

AP[®] Statistics

Syllabus 2

Primary Textbook

Peck, Roxy, Chris Olsen, and Jay Devore. *Introduction to Statistics and Data Analysis*, first edition. Pacific Grove, CA: Brooks/Cole, 2001.

Technology [C5]

- All students have a TI-83/TI-83+/TI-84 graphing calculator for use in class, at home, and on the AP Exam. Students will use their graphing calculator extensively throughout the course.
- All students have a copy of JMP-Intro statistical software for use at home and for demonstrations in class. Students will have occasional assignments that must be completed using JMP-Intro. After the AP exam, students will use JMP-Intro daily when we learn multiple regression and ANOVA.
- Various applets on the Internet

C5—The course teaches students how to use graphing calculators and demonstrates the use of computers and/or computer output to enhance the development of statistical understanding through exploring and analyzing data, assessing models, and performing simulations.

Course Outline

(organized by chapters in primary textbook):

Graphical displays include, but are not limited to using boxplots, dotplots, stemplots, back-to-back stemplots, histograms, frequency plots, parallel boxplots, and bar charts.

Chapter 1: An Introduction to Statistics

(total time: 1 day)

- Activity: Sexual Discrimination

Chapter 2: Collecting Data (total time: 14 days) [C2b]

- Types of Data
- Observational Studies
- Activity: Sampling from the Gettysburg Address
- Bias in sampling
- Simple random samples
- Stratified random samples
- Activity: The River Problem
- Cluster sampling
- Designing experiments
- Control groups
- Treatments
- Blocking

C2b: The course provides instruction in each of the following four broad conceptual themes outlined in the Course Description with appropriate emphasis on sampling and experimentation.

- Random assignment
- Replication
- Activity: The Caffeine Experiment
- The scope of inference

Chapter 3: Displaying Univariate Data **(total time: 4 days)** [C2a]

- Displaying categorical data: pie and bar charts
- Dotplots
- Stemplots
- Histograms
- Describing the shape of a distribution
- Cumulative frequency graphs

C2a: The course provides instruction in each of the following four broad conceptual themes outlined in the Course Description with appropriate emphasis on exploring data.

Chapter 4: Describing Univariate Data **(total time: 8 days)** [C2a] [C5]

- Describing center: mean and median
- Describing spread: range, interquartile range, and standard deviation
- Boxplots
- Outliers
- Using the TI-83
- The empirical rule
- Standardized scores
- Percentiles and quartiles
- Transforming data
- Using JMP-Intro
- Activity: Matching Distributions

C5—The course teaches students how to use graphing calculators and demonstrates the use of computers and/or computer output to enhance the development of statistical understanding through exploring and analyzing data, assessing models, and performing simulations.

Chapter 5: Describing Bivariate Data **(total time: 16 days)** [C2a] [C5]

- Introduction to bivariate data
- Making and describing scatterplots
- The correlation coefficient
- Properties of the correlation coefficient
- Least squares regression line
- Using the TI-83
- Regression to the mean
- Residual plots
- Standard deviation
- Coefficient of determination
- Unusual and influential points

- Activity: Matching Scatterplots and Correlations
- Applets: Demonstrating the effects of outliers
- Using JMP-Intro
- Modeling nonlinear data: exponential and power transformations

Midterm: Chapters 1–5 (total time: 3 days)

- Review Chapters 1–5 using previous AP questions
- Introduce first semester project

Chapter 6: Probability (total time: 13 days) [C2c] [C5]

- Definition of probability, outcomes, and events
- Law of large numbers
- Properties of probabilities
- Conditional probability
- Independence
- Addition rule
- Multiplication rule
- Estimating probabilities using simulation
- Using the TI-83 for simulations
- Activity: Cereal Boxes
- Activity: ESP Testing
- Activity: Senior parking

C2c: The course provides instruction in each of the following four broad conceptual themes outlined in the Course Description with appropriate emphasis on anticipating patterns.

C5—The course teaches students how to use graphing calculators and demonstrates the use of computers and/or computer output to enhance the development of statistical understanding through exploring and analyzing data, assessing models, and performing simulations.

Chapter 7: Random Variables (total time: 18 days) [C2c] [C5]

- Properties of discrete random variables
- Properties of continuous random variables
- Expected value (mean) of a discrete random variable
- Standard deviation of a discrete random variable
- Linear functions and linear combinations of random variables
- The binomial distribution
- The geometric distribution
- The normal distribution
- Using the normal table
- Using the TI-83 distribution menu
- Combining normal random variables
- Normal approximation to the binomial

First Semester Final Exam (total time: 4 days)

- Review using previous AP questions

Chapter 8: Sampling Distributions (total time: 9 days) [C2b]

- Sampling distributions

C2b: The course provides instruction in each of the following four broad conceptual themes outlined in the Course Description with appropriate emphasis on sampling and experimentation.

- Activity: How many textbooks?
- Activity: Cents and the central limit theorem
- Sampling distribution of the sample mean (including distribution of a difference between two independent sample means)
- Sampling distribution of the sample proportion (including distribution of a difference between two independent sample proportions)

Chapter 9: Confidence Intervals (total time: 10 days) [C2d]

- Properties of point estimates: bias and variability
- Confidence interval for a population proportion
- Confidence interval for a population mean
- Logic of confidence intervals
- Meaning of confidence level
- Activity: What does it mean to be 95% confident?
- Finding sample size
- Finite population correction factor
- +4 confidence interval for a proportion
- Confidence interval for a population mean
- The t-distribution
- Checking conditions

C2d: The course provides instruction in each of the following four broad conceptual themes outlined in the Course Description with appropriate emphasis on statistical inferences.

C5—The courses teaches students how to use graphing calculators and demonstrates the use of computers and/or computer output to enhance the development of statistical understanding through exploring and analyzing data, assessing models, and performing simulations.

Chapter 10: Hypothesis Tests (total time: 11 days) [C2d] [C5]

- Forming hypotheses
- Logic of hypothesis testing
- Type I and Type II errors
- Hypothesis test for a population proportion
- Test statistics and p-values
- Activity: Kissing the right way
- Two-sided tests
- Hypothesis test for a population mean
- Checking conditions
- Power
- Using JMP-Intro

Chapter 11: Two Sample Procedures (total time: 11 days) [C2d] [C5]

- Activity: Fish Oil
- Hypothesis test for the difference of two means (unpaired)
- Two-sided tests
- Checking conditions
- Confidence interval for the difference of two means (unpaired)
- Matched pairs hypothesis test

- Matched pairs confidence interval
- Hypothesis test for the difference of two proportions
- Confidence interval for the difference of two proportions
- Using the TI-83 test menu
- Choosing the correct test: It's all about the design

Midterm (chapters 8-11) (total time: 3 days)

- Review using previous AP questions

Chapter 12: Chi-square Tests (total time: 8 days) [C2d] [C5]

- Activity: M&M's
- The chi-square distribution
- Goodness of Fit test
- Checking conditions
- Assessing normality
- Homogeneity of Proportions test (including large sample test for a proportion)
- Using the TI-83
- Test of independence
- Choosing the correct test: It's all about the design.

C2d: The course provides instruction in each of the following four broad conceptual themes outlined in the Course Description with appropriate emphasis on statistical inferences.

C5—The courses teaches students how to use graphing calculators and demonstrates the use of computers and/or computer output to enhance the development of statistical understanding through exploring and analyzing data, assessing models, and performing simulations.

Chapter 13: Inference for Slope (total time: 5 days) [C2d] [C5]

- Activity: Dairy and Mucus
- Hypothesis test for the slope of a least squares regression line
- Confidence interval for the slope of a least squares regression line
- Using the TI-83
- Using JMP-Intro
- Understanding computer output

Review for AP Exam and Final Exam (total time: 7 days)

- 2002 complete AP exam
- Remaining previous AP questions
- Final exam
- AP exam

Post AP Exam (total time: 25 days)

- Second semester project (see below)
- Chapter 14: Multiple regression
- Using JMP-Intro
- Chapter 15: ANOVA
- Using JMP-Intro
- Guest speakers: careers in statistics

AP Statistics Example Project [[C2a, b, c, d]] [[C3]] [[C4]] [[C5]]

The Project: Students will design and conduct an experiment to investigate the effects of response bias in surveys. They may choose the topic for their surveys, but they must design their experiment so that it can answer at least one of the following questions:

- Can the wording of a question create response bias?
- Do the characteristics of the interviewer create response bias?
- Does anonymity change the responses to sensitive questions?
- Does manipulating the answer choices change the response?

The project will be done in pairs. Students will turn in one project per pair. A written report must be typed (single-spaced, 12-point font) and included graphs should be done on the computer using JMP-Intro or Excel.

Proposal: The proposal should

- Describe the topic and state which type of bias is being investigated.
- Describe how to obtain subjects (minimum sample size is 50).
- Describe what questions will be and how they will be asked, including how to incorporate direct control, blocking, and randomization.

Written Report: The written report should include a title in the form of a question and the following sections (clearly labeled):

- Introduction: What form of response bias was investigated? Why was the topic chosen for the survey?
- Methodology: Describe how the experiment was conducted and justify why the design was effective. Note: This section should be very similar to the proposal.
- Results: Present the data in both tables and graphs in such a way that conclusions can be easily made. Make sure to label the graphs/tables clearly and consistently.
- Conclusions: What conclusions can be drawn from the experiment? Be specific. Were any problems encountered during the project? What could be done different if the experiment were to be repeated? What was learned from this project?
- The original proposal.

Poster: The poster should completely summarize the project, yet be simple enough to be understood by any reader. Students should include some pictures of the data collection in progress.

Oral Presentation: Both members will participate equally. The poster should be used as a visual aid. Students should be prepared for questions.

C2a: The course provides instruction in each of the following four broad conceptual themes outlined in the Course Description with appropriate emphasis on exploring data.

C2b: The course provides instruction in each of the following four broad conceptual themes outlined in the Course Description with appropriate emphasis on sampling and experimentation.

C2c: The course provides instruction in each of the following four broad conceptual themes outlined in the Course Description with appropriate emphasis on anticipating patterns.

C2d: The course provides instruction in each of the following four broad conceptual themes outlined in the Course Description with appropriate emphasis on statistical inferences.

C3—The course draws connections between all aspects of the statistical process, including design, analysis, and conclusions.

C4—The course teaches students how to communicate methods, results, and interpretations using the vocabulary of statistics.

C5—The courses teaches students how to use graphing calculators and demonstrates the use of computers and/or computer output to enhance the development of statistical understanding through exploring and analyzing data, assessing models, and performing simulations.