AP® Statistics: Syllabus 3

Syllabus 1058827v1

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SC8	The course teaches students how to use graphing calculators to enhance the development of statistical understanding through exploring data, assessing models, and/or analyzing data.	4, 7–8
SC9	The course teaches students how to use graphing calculators, tables, or computer software to enhance the development of statistical understanding through performing simulations.	6
SC10	The course demonstrates the use of computers and/or computer output to enhance the development of statistical understanding through exploring data, analyzing data, and/or assessing models.	4, 8

Course Description

AP Statistics involves the study of four main areas: exploratory analysis, planning a study, probability, and statistical inference. According to the College Board, upon entering this course students are expected to have mathematical maturity and quantitative reasoning ability. *Mathematical maturity* could be defined as a complete working knowledge of the graphical and algebraic concepts through Math Analysis, including linear, quadratic, exponential, and logarithmic functions. In contrast to many math classes, this course will require reading of the text. This AP Statistics course is taught as an activity-based course in which students actively construct their own understanding of the concepts and techniques of statistics.

Course Text and Supplements

Yates, Dan, David S. Moore, and Daren S. Starnes. *The Practice of Statistics: TI-83/89 Graphing Calculator Enhanced*, 2nd ed. New York: W. H. Freeman & Co., 2002. Including *Student CD-ROM* and *Prep for the AP Exam Guide* supplements.

This AP course relies heavily on students' active engagement in doing statistics with appropriate technological tools throughout the course, including:

- Statistical software, including Microsoft Excel, and the TI-83+ and TI-84 family of graphing calculators. The statistical functions of the graphing calculator will be used daily and extensively for each unit of the course.

Course Projects [SC6 & SC7]

SC6—The course draws connections between all aspects of the statistical process including design, analysis, and conclusions.

SC7—The course teaches students how to communicate methods, results and interpretations using the vocabulary of statistics.

Course projects are in the form of extended *formal* writing assignments. As a consequence, form and technical adequacy are enforced. These assignments are given throughout the year. The main purpose of these course projects is for students to gain strong experience in developing statistical studies and making sound connections and judgments between the design and the results of an experiment.

Example: (Final Project)
Part 1 (1/3 of project grade)
You will revisit the information you collected in your experimental design project. Analyze the data you collected in each project using an appropriate test for inference. Were your original results valid? Were all necessary assumptions for each test met? What can you reasonably conclude from your data?

Part 2 (2/3 of project grade)
You may work alone or with a partner. If you work with a partner, this project will count as two quiz grades. If you work alone, you may choose to count this project as two quiz grades or a test grade. The first task is to decide on an appropriate and interesting question to investigate. Part of answering the question must involve a hypothesis test, confidence interval, and/or regression. You may collect your data via an observational study, a survey, or an experiment. If you choose a study, you must obtain your data through firsthand sources. School surveys must be preapproved by the administration and must be done representatively.

You must use at least 40 pieces of data.
Complete these steps and submit this part of the report before collecting any data:

- Describe the question you wish to investigate.
- Diagram and explain the design of your observational study, survey, or experiment. Include all steps taken to reduce confounding and bias. Describe how you will conduct this study. Be specific about how you will set up and perform all steps.
- Explain the criteria you will use to draw conclusions. Include any assumptions you will need to make. **[SC6 & SC7]**

SC6—The course draws connections between all aspects of the statistical process including design, analysis, and conclusions.

Collect your data as you described in your initial report.

Your final report should include the following:

- Tables and graphical presentations, as appropriate for your study. Clearly label what data are displayed.
- A description of any deviations you made from your initial description of the data-collection process.
- A description of any bias present, even after your attempts to eliminate it.
- An appropriate inference procedure, used to answer the initial question you posed, along with an interpretation of the result.
- Conclusions you are able to draw from this procedure. **[SC6 & SC7]**
- If you worked in a pair, include a list of all the specific duties each partner completed. Each partner is expected to contribute equally to this project.

SC7—The course teaches students how to communicate methods, results and interpretations using the vocabulary of statistics.

Format and Style

The report must have the following attributes:

- It must be word-processed. Use an application such as Equation Editor or Math Type for mathematical expressions, equations, and symbols.
- It must have a cover page that includes all pertinent information.
- All symbols you use must be defined in context. All formulas must be shown and set up.
- Graphs and tables must be neat, labeled, and accurate. Graphs may be either hand drawn or computer generated.
- Do not use or show "Calculator-Speak." (For example: "I then used LinReg L1, L3 to find the equation.")

Content/Skills *A major test will follow each major topic.*	**Approx. Time Frame** *(90 minutes per block)* **SOL, Chapter, Quarter**
Exploration of Data *Graphing and Numerical Distributions* **[SC1]** *The student will:* • Identify the individuals and variables in a set of data. • Identify each variable as categorical or quantitative. • Make and interpret bar graphs, pie charts, dot plots, stem plots, and histograms of distributions of a categorical variable. • Look for overall patterns and skewness in a distribution given in any of the above forms. • Give appropriate numerical measures of center tendency and dispersion. • Recognize outliers. • Compare distributions using graphical methods. • Graphing calculator is used to obtain summary statistics and to include the 5-number summary. **[SC8]** • Spreadsheet software is used to create pie charts and histograms. **[SC10]**	Quarter 1 SOL(s): PS.1, PS.2, PS.3 Chapter Correlation: 1 Time Frame: 5 blocks
The Normal Distribution *Density Curves and the Normal Distribution; Standard Normal Calculations* *The student will:* • Know that areas under a density curve represent proportions. • Approximate median and mean on a density curve. • Recognize the shape and significant characteristics of a normal distribution, including the 68-95-99.7 rule. • Find and interpret the standardized value (z-score) of an observation. • Find proportions above or below a stated measurement given relevant measures of central tendency and dispersion or between two measures. • Determine whether a distribution approaches normality.	Quarter 1 SOL(s): PS.17 Chapter Correlation: 2 Time Frame: 6 blocks

SC1—The course provides instruction in exploring data.

SC8—The course teaches students how to use graphing calculators to enhance the development of statistical understanding through exploring data, assessing models, and/or analyzing data.

SC10—The course demonstrates the use of computers and/or computer output to enhance the development of statistical understanding through exploring data, analyzing data, and/or assessing models.

Examining Relationships *Scatter Plots, Correlation; Least-Squares Regression* *The student will:* • Identify variables as quantitative or categorical. • Identify explanatory and response variables. • Make and analyze scatter plots to assess a relationship between two variables. • Find and interpret the correlation *r* between two quantitative variables. • Find and analyze regression lines. • Use regression lines to predict values and assess the validity of these predictions. • Calculate residuals and use their plots to recognize unusual patterns.	Quarter 1 SOL(s): PS.4, PS.5 Chapter Correlation: 3 Time Frame: 6 blocks
Two-Variable Data *Transformation of Relationships; Cautions About Correlation and Regression; Relations in Categorical Data* *The student will:* • Recognize exponential growth and decay. • Use logarithmic transformations to model a linear pattern, use linear regression to find a prediction equation for the linear data, and transform back to a nonlinear model of the original data. • Recognize limitations in both *r* and least-squares regression lines due to extreme values. • Recognize lurking variables. • Explain the difference between correlation and causality. • Find marginal distributions from a two-way table. • Describe the relationship between two categorical variables using percents. • Recognize and explain Simpson's paradox.	Quarter 1 SOL(s): PS.6, PS.7 Chapter Correlation: 4 Time Frame: 6 blocks
Production of Data *Designing Samples; Designing Experiments; Simulating Experiments* **[SC2 & SC3]** *The student will:* • Identify populations in sampling situations. • Identify different methods of sampling, strengths and weaknesses of each, and possible bias that might result from sampling issues. • Recognize the difference between an observational study and an experiment. • Design randomized experiments. • Recognize confounding of variables and the placebo effect, explaining when double-blind and block design would be appropriate. • Explain how to design an experiment to support cause-and-effect relationships.	Quarter 1 SOL(s): PS.8, PS.9, PS.10 Chapter Correlation: 5 Time Frame: 5 blocks

SC2—The course provides instruction in sampling.

SC3—The course provides instruction in experimentation.

Probability *Idea of Probability; Probability Models; General Probability Rules* **[SC4]** *The student will:* • Describe and generate sample spaces for random events. • Apply the basic rules of probability. • Use multiplication and addition rules of probability appropriately. • Identify disjointed, complementary, and independent events. • Use tree diagrams, Venn diagrams, and counting techniques in solving probability problems.	Quarter 1 SOL(s): PS.11, PS.12, PS.13 Chapter Correlation: 6 Time Frame: 7 blocks
Random Variables *Discrete and Continuous Random Variables, Means, and Variances of Random Variables* **[SC4]** *The student will:* • Recognize and define discrete and continuous variables. • Find probabilities related to normal random variables. • Calculate mean and variance of discrete random variable. • Use simulation methods using the graphing calculator and the law of large numbers to approximate the mean of a distribution. **[SC9]** • Use rules for means and rules for variances to solve problems involving sums, differences, and linear combinations of random variables.	Quarter 1 SOL(s): PS.16 Chapter Correlation: 7 Time Frame: 7 blocks
Binomial and Geometric Distributions *Binomial Distributions; Geometric Distributions* *The student will:* • Verify four conditions of a binomial distribution: two outcomes, fixed number of trials, independent trials, and the same probability of success for each trial. • Calculate cumulative distribution functions, cumulative distribution tables and histograms, and means and standard deviations of binomial random variables. • Use a normal approximation to the binomial distribution to compute probabilities. • Verify four conditions of a geometric distribution: two outcomes, the same probability of success for each trial, independent trials, and the count of interest must be the number of trials required to get the first success. • Calculate cumulative distribution functions, cumulative distribution tables and histograms, and means and standard deviations of geometric random variables.	Quarter 1 SOL(s): PS.14, PS.15 Chapter Correlation: 8 Time Frame: 3 blocks

SC4—The course provides instruction in anticipating patterns.

SC9—The course teaches students how to use graphing calculators, tables, or computer software to enhance the development of statistical understanding through performing simulations.

Sampling Distributions *Sampling Distributions; Sample Proportions; Sample Means* **[SC4]** *The student will:* • Identify parameters and statistics in a sample. • Interpret a sampling distribution, including bias and variability and how to influence each. • Recognize when a problem involves a sample proportion. • Analyze problems involving sample proportions, including using the normal approximation to calculate probabilities. • Recognize when a problem involves sample means. • Analyze problems involving sample means and understand how to use the central limit theorem to approximate a normal distribution.	Quarter 2 SOL(s): PS.20 Chapter Correlation: 9 Time Frame: 6 blocks
Introduction to Inference *Estimating with Confidence, Tests of Significance, Interpreting Statistical Significance; Inference as Decision* **[SC5]** *The student will:* • Describe confidence intervals and use them to determine sample size. • State null and alternative hypotheses in a testing situation involving a population mean. • Calculate the one-sample z statistics and p-value for both one-sided and two-sided tests about the mean μ using the graphing calculator. **[SC8]** • Assess statistical significance by comparing values. • Analyze the results of significance tests. • Explain Type I error, Type II error, and power in significance testing.	Quarter 2 SOL(s): PS.18 Chapter Correlation: 10 Time Frame: 6 blocks
Inference for Distributions *Inference for the Mean of a Population; Comparing Two Means* *The student will:* • Recognize when inference about a mean or comparison of two means is necessary. • Perform and analyze a one-sample t test to hypothesize a population mean and discuss the possible problems inherent in the test. • Perform and analyze a two-sample t test to compare the difference between two means and discuss the possible problems inherent in the test. • Use the graphing calculator to obtain confidence intervals and test hypotheses. **[SC8]**	Quarter 2 SOL(s): PS.18, PS.21 Chapter Correlation: 11 Time Frame: 5 blocks

SC4—The course provides instruction in anticipating patterns.

SC5—The course provides instruction in statistical inference.

SC8—The course teaches students how to use graphing calculators to enhance the development of statistical understanding through exploring data, assessing models, and/or analyzing data.

Inference for Proportions *Inference for a Population Proportion; Comparing Two Proportions* **[SC5]** *The student will:* • Recognize whether one-sample, matched pairs, or two-sample procedures are needed. • Use the z procedure to test significance of a hypothesis about a population proportion. • Use the two-sample z procedure to test the hypothesis regarding equality of proportions in two distinct populations. • Use the graphing calculator to obtain confidence intervals and test hypotheses. **[SC8]**	Quarter 2 SOL(s): PS.18, PS.19 Chapter Correlation: 12 Time Frame: 5 blocks
Inference for Tables *Test for Goodness of Fit; Inference for Two-Way Tables* **[SC5]** *The student will:* • Choose the appropriate chi-square procedure for a given situation. • Perform chi-square tests and calculate the various relevant components. • Interpret chi-square test results obtained from computer output. **[SC10]**	Quarter 2 SOL(s): PS.19 Chapter Correlation: 13 Time Frame: 4 blocks
Inference for Regression *Inference About the Model, Predictions, and Conditions* **[SC5]** *The student will:* • Recognize when linear regression inference is appropriate for a set of data. • Interpret the meaning of a regression for a given set of data. • Interpret the results of computer output for regression. **[SC10]**	Quarter 2 SOL(s): PS.5 Chapter Correlation: 14 Time Frame: 3 blocks
AP Exam Review	Quarter 2 Chapter Correlation: All Time Frame: 4 blocks
Analysis of Variance *Inference for Population Spread; One-Way Analysis of Variance* *The student will:* • Recognize the meaning and appropriateness of comparing means using ANOVA. • Interpret the meaning of an ANOVA result and its corresponding components.	Quarter 2 Chapter Correlation: 15 Time Frame: 5 Blocks
Final Project ***See example under Course Projects.***	Quarter 2 Chapter Correlation: All Time Frame: 6 Blocks

SC5—The course provides instruction in statistical inference.

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