided by these key learning principles:

1. **Help students see the relevance of statistics to their own careers by providing examples drawn from the functional areas in which they may be specializing.** Students need a frame of reference when learning statistics, especially when statistics is not their major. That frame of reference for business students should be the functional areas of business, such as accounting, finance, information systems, management, and marketing. Each statistics topic needs to be presented in an applied context related to at least one of these functional areas. The focus in teaching each topic should be on its application in business, the interpretation of results, the evaluation of the assumptions, and the discussion of what should be done if the assumptions are violated.
2. **Emphasize interpretation of statistical results over mathematical computation.** Introductory business statistics courses should recognize the growing need to *interpret* statistical results that computerized processes create. This makes the interpretation of results more important than knowing how to execute the tedious hand calculations required to produce them.
3. **Give students ample practice in understanding how to apply statistics to business.** Both classroom examples and homework exercises should involve actual or realistic data as much as possible. Students should work with data sets, both small and large, and be encouraged to look beyond the statistical analysis of data to the interpretation of results in a managerial context.
4. **Familiarize students with how to use statistical software to assist business decision-making.** Introductory business statistics courses should recognize that programs with statistical functions are commonly found on a business decision maker's desktop computer. Integrating statistical software into all aspects of an introductory statistics course allows the course to focus on interpretation of results instead of computations (see point 2).
5. **Provide clear instructions to students for using statistical applications.** Books should explain clearly how to use programs such as Microsoft Excel with the study of statistics, without having those instructions dominate the book or distract from the learning of statistical concepts.

4 Teaching Tips

First Things First

In a time of change, you can never know exactly what knowledge and background students bring into an introductory business statistics classroom. Add that to the need to curb the fear factor about learning statistics that so many students begin with, and there's a lot to cover even before you teach your first statistical concept.

We created "First Things First" to meet this challenge. This unit sets the context for explaining what statistics is (not what students may think!) while ensuring that all students share an understanding of the forces that make learning business statistics critically important today. Especially designed for instructors teaching with course management tools, including those teaching hybrid or online courses, "First Things First" has been developed to be posted online or otherwise distributed before the first class section begins and is available from the download page for this book that is discussed in Appendix Section C.1.

We would argue that the most important class is the first class. First impressions are critically important. You have the opportunity to set the tone to create a new impression that the course will be important to their business education. Make the following points:

- This course is not a math course.
- State that you will be learning analytical skills for making business decisions.
- Explain that the focus will be on how statistics can be used in the functional areas of business.

This book uses a systematic approach for meeting a business objective or solving a business problem. This approach goes across all the topics in the book and most importantly can be used as a framework in real world situations when students graduate. The approach has the acronym **DCOVA**, which stands for **D**efine, **C**ollect, **O**rganize, **V**isualize, and **A**nalyze.

- **D**efine the business objective or problem to be solved and then define the variables to be studied.
- **C**ollect the data from appropriate sources
- **O**rganize the data
- **V**isualize the data by developing charts
- **A**nalyze the data by using statistical methods to reach conclusions.

To this, you can add **C** for Communicate which is critically important

You can begin by emphasizing the importance of defining your objective or problem. Then, discuss the importance of operational definitions of variables to be considered and define variable, data, and statistics.

Just as computers are used not just in the computer course, students need to know that statistics is used not just in the statistics course. This leads you to a discussion of business analytics in which data is

used to make decisions. Make the point that analytics should be part of the competitive strategy of every organization especially since “big data” meaning data collected in huge volumes at very fast rates. needs to be analyzed.

Inform the students that there is an Excel Guide at the end of each chapter. Strongly encourage or require students to read the Excel Guide at the end of this chapter so that they will be ready to use Excel with this book.

Chapter 1

You need to continue the discussion of the Define task by establishing the types of variables. Be sure to discuss the different types carefully since the ability to distinguish between categorical and numerical data will be crucial later in the course. Go over examples of each type of variable and have students provide examples of each type. Then, if you wish, you can cover the different measurement scales.

Then move on to the C of the DCOVA approach, collecting data. Mention the different sources of data and make sure to cover the fact that data often needs to be cleaned of errors.

Then, you could spend some time discussing sampling, you may want to take a bit more time and discuss the types of survey sampling methods and issues involved with survey sampling results. The *Consider This* essay discusses the important issue of the use of Web-based surveys.

The chapter also introduces two continuing cases related to *Managing Ashland MultiComm Services* and *CardioGood Fit*ness that appear at the end of many chapters. The Digital cases are introduced in this chapter also. In these cases, students visit Web sites related to companies and issues raised in the Using Statistics scenarios that start each chapter. The goal of the Digital cases is for students to develop skills needed to identify misuses of statistical information. As would be the situation with many real world cases, in Digital cases, students often need to sift through claims and assorted information in order to discover the data most relevant to a case task. They will then have to examine whether the conclusions and claims are supported by the data. (Instructional tips for using the *Managing Ashland MultiComm Services* and Digital cases and solutions to the *Managing Ashland MultiComm Services* and Digital cases are included in this *Instructor's Solutions Manual*.).

Make sure that students read the Excel Guide at the end of each chapter. Ways of Working With Excel on pages 7 and 8 explains the different type of Excel instructions. The *Workbook* instructions provide step-by-step instructions and live worksheets that automatically update when data changes. The *PHStat2 add-in* instructions provide instructions for using the PHStat2 add-in. *Analysis ToolPak* instructions provide instructions for using the Analysis ToolPak, the Excel add-in package that is included with many versions of Excel.

Chapter 2

This chapter moves on to the organizing and visualizing steps of the DCOVA framework. If you are going to collect sample data to use in Chapters 2 and 3, you can illustrate sampling by conducting a survey of students in your class. Ask each student to collect his or her own personal data concerning the time it takes to get ready to go to class in the morning or the time it takes to get to school or home from school. First, ask the students to write down a definition of how they plan to measure this time. Then, collect the various answers and read them to the class. Then, a single definition could be provided (such as the time to get ready is the time measured from when you get out of bed to when you leave your home, recorded to the nearest minute). In the next class, select a random sample of students and use the data collected (depending on the sample size) in class when Chapters 2 and 3 are discussed.

Then, move on to the Organize step that involves setting up your data in an Excel worksheet and develop tables to help you prepare charts and analyze your data. Begin your discussion for categorical data with the example on p. 34 concerning how people pay for purchases and other transactions. Show the summary table and then if you wish, explain that you can sometimes organize the data into a two-way table that has one variable in the row and another in the column.

Continue with organizing data (but now for numerical data) by referring to the cost of a restaurant meal on p. 38. Show the simple ordered array and how a frequency distribution, percentage distribution, or cumulative distribution can summarize the raw data in a way that is more useful.

Now you are ready to tackle the Visualize step. A good way of starting this part of the chapter is to display the following quote.

"A picture is worth a thousand words."

Students will almost certainly be familiar with Microsoft® Word and may have already used Excel to construct charts that they have pasted into Word documents. Now you will be using Excel to construct many different types of charts. Return to the purchase payment data previously discussed and illustrate how a bar chart, pie, and doughnut chart can be constructed using Excel. Mention the advantages and disadvantages of each chart. A good example is to show the data on incomplete ATM transactions on p. 49 and how the Pareto chart enables you to focus on the vital few categories. If time permits, you can discuss the side-by-side bar chart for a contingency table.

To examine charts for numerical variables you can either use the restaurant data previously mentioned, the retirement funds data, or data that you have collected from your class. You may want to begin with a simple stem-and-leaf display that both organizes the data and shows a bar type chart. Then move on to the histogram and the various polygons, pointing out the advantages and disadvantages of each.

8 Teaching Tips

If time permits, you can discuss the scatter plot and the time-series plot for two numerical variables. Otherwise, you can wait until you get to regression analysis. If you cover the time series plot, you might also want to mention sparklines that are discussed in Section 2.6.

Also, if possible, you may want to discuss how multidimensional tables allow you to drill down to individual cells of the table. You can follow this with further discussion of PivotTables and Excel slicers that enable you to see panels for each variable being studied.

If the opportunity is available, we believe that it is worth the time to cover Section 2.7 on Challenges in Organizing and Visualizing Variables. This is a topic that students very much enjoy since it allows for a great deal of classroom interaction. After discussing the fundamental principles of good graphs, try to illustrate some of the improper displays shown in Figures 2.26 – 2.28. Ask students what is "bad" about these figures. Follow up with a homework assignment involving Problems 2.69 – 2.73 (*USA Today* is a great source).

You will find that the chapter review problems provide large data sets with numerous variables. Report writing exercises provide the opportunity for students to integrate written and or oral presentation with the statistics they have learned.

The *Managing Ashland MultiComm Services* case enables students to examine the use of statistics in an actual business environment. The Digital case refers to the EndRun Financial Services and claims that have been made. The CardioGood Fitness case focuses on developing a customer profile for a market research team. The Choice Is Yours Follow-up expands on the chapter discussion of the mutual funds data. The Clear Mountain State Student Survey provides data collected from a sample of undergraduate students.

The Excel Guide for this and the remaining chapters are organized according to the sections of the chapter. It is quite extensive since it covers both organizing and visualizing many different graphs. The Excel Guide includes instructions for Workbook, PHStat2, and the Analysis ToolPak.

Chapter 1

1.1 (a) The type of beverage sold yields categorical or "qualitative" responses rather than numerical responses. Each beverage type represents a separate category.
(b) The type of beverage category expresses no order or ranking.

1.2 Business size represents a categorical variable because each size represents a particular category. Because of the different sizes, order is implied, but this variable includes no information about the quantity of differences among the three sizes.

1.3 (a) The time it takes to download a video from the Internet is a continuous numerical or "quantitative" variable because time can have any value from 0 to any reasonable unit of time
(b) The time it takes to download a video from the Internet is a ratio-scaled variable because it is an ordered scale that includes a true zero point.

1.4 (a) The number of cellphones is a numerical variable that is discrete because the outcome is a count.
(b) Monthly data usage is a numerical variable that is continuous because any value within a range of values can occur.
(c) Number of text messages exchanged per month is a numerical variable that is discrete because the outcome is a count.
(d) Voice usage per month is a numerical variable that is continuous because any value within a range of values can occur.
(e) Whether a cellphone is used for streaming video is a categorical variable because the answer can be only yes or no.

1.5 (a) numerical, ratio
(b) numerical, ratio
(c) categorical, nominal
(d) categorical, nominal

1.6 (a) Categorical, nominal scale
(b) Numerical, continuous, ratio scale
(c) Categorical, nominal scale
(d) Numerical, discrete, ratio scale
(e) Categorical, nominal scale

1.7 (a) numerical, ratio scale, continuous
(b) categorical, nominal scale
(c) categorical, nominal scale
(d) numerical, ratio scale, discrete

1.8 (a) numerical, continuous, ratio scale
(b) numerical, discrete, ratio scale
(c) numerical, continuous, ratio scale
(d) categorical, nominal scale

1.9 (a) Income may be considered discrete if we "count" our money. It may be considered continuous if we "measure" our money; we are only limited by the way a country's monetary system treats its currency.
(b) The first format would provide more information because it includes a ratio scale value while the second measure would only include a range of values for each choice category.

1.10 The underlying variable, ability of the students, may be continuous, but the measuring device, the test, does not have enough precision to distinguish between the two students.

1.11 (a) The population is "all working women from the metropolitan area." A systematic or random sample could be taken of women from the metropolitan area. The director might wish to collect both numerical and categorical data.
(b) Three categorical questions might be occupation, marital status, type of clothing. Numerical questions might be age, average monthly hours shopping for clothing, income.

1.12 (a) Data distributed by an organization or individual.
(b) The American Community Survey is based on a sample.

1.13 The answer depends on the specific story.

1.14 The answer depends on the specific story.

1.15 The transportation engineers and planners should use primary data collected through an observational study of the driving characteristics of drivers over the course of a month.

1.16 The information presented there is based mainly on a mixture of data distributed by an organization and data collected by ongoing business activities.

1.17 (a) 001
(b) 040
(c) 902

1.18 Sample without replacement: Read from left to right in 3-digit sequences and continue unfinished sequences from end of row to beginning of next row.
Row 05: 338 505 855 551 438 855 077 186 579 488 767 833 170
Rows 05–06: 897
Row 06: 340 033 648 847 204 334 639 193 639 411 095 924
Rows 06–07: 707
Row 07: 054 329 776 100 871 007 255 980 646 886 823 920 461
Row 08: 893 829 380 900 796 959 453 410 181 277 660 908 887
Rows 08–09: 237
Row 09: 818 721 426 714 050 785 223 801 670 353 362 449
Rows 09–10: 406
Note: All sequences above 902 and duplicates are discarded.

1.19 (a) Row 29: 12 47 83 76 22 99 65 93 10 65 83 61 36 98 89 58 86 92 71
Note: All sequences above 93 and all repeating sequences are discarded.
(b) Row 29: 12 47 83 76 22 99 65 93 10 65 83 61 36 98 89 58 86
Note: All sequences above 93 are discarded. Elements 65 and 83 are repeated.

1.20 A simple random sample would be less practical for personal interviews because of travel costs (unless interviewees are paid to attend a central interviewing location).

1.21 This is a probability sample because the selection is based on chance. It is not a simple random sample because A is more likely to be selected than B or C.

1.22 Here all members of the population are equally likely to be selected and the sample selection mechanism is based on chance. But not every sample of size 2 has the same chance of being selected. For example the sample "B and C" is impossible.

1.23 (a) Since a complete roster of full-time students exists, a simple random sample of 200 students could be taken. If student satisfaction with the quality of campus life randomly fluctuates across the student body, a systematic 1-in-20 sample could also be taken from the population frame. If student satisfaction with the quality of life may differ by gender and by experience/class level, a stratified sample using eight strata, female freshmen through female seniors and male freshmen through male seniors, could be selected. If student satisfaction with the quality of life is thought to fluctuate as much within clusters as between them, a cluster sample could be taken.

(b) A simple random sample is one of the simplest to select. The population frame is the registrar's file of 4,000 student names.

(c) A systematic sample is easier to select by hand from the registrar's records than a simple random sample, since an initial person at random is selected and then every 20th person thereafter would be sampled. The systematic sample would have the additional benefit that the alphabetic distribution of sampled students' names would be more comparable to the alphabetic distribution of student names in the campus population.

(d) If rosters by gender and class designations are readily available, a stratified sample should be taken. Since student satisfaction with the quality of life may indeed differ by gender and class level, the use of a stratified sampling design will not only ensure all strata are represented in the sample, it will also generate a more representative sample and produce estimates of the population parameter that have greater precision.

(e) If all 4,000 full-time students reside in one of 10 on-campus residence halls which fully integrate students by gender and by class, a cluster sample should be taken. A cluster could be defined as an entire residence hall, and the students of a single randomly selected residence hall could be sampled. Since each dormitory has 400 students, a systematic sample of 200 students can then be selected from the chosen cluster of 400 students. Alternately, a cluster could be defined as a floor of one of the 10 dormitories. Suppose there are four floors in each dormitory with 100 students on each floor. Two floors could be randomly sampled to produce the required 200 student sample. Selection of an entire dormitory may make distribution and collection of the survey easier to accomplish. In contrast, if there is some variable other than gender or class that differs across dormitories, sampling by floor may produce a more representative sample.

1.24 (a)

Row 16: 2323 6737 5131 8888 1718 0654 6832 4647 6510 4877
Row 17: 4579 4269 2615 1308 2455 7830 5550 5852 5514 7182
Row 18: 0989 3205 0514 2256 8514 4642 7567 8896 2977 8822
Row 19: 5438 2745 9891 4991 4523 6847 9276 8646 1628 3554
Row 20: 9475 0899 2337 0892 0048 8033 6945 9826 9403 6858
Row 21: 7029 7341 3553 1403 3340 4205 0823 4144 1048 2949
Row 22: 8515 7479 5432 9792 6575 5760 0408 8112 2507 3742
Row 23: 1110 0023 4012 8607 4697 9664 4894 3928 7072 5815
Row 24: 3687 1507 7530 5925 7143 1738 1688 5625 8533 5041
Row 25: 2391 3483 5763 3081 6090 5169 0546

Note: All sequences above 5000 are discarded. There were no repeating sequences.

(b)

089	189	289	389	489	589	689	789	889	989
1089	1189	1289	1389	1489	1589	1689	1789	1889	1989
2089	2189	2289	2389	2489	2589	2689	2789	2889	2989
3089	3189	3289	3389	3489	3589	3689	3789	3889	3989
4089	4189	4289	4389	4489	4589	4689	4789	4889	4989

(c) With the single exception of invoice #0989, the invoices selected in the simple random sample are not the same as those selected in the systematic sample. It would be highly unlikely that a random process would select the same units as a systematic process.

1.25 (a) A stratified sample should be taken so that each of the three strata will be proportionately represented.

(b) The number of observations in each of the three strata out of the total of 100 should reflect the proportion of the three categories in the customer database. For example, 500/1000 = 50% so 50% of 100 = 50 customers should be selected from the potential customers; similarly, 300/1000 = 30% so 30 customers should be selected from those who have purchased once, and 200/1000 = 20% so 20 customers from the repeat buyers.

(c) It is not simple random sampling because, unlike the simple random sampling, it ensures proportionate representation across the entire population.

1.26 (a) For the third value, Apple is spelled incorrectly. The twelfth value should be Blackberry not Blueberry. The fifteenth value, APPLE, may lead to an irregularity. The eighteenth value should be Samsung not Samsun.

(b) This list contains 19 names, where one would expect to find 20 names.

1.27 Only the second value, 2.7MB, contains units and the eighth value, 1,079, might be confused with 1, 79.

1.28 (a) The times for each of the hotels would be arranged in separate columns.

(b) The hotel names would be in one column and the times would be in a second column.

1.29 A recoded variable PriceLevel could be defined, assigning the value Budget for hotels with budget-priced rooms, Moderate for hotels with moderate-priced rooms, and Deluxe for hotels with deluxe-priced rooms.

1.30 Before accepting the results of a survey of college students, you might want to know, for example:
Who funded the survey? Why was it conducted? What was the population from which the sample was selected? What sampling design was used? What mode of response was used: a personal interview, a telephone interview, or a mail survey? Were interviewers trained?

1.30 cont. Were survey questions field-tested? What questions were asked? Were they clear, accurate, unbiased, valid? What operational definition of "vast majority" was used? What was the response rate? What was the sample size?

1.31 (a) Possible coverage error: Only employees in a specific division of the company were sampled.
(b) Possible nonresponse error: No attempt is made to contact nonrespondents to urge them to complete the evaluation of job satisfaction.
(c) Possible sampling error: The sample statistics obtained from the sample will not be equal to the parameters of interest in the population.
(d) Possible measurement error: Ambiguous wording in questions asked on the questionnaire.

1.32 Coverage error could result if bank executives are systematically excluded from the population thereby not allowing them to be part of any sample that is used to generate the results. This could lead to selection bias. Non-response error that results in non-response bias could result if not all bank executives who were selected for inclusion in the sample are contacted even after multiple attempts to do so. In this case, data that was desired and necessary for inclusion in the sample would then not be present. Sampling error reflects the variability in outcomes when taking different samples. Sampling error is unavoidable. One can obtain an impression of the size of the sampling error by creating interval estimates. Measurement error could arise if the bank executives self-report results or if the methods of reporting are not standardized, i.e. if questions are not asked in the same manner from respondent to respondent, or if those conducting the survey do not do so in a consistent manner.

1.33 Before accepting the results of the survey, you might want to know, for example:
Who funded the survey? Why was it conducted? What was the population from which the sample was selected? What sampling design was used? What mode of response was used: a personal interview, a telephone interview, or a mail survey? Were interviewers trained? Were survey questions field-tested? What questions were asked? Were they clear, accurate, unbiased, valid? What was the response rate? What was the margin of error? What was the sample size? What frame was used?

1.34 Before accepting the results of the survey, you might want to know, for example:
Who funded the survey? Why was it conducted? What was the population from which the sample was selected? What sampling design was used? What mode of response was used: a personal interview, a telephone interview, or a mail survey? Were interviewers trained? Were survey questions field-tested? What questions were asked? Were they clear, accurate, unbiased, valid? What was the response rate? What was the margin of error? What was the sample size? What frame was used?

1.35 A population contains all the items of interest whereas a sample contains only a portion of the items in the population.

1.36 A statistic is a summary measure describing a sample whereas a parameter is a summary measure describing an entire population.

1.37 Categorical random variables yield categorical responses such as yes or no answers. Numerical random variables yield numerical responses such as your height in inches.

1.38 Discrete random variables produce numerical responses that arise from a counting process. Continuous random variables produce numerical responses that arise from a measuring process.

1.39 Both nominal scaled and ordinal scaled variables are categorical variables but no ranking is implied in nominal scaled variable such as male or female while ranking is implied in ordinal scaled variable such as a student's grade of A, B, C, D and F.

1.40 Both interval scaled and ratio scaled variables are numerical variables in which the difference between measurements is meaningful but an interval scaled variable does not involve a true zero such as standardized exam scores while a ratio scaled variable involves a true zero such as height.

1.41 Items or individuals in a probability sampling are selected based on known probabilities while items or individuals in a nonprobability samplings are selected without knowing their probabilities of selection.

1.42 Missing values are values that were not collected for a variable. Outliers are values that seem excessively different from most of the other values

1.43 In unstacked arrangements, separate numerical variables are created for each group in the data. For example, you might create a variable for the weights of men and a second variable for the weights of women. In stacked arrangements, a single numerical variable is paired with a categorical variable that represents the categories. For example, all weights would be in one variable, with a categorical variable indicating male or female.

1.44 Coverage error is error generated due to an improperly or inappropriately framed population which can result in a sample that may not be representative of the population that one wishes to study. Non-response error is error generated due to members of a chosen sample not being contacted even after repeated attempts so that information that should be provided is missing.

1.45 Sampling error results from the variability of outcomes of different samples. This sample to sample variation is inevitably connected to the sampling process. Measurement error is error that results from either self-reported data or data that is collected in an inconsistent manner by those who are responsible for collecting and summarizing the desired information.

1.46 Microsoft Excel:
This product features a spreadsheet-based interface that allows users to organize, calculate, and organize data. Excel also contains many statistical functions to assist in the description of a dataset. Excel can be used to develop worksheets and workbooks to calculate a variety of statistics including introductory and advanced statistics. Excel also includes interactive tools to create graphs, charts, and pivot tables. Excel can be used to summarize data to better understand a population of interest, compare across groups, predict outcomes, and to develop forecasting models. These capabilities represent those that are generally relevant to the current course.

Excel also includes many other statistical capabilities that can be further explored on the Microsoft Office Excel official website.

1.47 (a) The population of interest include banking executives representing institutions of various sizes and U.S. geographic locations.
(b) The collected sample includes 163 banking executives from institutions of various sizes and U.S. geographic locations.

1.47 cont.
(c) A parameter of interest is the percentage of the population of banking executives that identify customer experience initiatives as an area where increased spending is expected.
(d) A statistic used to the estimate the parameter in (c) is the percentage of the 163 banking executives included in the sample who identify customer experience initiatives as an area where increased spending is expected. In this case, the statistic is 55%.

1.48 The answers are based on an article titled "U.S. Satisfaction Still Running at Improved Level" and written by Lydia Saad (August 15, 2018). The article is located on the following site: https://news.gallup.com/poll/240911/satisfaction-running-improved-level.aspx?g_source=link_NEWSV9&g_medium=NEWSFEED&g_campaign=item_&g_content=U.S.%2520Satisfaction%2520Still%2520Running%2520at%2520Improved%2520Level

(a) The population of interest includes all individuals aged 18 and older who live within the 50 U.S. states and the District of Columbia.
(b) The collected sample includes a random sample of 1,024 individuals aged 18 and older who live within the 50 U.S. states and the District of Columbia.
(c) A parameter of interest is the percentage of the population of individuals aged 18 and older and live within the 50 U.S. states and the District of Columbia who are satisfied with the direction of the U.S.
(d) A statistic used to the estimate the parameter in (c) is the percentage of the 1,024 individuals included in the sample. In this case, the statistic is 36%.

1.49 The answers were based on information obtained from the following site:
(a) The population of interest is U.S. CEOs
(b) The sample included 1,000 U.S. CEOs.
(c) A parameter of interest would be the percentage of CEOs among the population of interest that believe that AI will significantly change the way they will do business in the next five years.
(d) The statistic used to estimate the parameter in (c) is the percentage of CEOs among the 1,000 CEOs included in the sample who believe that AI will significantly change the way they will do business in the next five years. In this case, the statistic is 80% agree with this statement

1.50 (a) One variable collected with the American Community Survey is marital status with the following possible responses: now married, widowed, divorced, separated, and never married.
(b) The variable in (a) represents a categorical variable.
(c) Because the variable in (a) is a categorical, this question is not applicable. If one had chosen age in years from the American Community Survey as the variable, the answer to (c) would be discrete.

1.51 Answers will vary depending on the specific sample survey used. The below answers were based on the sample survey located at: bit.ly/21qjI6F

(a) An example of a categorical variable included in the survey is gender with male or female as possible answers.
(b) An example of a numerical variable included in the survey would be the number of phone calls made or received from or to ones direct supervisor in an average week.

1.52 (a) The population of interest consisted of 10,000 benefited employees of the University of Utah.
(b) The sample consisted of 3,095 employees of the University of Utah.

1.52 cont. (c) Gender, marital status, and employment category represent categorical variables. Age in years, education level in years completed, and household income represent numerical variables.

1.53 (a) Key social media platforms used represents a categorical variable. The frequency of social media usage represents a discrete numerical variable. Demographics of key social media platform users represent categorical variables.

(b) 1. Which of the following is your preferred social media platform: YouTube, Facebook, or Twitter?
2. What time of the day do you spend the most amount of time using social media: morning, afternoon, or evening?
3. Please indicate your ethnicity?
4. Which of the following do you most often use to access social media: mobile device, laptop computer, desktop computer, other device?
5. Please indicate whether you are a home owner: Yes or No?

(c) 1. For the past week, how many hours did you spend using social media?
2. Please indicate your current age in years.
3. What was your annual income this past year?
4. Currently, how many friends have you accepted on Facebook?
5. Currently, how many twitter followers do you have?

Chapter 2

2.1 (a)

Category	Frequency	Percentage
A	13	26%
B	28	56%
C	9	18%

(b) Category "B" is the majority.

2.2 (a) Table frequencies for all student responses

	Student Major Categories			
Gender	A	C	M	Totals
Male	14	9	2	25
Female	6	6	3	15
Totals	20	15	5	40

(b) Table percentages based on overall student responses

	Student Major Categories			
Gender	A	C	M	Totals
Male	35.0%	22.5%	5.0%	62.5%
Female	15.0%	15.0%	7.5%	37.5%
Totals	50.0%	37.5%	12.5%	100.0%

Table based on row percentages

	Student Major Categories			
Gender	A	C	M	Totals
Male	56.0%	36.0%	8.0%	100.0%
Female	40.0%	40.0%	20.0%	100.0%
Totals	50.0%	37.5%	12.5%	100.0%

Table based on column percentages

	Student Major Categories			
Gender	A	C	M	Totals
Male	70.0%	60.0%	40.0%	62.5%
Female	30.0%	40.0%	60.0%	37.5%
Totals	100.0%	100.0%	100.0%	100.0%

2.3 (a) You can conclude Apple, Samsung, and LG dominated the market from the third quarter of 2017 through the third quarter of 2018. Apple has the largest market share and the largest gain in market share increasing from 33% in the third quarter of 2017 to 39% in the third quarter of 2018.

(b) Apple, Samsung, and Motorola increased market share while LG and Others decreased market share.