

AP Statistics

Syllabus

Course Material

Course Design

One of the greatest differences between teaching statistics and teaching most other mathematics courses is the flexibility allowed to the teacher. In the AP Statistics classes students are able to collaborate and brainstorm together, thus fostering classroom discussions and cooperative learning. Students also enjoy the varied instruction they get from each other, rather than always relying on the teacher. This AP course follows the following structure; Notes are given at the beginning of each section in the chapter and usually a lecture is given, occasionally the chapter will begin with an activity to introduce new concepts, if applicable example problems will be presented along with necessary formulas. This will be followed by work time where student are free to collaborate and brainstorm together. Finally, the chapter will end with a review day and then a formal test that parallels the AP exam; 50% multiple choice and 50% free-responses. The class will also incorporate the use of the TI-83/TI-83+/TI-84+ graphing calculator into their everyday assignments as applicable. The book does a nice job of illustrating its use in appropriate situations. Students will also be taught how to read and interpret computer generated output relevant to statistical analysis of data.

A survey project incorporating and tying together major concepts of the year will be the main focus after the AP exam is taken. The Survey Project was taken from the *Golden Resource Binder* provided by the authors of the primary text. A more outlined explanation of this project is included at the end of the syllabus.

Primary Textbook

The Practice of Statistics: TI-83/89 Graphing Calculator Enhanced, 2nd Edition. Daniel S. Yates, David S. Moore, and Daren S. Starnes. 2003, W. H. Freeman.

Video Series

Decisions Through Data from the Consortium on Mathematics and Its Applications (COMAP)

Technology

- 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 access to a computer lab throughout the year. Twice during the year classes frequent the lab to utilize the online quizzes and applets on the website provide by the text: www.whfreemancom/tps.

Course Outline and Content

(organized by chapters in the primary textbook):

Chapter 1: Exploring Data (Total Time: 12 Days)

- Displaying Distributions with Graphs
 - Individuals and Variables, analyzing categorical data
 - Dotplots, stemplots, and interpretation
 - Histograms and relative cumulative frequency
 - Timeplots
- Describing Distributions with Numbers
 - Measuring center: mean vs. median
 - Quartiles and boxplots
 - Measuring spread: standard deviation
 - Changing units (linear transformations)
 - Comparing distributions

Chapter 2: Normal Distributions (Total Time: 8 Days)

- Density Curves and the Normal Distribution
 - Density curves, mean and median
 - Normal distributions & 68-95-99.7 rule
- Standard Normal Curve
 - Standardizing and the standard normal curve
 - Nonstandard normal curves
 - Assessing normality
 - Normal distributions & calculations on TI-83/89

Chapter 3: Examining Relationships (Total Time: 10 Days)

- Scatterplots
 - Scatterplots – making and interpreting
- Correlation
 - Correlation and facts about it
- Least-Square Regression
 - Least squares regression facts; r^2
 - Residuals, outliers, influential observations

Chapter 4: More on Two-Variable Data (Total Time: 12 Days)

- Transforming Relationships
 - Transforming relationships & ladder of powers
 - Exponential growth, logarithm transformations
 - Power model, log-log transformations
- Cautions about Correlation and Regression
 - Causation, confounding, and common response
- Relations in Categorical Data
 - Relations in categorical data: marginal
 - Conditional distributions & Simpson's Paradox

Chapter 5: Producing Data (Total Time: 12 Days)

- Designing Samples
 - Simple random samples & other sampling methods
 - Designing surveys: cautions
- Designing Experiments
 - Experiments – terminology
 - Randomized comparative experiments; The principles of experimental design
 - More complex designs: blocking & matched pairs
- Simulating Experiments
 - Calculator simulations TI-83/89

Chapter 6: Probability (Total Time: 12 Days)

- The idea of Probability
 - What is probability?
- Probability Models
 - Probability rules – basic
 - Independence and the multiplication rule
- General Probability Rules
 - General addition rule/Venn diagrams
 - Conditional probability & Bayes' Theorem

Chapter 7: Random Variables (Total Time: 14 Days)

- Discrete and Continuous Random Variables
 - Introduction; discrete random variables
 - Continuous random variables – uniform & normal
- Means and Variances of Random Variables
 - Mean and variance of a discrete random variable
 - Law of large numbers; rules for means
 - Rules for variances and independence

Chapter 8: Binomial & Geometric r.v.'s (Total Time: 12 Days)

- The Binomial Distribution
 - Binomial settings
 - Calculating binomial probabilities: by formula and by calculator TI-83/89
 - Mean and standard deviation of binomial r.v.; normal approximation to the binomial
 - Binomial simulations
- The Geometric Distribution
 - Geometric setting and geometric probability
 - Properties of geometric r.v. & simulations

1st Semester Final Exam (Total Time: 4 Days)

Chapter 9: Sampling Distributions (Total Time: 10 Days)

- Sampling Distributions
 - Sampling distributions: sampling variability & bias
- Sample Proportions
 - Sampling distribution of sample proportion

- Samples Means
 - Sampling distribution of sample mean; the Central Limit Theorem

Chapter 10 Introduction to Inference (Total Time: 15 Days)

- Estimating with Confidence
 - Estimating with confidence: connecting your thinking to the sampling distribution
 - Confidence interval for population mean
 - How confidence intervals behave; choosing sample size; cautions
- Tests of Significance
 - Logic of significance tests; stating hypotheses
 - P -values and statistical significance
 - Carrying out a significance test; including fixed significance level tests
 - Test from a confidence interval
- Making Sense of Statistical Significance
 - About statistical significance
- Inference as Decision
 - Concepts of Type I, Type II error & power

Chapter 11: Inference for Means (Total Time: 9 Days)

- Inference for the Mean of a Population
 - What to do when SIGMA is unknown – t Comparing two Means
 - Confidence intervals and significance tests with t
 - Matched pairs – a special case of one-sample t
 - Robustness of t procedures; calculator use
- Comparing Two Means
 - Matched pairs vs. two independent samples
 - Comparing two population means
 - More accurate degrees of freedom from technology

Chapter 12: Inference for Proportions (Total Time: 5 Days)

- Inference for a Population Proportion
 - Inference conditions
 - Confidence intervals and significance tests
 - Determining sample size
- Comparing Two Proportions
 - Confidence intervals about difference in proportions
 - Significance tests about difference in proportions

Chapter 13: Inference for Distributions (Total Time: 8 Days)

- Test for Goodness of Fit
- Inference for Two-Way Tables
 - Chi-square test for homogeneity
 - Chi-square test for association/independence

Chapter 14: Inference for Regression (Total Time: 5 Days)

- Inference About the Model
 - The idea of the regression model; computer output
- Predictions and Conditions
 - Confidence intervals and significance tests for the slope of the population regression line

Review for AP Exam (Total Time: 14 Days)

Post AP: Exam Survey Project (Total Time: 14 Days)

(as taken from the Golden Resource binder of the text)

2nd Semester Final Exam (Total Time: 4 Days)

AP Statistics Survey Project

Phase I: Team members brainstorm possible survey topics on issues of school interest

Phase II: Each team submits a typed proposal describing:

- Topic/question of interest
- Background motivation for selecting this topic/question
- Questions to be included in the survey
- Methodology
 - The type of sampling procedure do you intend to use – stratified, cluster, SRS, or systematic
 - Precise description of your randomization, including labeling
 - When, where, and how you will administer the survey

Phase III: Select your sample and administer your survey

Phase IV: Organize, summarize, and analyze your data

Phase V: Prepare a written report that documents your survey. Follow these guidelines.

Your written report should include each of the sections described below. The finished product will be evaluated according to the rubric on the attached page, so read it carefully.

- Topic/Question -- should be descriptive, and eye-catching
- Background -- Why did you decide to investigate this topic/question?
- Methodology -- This should be clear enough so that anyone who reads your description could replicate the survey effortlessly.
 - Describe and defend your chosen sampling procedure.
 - Detail your randomization process.
 - Carefully explain when, where, and how you administered the survey.
 - Provide a copy of your survey.
- Data -- Organize your data in tabular form.
- Analysis -- Include appropriate graphical and numerical summaries – bar graphs, pie charts, counts, proportions, percents.
- Interpretation -- Discuss what the data tells you about the topic/question you chose. What generalizations might you draw about the population from which the sample was drawn?

- Pitfalls and extensions – Share any difficulties you experienced during the survey project. What might you do differently if you were to repeat the survey? Are there any possible extensions of this survey project that might prove interesting?

Phase VI: Class Presentation -- a ten minute opportunity for you to share the critical aspects of your survey project with your classmates. Make it interesting!! See the attached grading guide.

AP Statistics Survey Project Scoring Rubric

Topic/question and Background

4 The topic/question selected is clearly stated, is of interest to the school community, and is appropriately narrow in scope. The background provided gives strong motivation for the team's choice of this topic/question and delineates its relevance to the school community.

3 The topic/question selected is clearly stated, is of interest to the school community, and is appropriately narrow in scope. The background provided gives considerable support for the team's choice of this topic/question, and some attempt is made to show its relevance to the school community.

2 Either the topic/question is flawed in one of the areas: clearly stated, of interest to the school community, appropriately narrow in scope OR the background provided fails in either its support for the chosen topic/question or the relevance to the school community.

1 Both the topic/question and the background provided are flawed in at least one area. However, one or both satisfactorily address at least half of the areas specified.

0 Neither the topic/question nor the background provided satisfactorily address at least half of the specified areas.

Methodology – Sampling Procedure

4 The chosen sample procedure is appropriate for addressing the selected topic/question, is described accurately, and is implemented according to the stated plan.

3 The chosen sample procedure satisfies two of the three criteria mentioned above, but is weak in the other area.

2 The chosen sample procedure satisfies two of the three criteria completely, and does not satisfy the third requirement OR the chosen sample procedure satisfies one of the three criteria completely and the other two partially.

1 The chosen sample procedure satisfies one of the three criteria completely, and one of the

other two criteria partially.

0 The chosen sample procedure does not satisfy any of the three criteria completely.

Methodology –Randomization

4 The randomization process includes a clear and correct labeling of subjects, a description of the number selection process (random number table or calculator), and the results of that randomization (i.e. the numbers and subjects chosen). In addition, the randomization process matches the chosen sampling procedure.

3 The randomization process includes all three components listed above. However, clarity of communication would prevent easy replication of this randomization. Still, the randomization process matches the chosen sampling procedure.

2 The randomization process includes all three components listed above. However, the randomization process does not match the chosen sampling procedure OR the randomization process matches the chosen sampling procedure, but the clarity of communication would prevent easy replication of this randomization, in spite of it being correctly designed and implemented.

1 There is some flaw in the randomization procedure itself. Some aspect of the randomization –labeling, number selection, or results is completely correct.

0 The randomization is flawed in all three areas –labeling, number selection, and results.

Scoring Guide: 45 – 52 A

36 – 44 B

27 – 35 C

18 – 26 D

Methodology –Administration of Survey

4 The survey is administered according to the stated plan. All those selected in the randomization process actually complete the survey successfully. No evidence of bias is present.

3 The survey is administered almost entirely according to the stated plan. Nearly all of those selected in the randomization process complete the survey successfully. No evidence of bias.

2 The survey is administered almost entirely according to the stated plan, and nearly all of those selected actually complete the survey. Some evidence of bias is present. OR The survey administration deviates from the stated plan in some way that does not introduce bias, but that might impact who completes the survey.

1 Bias has impacted the survey administration to a great extent, but the stated plan was generally followed OR the administration procedure deviated markedly from the stated plan, with some bias.

0 The administration process deviates markedly from the stated plan and bias is noticeable.

Methodology – The Survey

4 Survey questions have all been pre-tested and refined. They are clear and unbiased.

3 Survey questions have all been pre-tested and refined. They are unbiased, but somewhat unclear.

2 Survey questions have been pre-tested, but not completely refined or show some bias.

1 Survey questions have not been pre-tested, but are somewhat clear and relatively unbiased.

0 Survey questions are unclear and show distinct bias.

Data Recording and Summarization

4 Original data provided and summarized in appropriate tabular form. Neat and accurate.

3 Original data provided and summarized in tabular form, but with a minor error in tabulation or sloppy presentation.

2 Either original data is omitted, but the data is summarized neatly and accurately in tabular form OR the original data is presented, and there is a major flaw in the presentation of the data (but not in the accuracy of the tally).

1 Original data is provided, but is not appropriately tabulated OR the original data is omitted but the data is summarized partially correctly in tabular form.

0 Original data is not provided and the data is not tabulated appropriately.

Interpretation

4 The student thoroughly and accurately interprets the meaning of the graphical and numerical summaries in the context of the data. In addition, the student identifies any generalizations that may be drawn about the population from which the sample was drawn.

3 The student interprets the meaning of the graphical and numerical summaries in the context of the data correctly, except for minor errors or omissions. In addition, the student identifies any generalizations that may be drawn about the population from which the sample was drawn.

2 The student accurately interprets the meaning of either the graphical or numerical summaries in the context of the data, but makes serious errors/omissions in interpreting the other.

In addition, the student identifies any generalizations that may be drawn about the target population.

1 The student makes a genuine attempt to interpret both the numerical and graphical summaries, but fails to completely or correctly address either one. The student might also omit generalizations to the target population.

0 The student's interpretation of both the numerical and graphical summaries is inadequate.

Graphical and Numerical Summaries

4 The student has correctly summarized the data using bar graphs/pie charts and counts/proportions/percentages. Graphs and calculations are neat and accurate.

3 The student has correctly summarized the data using bar graphs/pie charts and counts/proportions/percentages, but has made a minor error in either computation or graphing.

2 The student has correctly summarized the data either graphically or numerically, but has made a major error in the other component.

1 The student has used appropriate techniques to summarize the data either graphically or numerically, but has not executed the techniques correctly.

0 Neither the graphical nor the numerical summary is appropriate.

Pitfalls and Extensions

4 The student articulates all pitfalls encountered, and clearly explains how (s)he dealt with each of these obstacles. In addition, the student shares at least one plausible extension of the survey project.

3 The student articulates all pitfalls encountered, and explains how (s)he dealt with each obstacle, though not in a clear manner. In addition, the student shares at least one plausible extension of the survey project.

2 The student articulates some of the pitfalls encountered, and explains how (s)he dealt with some of these obstacles. The student also shares at least one plausible extension of the survey project.

1 The student articulates some pitfalls encountered, but does not explain how (s)he dealt with these obstacles or does not share at least one plausible extension of the survey project.

0 The student does not articulate the obstacles (s)he encountered.

English Mechanics

4 The student's writing is grammatically correct, is punctuated properly, and flows

logically from one point to the next. No spelling mistakes!!

3 The student's writing is grammatically correct, is punctuated properly, and flows logically from one point to the next, except for minor errors in **one** of these categories. No spelling mistakes!!

2 The student has made significant errors in one of the areas: grammar, punctuation, spelling, flow OR minor errors in two areas.

1 The student's writing is flawed in two or three of the areas: grammar, punctuation, spelling, flow.

0 The student's writing is deficient in all four areas: grammar, punctuation, spelling, flow.

Oral Presentation –Content

6 The group accurately presents all key aspects of its survey project, including topic/question, background, methodology, data summary, graphical and numerical analysis, interpretation, and possible pitfalls/extensions. Correct terminology is used throughout and all members participate.

4 Minor errors or omissions are made in discussing the key aspects of the survey project OR the group fails to use appropriate statistical terminology throughout OR imbalanced contributions.

2 Major error in content OR complete failure to use appropriate terminology throughout OR a one person show!

0 A complete disaster-debilitating flaws in content and terminology.

Oral Presentation –Delivery

6 The presentation is clear, well organized and fluent. Visual aids are used to assist the audience in understanding important points.

4 The presentation is generally clear, well organized and fluent. Visual aids are not used adequately OR the delivery interferes at times with understanding of the content.

2 The delivery is not especially clear, well organized, or fluent and/or visual aids are lacking.

0 Delivery destroyed content.