

# Stats Data and Models

FIFTH EDITION

De Veaux • Velleman • Bock





# Get the Most Out of MyLab Statistics 11111

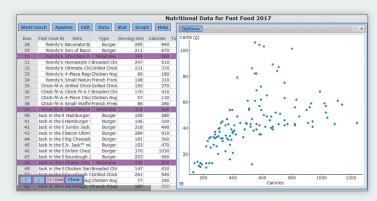
MyLab<sup>TM</sup> Statistics is the teaching and learning platform that empowers instructors to reach *every* student. By combining trusted author content with digital tools and a flexible platform, MyLab Statistics personalizes the learning experience and improves results for each student.

# Collect, crunch, and communicate with StatCrunch

With StatCrunch<sup>®</sup>, Pearson's powerful web-based statistical software, instructors and students can access tens of thousands of data sets including those from the textbook, perform complex analyses, and generate compelling reports. StatCrunch is integrated

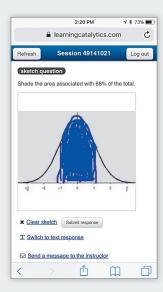
directly into MyLab Statistics.

Beyond StatCrunch, MyLab Statistics makes learning and using a variety of statistical software packages seamless and intuitive by allowing users to download and copy data sets directly into other programs. Students can access instructional tools including tutorial videos, and study cards.



# **Give every student a voice with Learning Catalytics**

Learning Catalytics™ is an interactive classroom tool that allows every student to participate. Instructors ask a variety of questions that help students recall ideas, apply concepts, and develop critical-thinking skills. Students answer using their smartphones, tablets, or laptops to show that they do—or don't—understand. Instructors monitor responses to adjust their teaching approach, and even set up peer-to-peer learning. More importantly, they use real-time analytics to address student misconceptions the moment they occur and ensure they hear from every student when it matters most.



# Stats: Data and Models, Global Edition

# **Table of Contents**

C	Ω	٧,	Δ	r
` '	. ,	v	_	

Get the Most Out of MyLab Statistics

Title Page

Copyright

Dedication

Meet the Authors

**Table of Contents** 

Preface

MyLab Statistics for Stats: Data & Models, 5e

Resources for Success

Acknowledgments

Index of Applications

Part I: Exploring and Understanding Data

- 1. Stats Starts Here
  - 1.1 What Is Statistics?
  - 1.2 Data
  - 1.3 Variables
  - 1.4 Models
- 2. Displaying and Describing Data
  - 2.1 Summarizing and Displaying a Categorical Variable
  - 2.2 Displaying a Quantitative Variable
  - 2.3 Shape
  - 2.4 Center
  - 2.5 Spread
- 3. Relationships Between Categorical VariablesContingency Tables
  - 3.1 Contingency Tables
  - 3.2 Conditional Distributions
  - 3.3 Displaying Contingency Tables
  - 3.4 Three Categorical Variables



# 4. Understanding and Comparing Distributions

- 4.1 Displays for Comparing Groups
- 4.2 Outliers
- 4.3 Timeplots: Order, Please!
- 4.4 Re-Expressing Data: A First Look

### 5. The Standard Deviation as a Ruler and the Normal Model

- 5.1 Using the Standard Deviation to Standardize Values
- 5.2 Shifting and Scaling
- 5.3 Normal Models
- 5.4 Working with Normal Percentiles
- 5.5 Normal Probability Plots

# Review of Part I: Exploring and Understanding Data

# Part II: Exploring Relationships Between Variables

- 6. Scatterplots, Association, and Correlation
  - 6.1 Scatterplots
  - 6.2 Correlation
  - 6.3 Warning: Correlation Causation
  - \*6.4 Straightening Scatterplots

### 7. Linear Regression

- 7.1 Least Squares: The Line of Best Fit
- 7.2 The Linear Model
- 7.3 Finding the Least Squares Line
- 7.4 Regression to the Mean
- 7.5 Examining the Residuals
- 7.6 R2The Variation Accounted for by the Model
- 7.7 Regression Assumptions and Conditions

#### 8. Regression Wisdom

- 8.1 Examining Residuals
- 8.2 Extrapolation: Reaching Beyond the Data
- 8.3 Outliers, Leverage, and Influence
- 8.4 Lurking Variables and Causation
- 8.5 Working with Summary Values
- \*8.6 Straightening ScatterplotsThe Three Goals
- \*8.7 Finding a Good Re-Expression
- 9. Multiple Regression
  - 9.1 What Is Multiple Regression?



- 9.2 Interpreting Multiple Regression Coefficients
- 9.3 The Multiple Regression ModelAssumptions and Conditions
- 9.4 Partial Regression Plots
- \*9.5 Indicator Variables

Review of Part II: Exploring Relationships Between Variables

# Part III: Gathering Data

- 10. Sample Surveys
  - 10.1 The Three Big Ideas of Sampling
  - 10.2 Populations and Parameters
  - 10.3 Simple Random Samples
  - 10.4 Other Sampling Designs
  - 10.5 From the Population to the Sample: You Cant Always Get What You Want
  - 10.6 The Valid Survey
  - 10.7 Common Sampling Mistakes, or How to Sample Badly

### 11. Experiments and Observational Studies

- 11.1 Observational Studies
- 11.2 Randomized, Comparative Experiments
- 11.3 The Four Principles of Experimental Design
- 11.4 Control Groups
- 11.5 Blocking
- 11.6 Confounding

Review of Part III: Gathering Data

# Part IV: Randomness and Probability

- 12. From Randomness to Probability
  - 12.1 Random Phenomena
  - 12.2 Modeling Probability
  - 12.3 Formal Probability

#### 13. Probability Rules!

- 13.1 The General Addition Rule
- 13.2 Conditional Probability and the General Multiplication Rule
- 13.3 Independence
- 13.4 Picturing Probability: Tables, Venn Diagrams, and Trees
- 13.5 Reversing the Conditioning and Bayes Rule

#### 14. Random Variables

- 14.1 Center: The Expected Value
- 14.2 Spread: The Standard Deviation



- 14.3 Shifting and Combining Random Variables
- 14.4 Continuous Random Variables
- 15. Probability Models
  - 15.1 Bernoulli Trials
  - 15.2 The Geometric Model
  - 15.3 The Binomial Model
  - 15.4 Approximating the Binomial with a Normal Model
  - \*15.5 The Continuity Correction
  - 15.6 The Poisson Model
  - 15.7 Other Continuous Random Variables: The Uniform and the Exponential

# Review of Part IV: Randomness and Probability

# Part V: Inference for One Parameter

- 16. Sampling Distribution Models and Confidence Intervals for Proportions
  - 16.1 The Sampling Distribution Model for a Proportion
  - 16.2 When Does the Normal Model Work? Assumptions and Conditions
  - 16.3 A Confidence Interval for a Proportion
  - 16.4 Interpreting Confidence Intervals: What Does 95% Confidence Really Mean?
  - 16.5 Margin of Error: Certainty vs. Precision
  - \*16.6 Choosing the Sample Size

#### 17. Confidence Intervals for Means

- 17.1 The Central Limit Theorem
- 17.2 A Confidence Interval for the Mean
- 17.3 Interpreting Confidence Intervals
- \*17.4 Picking Our Interval up by Our Bootstraps
- 17.5 Thoughts About Confidence Intervals

## 18. Testing Hypotheses

- 18.1 Hypotheses
- 18.2 P-Values
- 18.3 The Reasoning of Hypothesis Testing
- 18.4 A Hypothesis Test for the Mean
- 18.5 Intervals and Tests
- 18.6 P-Values and Decisions: What to Tell About a Hypothesis Test

#### 19. More About Tests and Intervals

- 19.1 Interpreting P-Values
- 19.2 Alpha Levels and Critical Values
- 19.3 Practical vs. Statistical Significance



#### 19.4 Errors

Review of Part V: Inference for One Parameter

# Part VI: Inference for Relationships

# 20. Comparing Groups

- 20.1 A Confidence Interval for the Difference Between Two Proportions
- 20.2 Assumptions and Conditions for Comparing Proportions
- 20.3 The Two-Sample z-Test: Testing the Difference Between Proportions
- 20.4 A Confidence Interval for the Difference Between Two Means
- 20.5 The Two-Sample t-Test: Testing for the Difference Between Two Means
- \*20.6 Randomization Tests and Confidence Intervals for Two Means
- \*20.7 Pooling
- \*20.8 The Standard Deviation of a Difference

# 21. Paired Samples and Blocks

- 21.1 Paired Data
- 21.2 The Paired t-Test
- 21.3 Confidence Intervals for Matched Pairs
- 21.4 Blocking

# 22. Comparing Counts

- 22.1 Goodness-of-Fit Tests
- 22.2 Chi-Square Test of Homogeneity
- 22.3 Examining the Residuals
- 22.4 Chi-Square Test of Independence

#### 23. Inferences for Regression

- 23.1 The Regression Model
- 23.2 Assumptions and Conditions
- 23.3 Regression Inference and Intuition
- 23.4 The Regression Table
- 23.5 Multiple Regression Inference
- 23.6 Confidence and Prediction Intervals
- \*23.7 Logistic Regression
- \*23.8 More About Regression

### Review of Part VI: Inference for Relationships

### Part VII: Inference When Variables Are Related

- 24. Multiple Regression Wisdom
  - 24.1 Cleaning and Formatting Data
  - 24.2 Diagnosing Regression Models: Looking at the Cases



- 24.3 Building Multiple Regression Models
- 25. Analysis of Variance
  - 25.1 Testing Whether the Means of Several Groups Are Equal
  - 25.2 The ANOVA Table
  - 25.3 Assumptions and Conditions
  - 25.4 Comparing Means
  - 25.5 ANOVA on Observational Data
- 26. Multifactor Analysis of Variance
  - 26.1 A Two-Factor ANOVA Model
  - 26.2 Assumptions and Conditions
  - 26.3 Interactions
- 27. Introduction to Statistical Learning and Data Science
  - 27.1 Data Science and Big Data
  - 27.2 The Data Mining Process
  - 27.3 Data Mining Algorithms: A Sample
  - 27.4 Models Built from Combining Other Models
  - 27.5 Comparing Models
  - 27.6 Summary

Review of Part VII: Inference When Variables Are Related

**Cumulative Review Exercises** 

# **Appendixes**

Appendix A. Answers

Appendix B. Credits

Appendix C. Index

Appendix D. Tables and Selected Formulas