

STAT 117 Introduction to Statistics

Readings and Practice Exercises

The readings and practice exercises for the course are in the *Fundamentals of Statistics: Informed Decisions Using Data, Fifth Edition* by Michael Sullivan III. You must purchase MyStatLab (also referred to as *MyLab Statistics*) access in order to complete the MyStatLab assignments. Through MyStatLab, you may access the textbook and MyStatLab assignments as well as helpful resources including additional worked examples, videos, supplementary practice exercises, practice quizzes/tests, and the student solutions manual to accompany the textbook.

[MyStatLab ISBN 9780135910634 | Books a la Carte Edition packaged with MyStatLab ISBN 9780135990414]



For each of the eight (8) modules, you must read the corresponding sections of the textbook and work on the listed practice exercises. The purpose of the practice exercises is to allow you to *practice* the methods, notations, and terminology that you are learning throughout the course *before* you take a quiz, submit an assignment, or take an examination. While the practice exercises are not submitted for a grade, many of these practice exercises are related to and may be used in written assignments, assignments completed via MyStatLab, the midterm examination, or the final examination.

As you do the readings and work on practice exercises, pay attention to the terminology, types of tables, types of graphs, formulas, and methods discussed and how they are used with respect to data and in the context of the scenarios that you examine. You are expected to understand and be able to use terminology in the context of the data that you analyze, and you are expected to understand and apply all formulas, tables, graphs, and methods relative to the data you investigate. You must be able to perform all calculations using the formulas discussed and examined throughout the course: you may not use the statistics/probability functions programmed in calculators such as TI-83 and TI-84. As part of the study of statistics, you are expected to learn to apply terminology and formulas, create the tables and graphs, and apply methods related to the experimental design, sampling, summary/descriptive statistics, linear regression and correlation, probability, confidence intervals, and hypothesis testing.



▲ Module 1: An Introduction to Statistics

What is Statistics? What are statistics? How are statistics used in various disciplines?

What is Statistics?

- Some [History of Statistics](#)
- [Statistics](#) on Math Careers

Why Statistics??? Many undergraduate major/minor concentrations (for example, at Framingham State University, programs in Biology, Business, Chemistry, Computer Science, Economics, Education, Fashion Design and Retailing, Geography, History, Mathematics, Political Science, Psychology, and Sociology require or recommend that students take a statistics course) and graduate programs require students to take statistics courses. Statistics are widely used, for example, in advertising (Trident gumⁱ and Toyotaⁱⁱ), for information related to health and the economy (illnessⁱⁱⁱ and student debt^{iv}), policy and public opinion issues (same-sex marriage^v), internet business^{vi}, and college/university acceptance rates^{vii}. Statistics are used and *misused* to present a variety of information; the misuse of statistics prompted Darrell Huff (a journalist and *not* a statistician), in 1954, to write the book *How to Lie with Statistics*, a general introduction to statistics that provides information regarding how the intentional and unintentional errors in the representation of data/information and the interpretation of statistics can lead to false/problematic conclusions.

The hyperlinks to the following TED Talks are provided as “food for thought”.

- [Arthur Benjamin: Teach statistics before calculus!](#)
- [Alan Smith: Why you should love statistics](#)
- [Chris Jordan: Turning powerful statistics into art](#) (Statistics are the foundation/basis of his art)
- [Malte Spitz: Your phone company is watching](#)

♥ Module 2: Design of Experiments, Sampling, and Data Collection

How does one gather or collect data? What makes a data set representative of the target subjects? Can data be “bad”?

The hyperlinks to the following TED Talks are provided as “food for thought”.

- [Ben Goldacre: Battling bad science](#)
- [Eric Mead: The magic of the placebo](#)
- [Michael Specter: The danger of science denial](#)

Chapter 1 – Data Collection

- 1.1 Introduction to the Practice of Statistics: Read pp. 3 – 10; Do p. 10, #1 – 59.
- 1.2 Observational Studies Versus Designed Experiments: Read pp. 14 – 18; Do p. 19, #1 – 24.
- 1.3 Simple Random Sampling: Read pp. 21 – 26; Do p. 26, #1 – 16.
- 1.4 Other Effective Sampling Methods: Read pp. 28 – 34; Do p. 34, #1 – 39.
- 1.5 Bias in Sampling: Read pp. 36 – 40; Do p. 40, #1 – 27, 29, 32, 33, 35 – 44.
- 1.6 The Design of Experiments: Read pp. 42 – 47; Do, p. 47, #1 – 30.
- Chapter 1 Review: Read pp. 52 – 53.
- Review Exercises: Do p. 53, #1 – 35.
- Chapter Test: Do p. 55, #1 – 20.

What are Levels of Measurement?

- [Levels of Measurement](#)
- [Data Levels of Measurement](#)

What is Sampling?

- [Survey Sampling Methods](#)

Surveys and Questionnaires

- Points to Ponder for [Designing Surveys and Questionnaires](#)

♦ Module 3: Summarizing Data Graphically

How can we present data in a manner so that it can be easily understood? What types of representations can be used or cannot be used with different types of data? Can a graphical representation for data be misleading?

The hyperlinks to the following TED Talks are provided as “food for thought”.

- [Mark Liddell: How statistics can be misleading](#)
- [David McCandless: The beauty of data visualization](#)
- [Hans Rosling: The best stats you've ever seen](#) (Statistics and the World Health)
- [Steven Levitt: Surprising stats about child carseats](#)
- [Anne Milgram: Why smart statistics are the key to fighting crime](#)
- [Lea Gaslowitz: How to spot a misleading graph](#)

Chapter 2 – Summarizing Data in Tables and Graphs

- 2.1 Organizing Qualitative Data: Read pp. 61 – 68; Do p. 68, #1 – 26, 29 – 33.
- 2.2 Organizing Quantitative Data: Read pp. 74 – 86; Do p. 87, #1 – 55.
- 2.3 Graphical Misrepresentations of Data: Read pp. 94 – 100; Do p. 100, #1 – 16.
- Chapter 2 Review: Read pp. 103 – 104.
- Review Exercises: Do p. 104, #1 – 12.
- Chapter Test: Do p. 107, #1 – 8.

♣ Module 4: Summarizing Data Numerically

How can we represent data numerically using as few numbers as possible to convey the information associated with the data? How can data be summarized numerically? When is it impossible to summarize data numerically?

The hyperlinks to the following TED Talks are provided as “food for thought”.

- [Sebastian Wernicke: Lies, damned lies and statistics \(about TEDTalks\)](#)
- [Mike Biddle: We can recycle plastic](#)
- [Niall Ferguson: The 6 killer apps of prosperity](#)

Chapter 3 – Numerically Summarizing Data

- 3.1 Measures of Central Tendency: Read pp. 111 – 119; Do p. 119, #1 – 34, 37 – 41.
- 3.2 Measures of Dispersion: Read pp. 124 – 134; Do p. 134, #1 – 26, 28 – 32.
- 3.3 Measures of Central Tendency and Dispersion from Grouped Data: Read pp. 140 – 145; Do p. 145, #1 – 6, 9 – 14.

- 3.4 Measures of Position and Outliers: Read pp. 147 – 154; Do p. 154, #1 – 28.
- 3.5 The Five-Number Summary and Boxplots: Read pp. 157 – 162; Do p. 162, #1 – 16.
- Chapter 3 Review: Read pp. 165 – 167.
- Review Exercises: Do p. 167, #1 – 10.
- Chapter Test: Do p. 169, #1 – 10.

How do we summarize a data set?

- [Measures of Central Tendency](#)
- [Measures of Variability](#)

♦ Module 5: Probability

What is probability? How does probability affect what we expect to have happen? What does it mean for a die or a game to be “fair”? How can probability be used to determine one’s expected winnings for a game of chance, a raffle, or the lottery?

The hyperlink to the following TED Talk is provided as “food for thought”.

- [Dan Katz: Can you solve the cheating royal riddle?](#)
- [Yannay Khaikin: How many ways can you arrange a deck of cards?](#)
- [Leonardo Barichello: The last banana: A thought experiment in probability](#)
- [Peter Donnelly: How juries are fooled by statistics](#)

Chapter 5 – Probability

- 5.1 Probability Rules: Read pp. 229 – 239; Do p. 239, #1 – 46.
- 5.2 The Addition Rule and Complements: Read pp. 244 – 251; Do p. 251, #1 – 26, 29 – 43.
- 5.3 Independence and the Multiplication Rule: Read pp. 255 – 259; Do p. 259, #1 – 30.
- 5.4 Conditional Probability and the General Multiplication Rule: Read pp. 261 – 268;
Do p. 268, #1 – 19, 21 – 32, 35, 36.
- 5.5 Counting Techniques: Read pp. 271 – 281; Do p. 281, #1 – 68.
- 5.6 Putting It Together: Which Method Do I Use?: Read pp. 284 – 287; Do p. 287, #1 – 24, 27 – 31.
- Chapter 5 Review: Read pp. 289 – 290.
- Review Exercises: Do p. 291, #1 – 26, 28, 30, 32.
- Chapter Test: Do p. 293, #1 – 17, 19, 20.

Chapter 6 – Discrete Probability Distributions

- 6.1 Discrete Random Variables: Read pp. 297 – 304; Do p. 305, #1 – 32.
- 6.2 The Binomial Probability Distribution: Read pp. 308 – 320; Do p. 320, #1 – 41, 43 – 47.
- Chapter 6 Review: Read p. 323 – 324.
- Review Exercises: Do p. 325, #1 – 8.
- Chapter Test: Do p. 326, #1 – 4, 6 – 9.

How do we calculate probability?

- [What is a probability distribution function?](#)
- [Discrete Random Variables: Probability Distribution Function \(PDF\) for a Discrete Random Variable](#)

♥ Module 6: The Normal Distribution

What is the Normal Distribution? How do we determine if a distribution is normal? What are the characteristics of the standard normal distribution? How is the standard normal distribution related to any normal distribution? How do we use the standard normal distribution to determine information about any normal distribution even if we do not have the data set available?

Chapter 7 – The Normal Probability Distribution

- 7.1 Properties of the Normal Distribution: Read pp. 329 – 335; Do p. 335, #1 – 12, 19 – 36.
- 7.2 Applications of the Normal Distribution: Read pp. 339 – 347; Do p. 347, #1 – 44, 51.
- 7.3 Assessing Normality: Read pp. 350 – 354.
- 7.4 The Normal Approximation to the Binomial Probability Distribution: Read pp. 355 – 359; Do p. 359, #1 – 28.
- Chapter 7 Review: Read p. 360 – 361.
- Review Exercises: Do p. 361, #1 – 13.
- Chapter Test: Do p. 363, #1 – 9.

♣ Module 7: Confidence Intervals and Hypothesis Testing

What is a confidence interval? What information can be determined using a confidence interval? How does one formulate a hypothesis? How does one determine if a hypothesis is valid?

Chapter 8 – Sampling Distributions

- 8.1 Distribution of the Sample Mean: Read pp. 367 – 375; Do p. 375, #1 – 29.
- 8.2 Distribution of the Sample Proportion: Read pp. 380 – 384; Do p. 384, #1 – 25.
- Chapter 8 Review: Read p. 387 – 388.
- Review Exercises: Do p. 388, #1 – 10.
- Chapter Test: Do p. 389, #1 – 6.

More about sampling distributions

- [Introduction to Sampling Distributions](#)
- [Sampling Distribution of the Mean](#)

Chapter 9 – Estimating the Value of a Parameter

- 9.1 Estimating a Population Proportion: Read pp. 392 – 402; Do p. 402, #1 – 31, 35 – 42.
- 9.2 Estimating a Population Mean: Read pp. 406 – 413; Do p. 414, #1 – 8, 13 – 30.
- 9.3 Putting It Together: Which Procedure Do I Use?: Read pp. 420 – 421; Do p. 421, #1 – 16.
- Chapter 9 Review: Read p. 423 – 424.
- Review Exercises: Do p. 424, #1 – 12.
- Chapter Test: Do p. 426, #1 – 4.

Chapter 10 – Hypothesis Testing Regarding a Parameter

- 10.1 The Language of Hypothesis Testing: Read pp. 429 – 434; Do p. 434, #1 – 40.
- 10.2 Hypothesis Tests for a Population Proportion: Read pp. 436 – 446; Do p. 446, #1 – 26.
- 10.3 Hypothesis Tests for a Population Mean: Read pp. 450 – 456; Do p. 456, #1 – 20, 31 – 33.
- 10.4 Putting It Together: Which Method Do I Use?: Read p. 460 – 461; Do p. 461, #1 – 10.
- Chapter 10 Review: Read pp. 463 – 464.
- Review Exercises: Do p. 464, #1 – 12, 15 – 18.
- Chapter Test: Do p. 466, #1 – 3, 5 – 7.

What is hypothesis testing?

- [Hypothesis Testing](#)

♠ Module 8: Analyzing and Representing the Relationship Between Two Variables

How do we determine if there is a relationship between two variables? What types of relationships can there be between two variables? How can we discuss a relationship between two variables? How can we represent the relationship between two variables? How do we determine the strength of the relationship between two variables?

Chapter 4 – Describing the Relationship between Two Variables

- 4.1 Scatter Diagrams and Correlation: Read pp. 173 – 182; Do p. 182, #1 – 46.
- 4.2 Least-Squares Regression: Read pp. 189 – 197; Do p. 197, #1 – 27, 29.
- 4.3 The Coefficient of Determination: Read pp. 203 – 206; Do p. 206, #1 – 14.
- Chapter 4 Review: Read pp. 220 – 221.
- Review Exercises: Do p. 221, #1 – 9.
- Chapter Test: Do p. 225, #1 – 4.

How do we analyze bivariate data? (Use these apps to develop your “eye” for correlation coefficients.)

- [Guess the Correlation](#)
- [Guessing Correlations](#)
- [Guess the Correlation](#) (Rossman/Chance)

The hyperlinks to the following TED Talks are provided as “food for thought”. Think about the use of data, graphs, and statistics in these talks. Are the statistics presented in context? Are the graphs meaningful and labeled so that the information can be understood? Are the graphs and statistics used effectively and presented in a comprehensible manner?

- [Talithia Williams: Own your body's data](#)
- [Aaron Koblin: Visualizing ourselves ... with crowd-sourced data](#)

- [Jean-Baptiste Michel and Erez Lieberman Aiden: What we learned from 5 million books](#)
- [Mitchell Besser: Mothers helping mothers fight HIV](#)
- [Laurie Garrett: Lessons from the 1918 flu](#)

Studying includes *but is not limited to* reading the course textbook, *reworking* the examples in the textbook and those examined during course meetings, working on practice exercises listed in this document and those provided on course handouts, asking questions during course meetings and outside of class, working with other students and instructor, and reviewing and augmenting course notes *daily*.

You can only learn the material – *make it your own* – by *working on it*. you do not learn by watching but by trying, thinking, puzzling, *rethinking*, discussing, *reworking*, and practicing. *Real* problems and real-world data take time to *analyze*. As you learn *more interesting methods for statistical analysis*, the calculations require more care and precision. Keep in mind that your questions are always welcome: asking questions enables you to make connections among concepts and methods and helps you to learn. **There is no such thing as a stupid question.**

i <http://www.nytimes.com/2009/07/28/business/media/28adco.html>

ii <http://www.toyota.com/corolla/awards.html>
<https://www.balisetoyotaofwarwick.com/compare-toyota-vs-other-brands-welcome-all-challengers/>

iii <https://www.nytimes.com/interactive/2021/us/massachusetts-covid-cases.html>
https://covid.cdc.gov/covid-data-tracker/#trends_dailytrendsdeaths

iv <http://ticas.org/posd/home> | <https://ticas.org/our-work/student-debt/>
<https://ticas.org/content/pub/student-debt-and-class-2015>
<http://www.marketwatch.com/story/class-of-2015-has-the-most-student-debt-in-us-history-2015-05-08>

v <https://www.pewforum.org/fact-sheet/changing-attitudes-on-gay-marriage/>
<http://www.gallup.com/poll/183272/record-high-americans-support-sex-marriage.aspx>
<http://www.gallup.com/poll/154529/Half-Americans-Support-Legal-Gay-Marriage.aspx>

vi <http://www.statista.com/statistics/268252/comparison-of-unique-us-visitors-to-facebook-and-google/>
<https://www.statista.com/statistics/271412/most-visited-us-web-properties-based-on-number-of-visitors/>

vii <https://www.usnews.com/best-colleges/framingham-state-2185>
<https://www.usnews.com/best-colleges/worcester-state-2190>
<https://www.usnews.com/best-colleges/bridgewater-state-college-2183>
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<https://www.usnews.com/best-colleges/westfield-state-college-2189>