

Interactive Statistics 3/e

By Michael Sullivan, III and George Woodbury

Preface to the Instructor

Capturing a Powerful and Exciting Discipline

Statistics is a powerful subject. Technology has changed the way the material is disseminated to the student, and, because of this, statistics education continues to evolve. *Interactive Statistics: Informed Decisions Using Data 3e* is one of the new and innovative tools that you may use to help your students learn and appreciate the power of Statistics. How? By presenting information through video, interactive explorations, and text.

Today's traditional-aged students have grown up with technology - they do not fear it but embrace and demand innovative technology. Today's non-traditional students did not grow up with technology and relied on textbooks exclusively for content knowledge. Therefore, digital texts are something they may not be completely comfortable with. Yet, all students need to be exposed to the latest techniques in delivering intellectual content. This product provides such an opportunity. A traditional book delivers examples via text (sometimes very dense text). Certainly, the ability to read material and understand the content is a vital skill to develop. However, much information in today's world is delivered via video and other media. *Interactive Statistics* presents material using a balanced approach of delivering content through both text and video, with the video embedded into the text. And we don't stop with video as the only media. Students learn best through experiential learning. So, there are applet activities also embedded into the text to help students discover concepts. To confirm that students watch the videos or work through the activities, there are short assessment questions written in MyLab that are tied to the MyLab gradebook following these media assignments.

The content in *Interactive Statistics: Informed Decisions Using Data 3e* is delivered entirely online through Interactive Assignments complete with videos, interactive activities, and exercises in one seamless learning experience. Instructors and students also have access to the eText which is a read-only version that contains everything within the Interactive Assignment except for the MathXL exercises. Both versions also have an extensive chapter review that will assist your students in preparing for exams.

As with the printed texts in the Sullivan Statistics series, a special effort is made to abide by the Guidelines for Assessment and Instruction in Statistics Education (GAISE) for the college introductory

course endorsed by the American Statistical Association (ASA). The GAISE report gives six recommendations for the course:

1. Emphasize statistical literacy and develop statistical thinking
2. Use real data in teaching statistics
3. Stress conceptual understanding
4. Foster active learning
5. Use technology for developing conceptual understanding
6. Use assessments to improve and evaluate student learning.

Navigation Within a Typical Section

Most of the sections are preceded with a MyLab assignment that contains exercises based on prerequisite topics called Preparing for... . The assignment is meant to verify that students understand material covered earlier in the course that is needed to succeed in the upcoming section. The problems selected may be changed or deleted by the instructor. Additional problems may be added to the MyLab assignment as well. Finally, this assignment may be set up as a prerequisite for the upcoming section with a level of mastery established by the instructor.

Section 9.1 Estimating a Population Proportion

Estimating a Population Proportion

PREPARE ▶ Before getting started, complete the [Preparing for this Section Assignment](#).

READ & INTERACT ▶ Complete the [9.1 Interactive Assignment](#). While working through the Interactive Assignment take notes in the [Guided Notebook](#) so you have a record of material presented in this section.

ASSESS ▶ Complete the [9.1 Homework](#) to assess your understanding.

After completing the Preparing for... MyLab assignment, the student moves to the section (**READ & INTERACT**). This is where the student engages with the material and should use the Guided Notebook to take notes. Upon clicking "[x.x Interactive Assignment](#)", the student is taken to a section launch page. This page will say "Get started" in the top left corner if the assignment has not been started. The page will say "Resume" along with a progress bar if the student has started the assignment. The top right indicates the student's score on the assignment. The bottom left portion indicates the slates and MyLab exercises that are part of the assignment. When the student has started the assignment, this list will indicate whether the student has completed a particular slate/exercise. This way, the student will know where to resume the assignment.

Assignment Manager

The structure of each section “out of the box” is Prepare ► Interactive Assignment ► End of Section Homework. However, the instructor has the ability to add MyLab exercises to the Interactive Assignment. So, if you prefer, the end of the Interactive Assignment may contain your end of section MyLab exercises (rather than having a separate end of section assignment). This gives you the flexibility in building assignments you asked for!

Step-by-Step Example Structure and Technology





The examples are set up as Problem statements. We then provide an outline of the recommended Approach in solving the Problem. Next, we present the Solution. Virtually all examples have video solutions. The video solutions are done by hand, using a TI-84C calculator, StatCrunch, and Excel. By clicking on one of the icons (as shown below), you will be able to view a video solution. The instructor should inform their students as to which video solution should be viewed. For example, if you are using StatCrunch as your data analysis tool, then tell the students to only watch the StatCrunch video solution.

Often, we also provide text solutions by hand in the text if we believe it is beneficial to have such a solution for conceptual development. In addition, many of the examples that have video-only solutions will include Results of the analysis completed in the video solution. Again, this is to help your students while they review the material. We also provide Technology Step-by-Step instructions that explain how to obtain results found in the examples using the TI-calculator, StatCrunch, and Excel. Each technology has a “Show/Hide” feature so students can view the technology utilized in class. In addition, the videos include the steps used to obtain the output from each technology.

EXAMPLE 4: Computing a Sample Standard Deviation

Problem In a [previous lesson](#), we obtained a simple random sample of exam scores and computed a sample mean of 73.75. Compute the sample standard deviation of the sample test scores for that data.

Video Solutions

-  [By hand](#)
-  [TI-83/84](#)
-  [StatCrunch](#)
-  [Microsoft Excel](#)

Technology Step-by-Step

▼ Show TI-83/84 Plus

^ Hide StatCrunch

Finding the Sample Standard Deviation

1. Enter the raw data into the spreadsheet. Name the column variable.
2. Select **Stat**, highlight **Summary Stats**, and select **Columns**.
3. Click on the variable you want to summarize. Note that **Unadj. std.**

Text Solution

APPROACH

Follow the same approach used to compute the population standard deviation, but this time use the sample data:

Jennifer (62), Juan (88), Ryanne (77), and Dave (68)

When computing the sample standard deviation, be sure to use \bar{x} with as many decimal places as possible to avoid round-off error. However, report the standard deviation to one more decimal place than the original data. For this example, report the standard deviation to the tenths place.

SOLUTION

Step 1. Enter the sample data in Column 1. In Column 2, enter the sample mean. See Table 8(a).

 **TABLE 8(a)**

Score, x_i	Sample Mean, \bar{x}
62	73.75
88	73.75
77	73.75
68	73.75

Any problem that has 12 or more observations in the **Data Set** has a link that opens the data in StatCrunch.


EXAMPLE 3: Comparing Two Distributions Using Boxplots

Problem Rideshares come with two options: Share a ride or do not share a ride. When you share a ride, you are placed in a car with a group of up to 6 people. Is there a difference in the length of a ride depending on whether the rider shares a ride with others? The data in Table 14 shows the rideshare status of the rides we have been analyzing in this section. Draw a side-by-side boxplot

 TABLE 14

Shared				Not Shared			
2.2	8.2	3.4	2.7	3.4	5.0	4.5	5.5
21.3	16.5	6.3	11.4	8.5	1.1	15.5	8.9
2.8	1.5	4.6	9.4	17.2	17.5	2.4	1.3
1.3	4.7	1.3	2.5	5.4	19.3	42.3	0.6
0.4	5.7	1.1	9.4	7.7	23.2	0.8	21.6
2.9	1.4	6.5	5.1	2.5	1.6	9.6	3.8
1.4				14.6			

Source: data.cityofchicago.org

 Open the data in [StatCrunch](#).



Open data in StatCrunch

Video Solutions

 By hand

 TI-83/84

Technology Step-by-Step

▼ Show TI-83/84 Plus

▼ Show StatCrunch

▼ Show Excel

Features within the Interactive Assignment

- **Preparing for This Section** Almost every section has a prebuilt “Preparing for...” MyLab assignment based upon prerequisite skills that are necessary for students to succeed in the section.
- **Objectives** A list of learning objectives for the section is provided. The objectives are linked to the material in the section and are also tabbed on each slide for easy navigation.
- Great efforts were made to extensively incorporate **real data** in the exercises and examples to pique your students’ interest and show the relevance of statistics.
- **Step-by-Step Examples** guide students from problem to solution in easy-to-follow steps. Solutions are also provided via video (by hand, TI-84C, StatCrunch, and Excel). Follow-up exercises assess understanding of the material presented. Many of the examples also provide a traditional text solution. Technology steps are provided within examples that include video solutions using TI-84 calculators, StatCrunch, or Excel.

- **Applet Activities** appear throughout the text and help students learn concepts through an experiential approach. Follow-up MyLab exercises assess the student's understanding of the concepts.

Activity What Is Least-Squares?

This activity will allow you to visualize and understand the least-squares regression criterion.

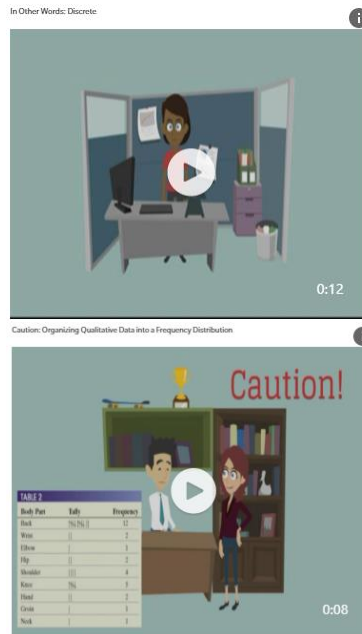
(A) Click "Reset" on the applet below to remove all points from the scatter diagram. Create a scatter diagram that has positive association with eight points.

(B) Using the endpoints of the green line, attempt to fit a linear model to the data that minimizes the sum of squared residuals (or errors), SSE. Each point has a square whose side represents the residual of the point. Therefore, the area of the square is the value of the squared residual (because the area of a square equals side²). So your goal should be to make the sum of the areas of the squares as small as possible. The sum of the area of the squares is given under the heading SSE. Pay attention to the "fit" of the line versus the value of the sum of squared residuals (or errors), SSE.

(C) Check the "Regression" box. Compare the SSE for the green line to the least-squares regression line. Notice that it is not possible to find a line whose SSE is less than the regression line.

Line	# of points	Intercept	Slope	SSE
<input checked="" type="checkbox"/> Not selected	14	3.1326	0.5451	20.392
<input checked="" type="checkbox"/> All data	14	3.1326	0.5451	20.392

- **In Other Words/Caution Animations** Throughout the course, students encounter In Other Words animated videos with avatars. The In Other Words videos are meant to take statistical definitions and concepts and state them in simple, everyday language. The Caution animated videos are meant to alert students to the pitfalls in conducting statistical analysis.



- A **Chapter Summary** delivered via video using a **MindMap**. The MindMap visual summary is available as a pdf that may be downloaded from the Tools for Success. The chapter summary also includes the following:
 - A list of key chapter **Vocabulary** with pop-up definitions.
 - A list of **Formulas** used in the chapter.
 - **Chapter Objectives** listed with corresponding examples for each objective.
 - **Review Exercises** have been coded as MyLab exercises so that students can complete them in MyLab Statistics.
 - **Chapter Test** with answers available. Plus, each chapter test problem has complete worked out video solutions (by hand, TI-84C, StatCrunch, and Excel).
 - **Informed Decisions** and **Case Study** projects allow students to utilize the skills learned within the chapter.

Print Supplements

Interactive Statistics 3e comes with a variety of print supplements.

- **Guided Notebook** Written by author George Woodbury. The Guided Notebook follows the material in the Interactive Assignment. The student is expected to fill out the notebook as they progress through the reading assignment. When complete, the student has a complete text written in their own words. Instructors

may want to check each student's Guided Notebook to verify the student is completing each Interactive Assignment. The Guided Notebook is either available as a print supplement or may be downloaded directly from the left navigation bar in MyLab. In addition, there is a Guided Notebook Instructor's Edition which represents a completely filled in Guided Notebook. This is available in Instructor Resources.

- **Additional Exercises** These are stagnant paper/pencil problems that you may use as additional assignments that are available for each section. The authors use these for weekly homework that is turned in as a formative assessment. This allows instructors to see the student's work and provide feedback. The additional exercises appear in the left navigation bar within the drop-down menu of each section's interactive assignment. They are hidden from student view by default. Answers are provided as well (hidden from student view).
- **Student Activity Workbook** The subject of statistics, like many things in life, is best learned through active participation. These activities have been designed to improve your student's study of statistics, encouraging them to become a more active participant in the discipline. The activity workbook is available as a print supplement or may be downloaded from Tools for Success. **New and updated**

student activities:

- Chapter 1
 - Data Wrangling
 - Retrieving and Cleansing Data
 - Building a Survey Using StatCrunch
- Chapter 2
 - Graphically Summarizing Qualitative Data_Tornadoes
 - Graphically Summarizing Quantitative Data_Tornadoes
- Chapter 3
 - Population Mean versus Sample Mean
 - Standard Deviation as a Measure of Spread
 - Numerically Summarizing Data_Tornadoes
- Chapter 4
 - What Does It Mean to "Regress to the Mean?"
- Chapter 5
 - Let's Make a Deal
 - Tennis Anyone?
- Chapter 7
 - Fooled by Randomness
 - Home Run Distances
- Chapter 8
 - Using Real Data to Describe the Distribution of the Sample Mean: Approximately Normal Population

- Using Real Data to Describe the Distribution of the Sample Mean: Non-Normal Data
 - Describing the Distribution of the Sample Proportion Using the Urn Applet
 - Chapter 9
 - Tips for a Taxi Ride
 - Chapter 10
 - Sensitivity and Specificity
 - Computing the Power of the Test
 - What is a P -Value?
 - Chapter 11
 - Comparing Rental Car Prices
 - Chapter 12
 - COVID-19, Taxis, and Benford's Law
 - Chapter 13
 - Lengths of Tornadoes
- **Instructor Resource Guide** This guide provides an overview of every chapter, suggestions for presenting the material, and additional examples that you may use when developing your lectures. The Instructor Resource Guide is available under Instructor Resources.
- **Classroom Notes** Written by author Michael Sullivan and Heidi Lyne, the classroom notes may be used as a guideline in developing your lectures. Sullivan and Lyne make these notes available to their students and each student fills in the notes during class. The notes have examples different from those in the Interactive Assignment. Available under Instructor Resources.
- **Pre-built Learning Catalytics modules.** Learning Catalytics is a “bring your own device” web-based clicker system. The authors have written modules for each chapter of *Interactive Statistics* that you may use in your classroom. If you are interested in the Learning Catalytics modules, reach out to your Pearson representative.

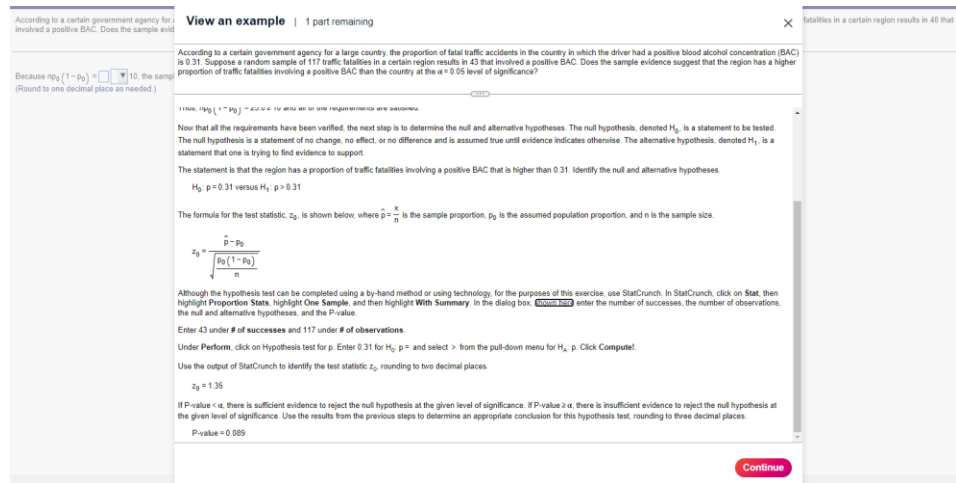
New to this Edition

Based on feedback from users of the second edition, we incorporated many new features into this revision.

- **Updated Platform** Interactive Statistics 3/e is now written in a new platform which allows instructors to customize their course down to the page level in the Assignment Manager. This means an instructor can easily remove objectives they

don't cover in the course. In addition, the instructor can add additional MyLab exercises.

- **Technology specific learning aides** in MyLab exercises for StatCrunch (-SC), TI-84 (-TI), and Excel (-E). Exercises in MyLab with the -SC, -TI, or -E designation will have learning aids (Help Me Solve This and View an Example) that contain technology specific help for your students. For example, in Section 3.2, Problem 29-SC offers specific StatCrunch tech help; Problem 29-E offers specific Excel tech help; Problem 29-TI offers specific TI-84 tech help.



- **Technology Step-by-Step guides** for StatCrunch, TI-84, and Excel. Provides instructions on how to obtain statistical results for each technology section-by-section. Available in MyLab under Tools for Success.
- **Real data-based algorithmic exercises.** These are MyLab exercises written by Michael Sullivan that are based on real data sets that utilize the power of MyLab's algorithms to generate unique problems for your students.

Chapter	Section	Problem
1	6	8
2	1	21
2	2	24, 25, 35
2	3	27
2	4	11, 15
3	1	22, 27, 35, 47
3	2	14, 25, 29
3	4	23

4	1	31, 33, 41, 45, 49
4	2	21, 25, 28
4	3	23
5	4	19
5	6	7
6	1	25, 27
6	2	35, 36, 39
7	2	49, 53, 57
7	3	13
8	1	22, 33, 34
8	2	16, 17, 19
9	1	34, 55
9	2	25, 35, 36, 48
9	3	19, 23, 24
10	2	33, 46
10	3	23, 24, 25
10	3A	1, 2, 3, 9, 11
10	4	21, 23
11	2	17
11	3	18
13	1	23
14	2	17, 18
14	3	19

- **Threaded tornado exercises.** These problems utilize a data set that measures a variety of variables among all tornadoes that struck the United States between 1950 and 2020. Throughout the text, students use the data set to answer questions relevant to the material presented within the section. The following Tornado exercises are programmed in MyLab.

Chapter	Section	Problem
1	1	47
1	3	X1-SC
2	1	25-T
2	2	33-T

3	1	41
3	2	51
3	4	29
4	3	31
5	1	49
8	1	33
9	1	33
9	2	37
10	2	33
10	3	35
11	1	29
11	3	17
12	1	X1, X2
14	2	17

- **Essay questions (-Essay).** These are free response questions, many of which that are algorithmic, that may be assigned in a MyLab quiz or exam. Must be graded by the instructor.
- **Updated lecture videos.** Many of the lecture videos that are part of the Interactive Assignment have been updated to provide a detailed presentation of the material, improve audio quality, and address compliance concerns.
- **New sections.**
 - 14.3 Multiple Regression
 - C.1 Estimating a Population Standard Deviation
 - C.2 Hypothesis Tests for a Population Standard Deviation
 - Integrated Review. A new chapter on functions, exponential functions, and logarithmic functions.
- **Soft skills/Affective domain.** Written by George Woodbury. These provide opportunity for your students to learn about growth mindset and develop study skills as they progress through the course.

INTEGRATED REVIEW

Based on Michael Sullivan's Developmental Math series, Interactive Statistics 3/e comes with a complete integrated review course. We offer a variety of tools to help students master the material. The two most likely to be used by the students are the objective-level videos and the text.

Videos: The videos feature author Michael Sullivan and are created at the objective level so that your students will not waste time watching videos on material they have already mastered. Each video includes a complete development of the topic, along with one or more examples illustrating the mathematics. When the amount of material within a particular objective warrants it, more than one video per objective may be available; this is done to keep video length short so that no one video is overwhelming.

Text: The text presents explanations, definition, examples, and homework problems for you to assign to your students. There is a Quick Response (QR) code at the beginning of each section in the text that allows you access to all the videos in the section.

Worksheets: A worksheet for each objective has a variety of exercises for the student to work on. Also provides a reference to the text so that students can easily remediate.