AP® Statistics

Course Description

AP* Statistics involves the study of four main areas: exploring data, sampling and experimentation, anticipating patterns, and statistical inference. According to the College Board, upon entering this course students are expected to have successfully completed a second-year course in algebra and possess sufficient mathematical maturity and quantitative reasoning ability. Students are expected to have a complete working knowledge of graphical and algebraic concepts, including linear, quadratic, exponential, and logarithmic functions. This course will require regular reading of the text. The AP Statistics course consistently engages students in constructing their own knowledge and includes the use of technology, projects, laboratories, cooperative group problem solving, and writing. Students will regularly build interdisciplinary connections with other subjects and with their world outside of school.

Course Materials

Students will use statistical software, including Microsoft Excel, ActivStats, and TI-83+ and TI-84 family of graphing calculators. Each chapter in the text has a section on calculator usage (when applicable) to give students instruction and practice using the statistical capabilities of their calculators. Statistical output is available in the text and used throughout the course for practice and on assessment items and projects.

Primary Text

Bock, Velleman, & De Veaux. *Stats: Modeling the World*. 3rd ed., AP ed., Pearson Education, Inc., 2010, with *ActivStats (for Data Desk)*.

References and Resource Materials

FR Selected AP Statistics Exam free-response questions are used throughout the course.

OTH Other resource materials: newspapers, select journals, and the World Wide Web.

PS Starnes, Yates, and Moore. *The Practice of Statistics*, preliminary 4th ed. New York: W.H. Freeman and Company, 2010. ISBN-13: 978-1-4292-6179-1.

SDA Peck, Olsen, and Devore. *Introduction to Statistic and Data Analysis,* 3rd ed. Belmont, California, Cengage Brooks/Cole, 2008. ISBN-13: 978-0-495-11873-2.

STA Starnes, Yates, and Moore. *Statistics Through Applications*, 2nd ed. New York: W.H. Freeman and Company, 2011. ISBN-13: 9-781-4292-1974-7.

TPS Carroll, Carver, Peters, and Ricks. *Pearson Education AP* Test Prep: Statistics for Stats: Modeling the World* 3rd ed. Boston: Addison-Wesley, 2010. ISBN-13: 978-0-13-135964-2.

WS Rossman, Chance, and Oehsen. *Workshop Statistics: Discovery with Data and the Graphing Calculator*. John Wiley & Sons, Inc., 2008. ISBN-13 978-0-470-413869.

Course Projects

Course projects are a major part of the course. Students will complete 4 – 8 projects throughout the year. Some of these projects are completed during class time while others are completed outside of class. These projects require students to design surveys and experiments, gather data, analyze the data numerically and graphically, and apply inferential statistics to draw conclusions for a population. Students will write formal reports on their projects using statistical language. Student projects are assigned as a major and formal assignment in the second semester. Students must, in stages: (a) plan the sampling procedure, (b) clearly define their measurement strategy, (c) anticipate confounding variables in the case of experiments and issues of bias in an observational study (d) suggest their statistical analysis at the planning stage, (e) conduct their analysis, (f) interpret their results in context, and (g) present their results. Both a written report and a short question-and-answer in front of the class are required.

For example: (Final Project)

At the completion of Unit III, you each completed an experimental design project. You will revisit the information you collected in this project. Analyze the data you collected using an appropriate test for inference. Determine if your original results were valid. Determine if all necessary assumptions for each test were met. Determine what you can reasonably conclude from your data.

Next, either alone or with a partner, you are to choose an appropriate and interesting question to investigate. This question can either come from the list of teacher-approved questions or you may create your own and have it approved. 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 approved by administration and must be done representatively. You must use at least 50 pieces of data. The following steps must be taken and a report written and submitted before collecting any data:

1. Describe the question you wish to investigate (and possibly include why you are interested in that topic)
2. 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!
3. Explain the criteria you will use to draw conclusions. Include any assumptions you will need to make.

Once this report is submitted and approved, collect your data as you described in your initial report. Your final report should include (but is not limited to) 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 – as always IN CONTEXT!!!
- If you worked with a partner, include a list of all the specific duties each partner completed. Each partner is expected to contribute equally to this project.

All reports should be word-processed. An application such as Equation Editor should be used for mathematical expressions, equations, and symbols. Your report should have a cover page with your name, the title of your report, the class and period, the teacher name, and date. All symbols you use must be defined in context and all formulas must be shown and set up. Graphs and tables must be neat, labeled, and accurate. Graphs may be hand-drawn but computer-generated is preferred. Finally, do not use or show "Calculator Speak." (For example: "I then used LinReg L_1, L_2 to find the equation.") A rubric will be provided for further clarification of what is expected.

Quarter 1 (approximately 45 days)

Approx. # of Days	*Topics*	*AP Statistics Course Topic Outline*	*Assignments/ Resources*
1	Course Overview, Policies & Expectations, Text Distribution		Read syllabus, cover book, read Chapter 1: Stats Start Here
3	Westvaco Discrimination Case: Introduction to Statistics Activity (introduction to the ideas of statistical thinking)	• Exploratory Data Analysis • Statistical Inference	Complete Westvaco Discrimination Case Activity & Read Chapter 2: Data
4	Chapter 2: Data Data are information in context, categorical or quantitative variables, and identifying the context	• Exploring Data	Chapter 2 Exercises: #1, 3, 5 or 6, 7, 14, 11, 15, 24, 17, 22 OTH – students find a current newspaper or online article in which data are reported Chapter 2 Quiz
5	Chapter 3: Displaying and Describing Categorical Data Frequency tables, the Area Principle, bar charts, pie charts, contingency tables, conditional distributions, segmented bar charts	• Exploring Categorical Data (Frequency tables and bar charts, marginal and joint frequencies for two-way tables, conditional relative frequencies and association, comparing distributions using bar charts	Chapter 3 Exercises: #1, 2, 5 – 9, 11, 13, 14, 19, 24, 30 Classwork: Smoking and Education Data Study OTH – students find a current newspaper or online article in which categorical data are reported

			Chapter 3 Quiz
4	Chapter 4: Displaying and Summarizing Quantitative Data Histograms, stem-and-leaf displays, dotplots, shape, center, spread, 5-number summary, mean, median, standard deviation Graphing calculator is used to obtain summary statistics, to include the 5-number summary. Spreadsheet software is used to create pie charts and histograms.	• Center and spread, clusters and gaps, outliers and other unusual features, shape, measuring center: median, mean, measuring spread: range, interquartile range, standard deviation, measuring position: quartiles, percentiles, standardized scores (z-scores), comparing center and spread: within group between group variation	Chapter 4 Exercises: #1, 2, 4-8, 10, 12, 13, 15, 30, 43 OTH – students find a current newspaper or online article in which categorical data are reported Investigative Task: Dollars for Students How Many Text Messages? (STA) Chapter 4 Quiz
4	Chapter 5: Understanding and Comparing Distributions Boxplots, 5-number summaries, comparing groups with histograms and boxplots, outliers, timeplots, re-expressing data (a first look)	• Center and spread, outliers and other unusual features, using boxplots, comparing center and spread: within group, between group variation, comparing clusters and gaps, comparing outliers and other unusual features, comparing shapes	Chapter 5 Exercises: #1, 3, 5, 7, 11, 13, 17, 18, 21, 22, 26, 33, 34, 36 Investigative Task: Auto Safety OTH – students find a current newspaper, magazine or online article that compares two or more groups of data Chapter 5 Quiz Hurricane Katrina/Ozone – importance of outliers

5	Chapter 6: The Standard Deviation as a Ruler and the Normal Model Standard deviation, standardizing with z-scores, shifting data, rescaling data, 68-95-99.7 rule, working with Normal models, finding Normal percentiles, Normal probability plot	• Measuring position: quartiles, percentiles, standardized scores (z-scores), the effect of changing units on summary measures, properties of the normal distribution, using tables of the normal distribution, the normal distribution as a model for measurements	Chapter 6 Exercises: #1 – 12, 17-20, 23, 25, 26, 28, 32, 35, 38, 42 Investigative Task: Normal Models TI-83 use for Normal distributions Chapter 6 Quiz Dear Abby and the Length of a Pregnancy Activity
3	Review of Unit 1 (Chapters 1 – 6): Exploring and Understanding Data Unit 1 Test	• As stated above	Review Exercises & Unit Test FR - Selected AP Statistics Exam free-response questions will be administered
4	Chapter 7: Scatterplots, Association, and Correlation Scatterplots, variables, correlation, correlation ≠ causation, straightening scatterplots	• Analyzing patterns in scatterplots, correlation and linearity	Chapter 7 Exercises: #1, 3, 5, 8, 11, 13, 18, 24, 25, 26, 41 Chapter 7 Quiz
6	Chapter 8: Linear Regression Residuals, least squares line, correlation, regression to the mean, regression line, residuals, variation	• Least-squares regression line, residual plots, outliers, and influential points	Chapter 8 Exercises: #1-11, 16, 20 – 22, 27-29, 37 Chapter 8 Quiz Class Activity: Distance and Ticket

	Interpret the results of computer output for regression.		Price Investigative Task: Smoking Tracks of a Killer Lab
3	Chapter 9: Regression Wisdom Analyzing residuals, sifting residuals for groups, subsets, extrapolation, outliers, leverage, influence, lurking variables and causation, summary values	• Residual plots, outliers, and influential points	Chapter 9 Exercises: #1, 2, 5-8, 11, 12, 15, 16, 18, 20, 21, 25 Class Activity: The Wandering Point Chapter 9 Quiz
5	Chapter 10: Re-expressing Data: Get it Straight! Goals of re-expression, the ladder of powers, logarithms	• Transformations to achieve linearity: logarithmic and power transformations	Chapter 10 Exercises: #1-3, 5-7, 12, 15, 17, 27 Investigative Task: Alligators Chapter 10 Quiz PS: Life Insurance Premiums Exploration
3	Unit 2 Review (Chapters 7 – 11) Exploring Relationships Between Variables	• As stated above	Review Exercises & Unit Test FR - Selected AP Statistics Exam free-response questions will be administered

Quarter 2 (approximately 45 days)

Approx. # of Days	*Topics*	*AP Statistics Course Topic Outline*	*Assignments/ Resources*
3	Chapter 11: Understanding Randomness Simulations	Simulation of random behavior and probability distributions, simulation of sampling distributions	Chapter 11 Exercises: #1, 6, 8, 9, 15-19, 25, 28, 31, 36, 39 Chapter 11 Quiz Draft Lottery – understanding the importance of randomness
5	Chapter 12: Sample Surveys Randomizing, sample size, census, populations, parameters, simple random samples, stratified sampling, cluster sampling, multistage sampling, systematic samples, pilot, bias	Census, sample survey, characteristics of a well-designed and well-conducted survey, populations, samples, and random selection, sources of bias in surveys, sampling methods	Chapter 12 Exercises: 1-4, 8, 9, 21, 23 Chapter 12 Quiz In-Class Activity: Random Rectangles Sampling Experimental Design: Rolling Down the River sampling project
4	Chapter 13: Experiments and Observational Studies Observational studies, randomized, comparative experiments, principles of experimental design, diagrams,	Experiment, observational study, characteristics of a well-designed and well-conducted experiment, treatments, control groups, experimental units, random assignments, and replication, sources of bias and confounding,	Chapter 13 Exercises: #1, 2, 4, 18, 19, 36, 40 Chapter 13 Quiz FR - Selected AP Statistics Exam

	statistical significance, samples, control treatments, blinding, placebos, blocking, factors, lurking and confounding variables	including placebo effect and blinding, completely randomized design, randomized block design, including matched pairs design	free-response questions will be administered WS: Reducing Cold Durations
3	Unit 3: Gathering Data Review & Test (Unit 3: Chapters 11, 12, & 13)	As stated above	Unit 3 Review Exercises and Test Project: Experimental Design
3	Chapter 14: From Randomness to Probability Random phenomena, trials, outcomes, events, sample space, Law of Large Numbers, "Law of Averages", probability, addition rule, disjoint, multiplication rule, independent events	Interpreting probability, including long-run relative frequency interpretation, "Law of large numbers" concept, addition rule, multiplication rule, conditional probability, and independence, mean (expected value) and standard deviation of a random variable, and linear transformation of a random variable	Chapter 14 Exercises: #3, 6, 11, 13, 16, 17, 18, 31, 33 Chapter 14 Quiz M&M's project
5	Chapter 15: Probability Rules! General addition rule, contingency tables and probability, conditional probability, general multiplication rule, independent events, disjoint events, tables and conditional probability, probability with and without replacement, tree diagrams, reversing the conditioning, Bayes's Rule	Addition rule, multiplication rule, conditional probability, and independence	Chapter 15 Exercises: #1-10, 13, 32, 34, 41 Chapter 15 Quiz

3	Chapter 16: Random Variables Random variables, discrete random variables, probability model, expected value, standard deviation, variance, continuous random variables	Discrete random variables and their probability distributions, including binomial and geometric, simulation of random behavior and probability distributions, notion of independence versus dependence, mean and standard deviation for sums and differences of independent random variables	Chapter 16 Exercises: #1-10, 15, 17-20, 25, 26, 38 Chapter 16 Quiz SDA: Hand-holding Couples
4	Chapter 17: Probability Models Geometric probability model, Bernoulli trials, the 10% condition, binomial model, binomial probability, success/failure condition, continuous random variables	Discrete random variables and their probability distributions, including binomial and geometric, simulation of random behavior and probability distributions	Chapter 17 Exercises: #1, 3, 4, 9, 15, 16, 17, 23, 38, 39 Chapter 17 Quiz
7	Unit IV test, Midterm Review and midterm exams	Midterm covers units I through IV (objectives stated above)	

Quarter 3 (approximately 45 days)

Approx. # of Days	*Topics*	*AP Statistics Course Topic Outline*	*Assignments/ Resources*
4	Chapter 18: Sampling Distribution Models Central limit theorem for sample proportions, sampling distribution, sampling distribution model, sampling error and variability, independence assumption, sample size assumption, randomization condition, 10% condition, success/failure condition, sampling distribution model for a proportion, simulating the sampling distribution of a mean, Central Limit Theorem	Sampling distribution of a sample proportion, sampling distribution of a sample mean, Central Limit Theorem, simulation of sampling distributions, properties of point estimators, including unbiasedness and variability	Chapter 18 Exercises: #2, 5, 6, 8, 9, 12, 16, 18, 29, 37, 39 Investigative Task: Simulated Coins Chapter 18 Quiz Labs: Coin Ages, German Tank Problem STA: Reese's Pieces Activity WS: College Football Scores
3	Chapter 19: Confidence Intervals for Proportions Confidence interval, standard error, one-proportion z-interval, margin of error, critical values, independence assumption, randomization condition, 10% condition, sample size assumption, success/failure condition Graphing calculator is used to obtain confidence intervals and test	Estimating population parameters and margins of error, properties of point estimators, including unbiasedness and variability, logic of confidence intervals, meaning of confidence level and confidence intervals, and properties of confidence intervals, large sample confidence interval for a proportion	Chapter 19 Exercises: #1, 3, 5, 7, 9, 13, 14, 17, 26, 35 Chapter 19 Quiz Reese's Pieces & confidence intervals

	hypotheses.		
2	Chapter 20: Testing Hypotheses about Proportions Hypotheses, null hypothesis, success/failure condition, P-values, alternative hypothesis, one-proportion z-test, two-sided (tailed) alternative, one-sided (tailed) alternative	Logic of significance testing, null and alternative hypotheses; p-values; one- and two-sided tests; concepts of Type I and Type II errors; concept of power, large sample test for a proportion	Chapter 20 Exercises: #1-4, 8, 9, 12, 14, 17, 22 Chapter 20 Quiz
3	Chapter 21: More about Tests and Intervals Null and alternative hypotheses, one-sided or two-sided alternatives, thinking about p-values, alpha levels, statistically significant, significance level, confidence intervals, hypothesis tests, success/failure condition, Type I and Type II errors, power of a test, effect size	Logic of significance testing, null and alternative hypotheses; p-values; one- and two-sided tests; concepts of Type I and Type II errors; concept of power	Chapter 21 Exercises: #1, 3, 4, 7, 14, 21, 25 Investigative Task: Life After High School? Chapter 21 Quiz Tests of Significance Checklist SDA: Concussions in Collegiate Sports
2	Chapter 22: Comparing Two Proportions The standard deviation of the difference between two proportions, assumptions and conditions, the sampling distribution model for a difference between two independent proportions,	Sampling distribution of a difference between two independent sample proportions, estimating the population parameters and margins of error, large sample confidence interval for a difference between two proportions, large sample test for a difference between two parameters	Chapter 22 Exercises: #1, 4, 5, 11, 14, 18, 23, 25 Chapter 22 Quiz WS: Kissing Couples

	pooling, two-proportion z-test		
2	Unit V Review and Test (Unit V covers chapters 18 – 22)		FR - Selected AP Statistics Exam free-response questions will be administered
3	Chapter 23: Inferences About Means The central limit theorem, Gosset's t, student's t, degrees of freedom, sampling distribution model for means, one-sample t-interval for the mean, finding t-model probabilities and critical values on TI, assumptions and conditions, one-sample t-test for the mean, significance and importance, intervals and tests, fail to reject, sample size,	Estimating population parameters and margins of error, properties of point estimators, including unbiasedness and variability, confidence interval for a mean, test for a mean	Chapter 23 Exercises: #1-4, 6, 8, 10, 14, 19, 22, 23, 29, 32 Chapter 23 Quiz Investigative Task: SAT Performance PS: Activity: Penny for your Thoughts
2-3	Chapter 24: Comparing Means Plotting data, comparing two means, two-sample t-interval, two-sample t-test, sampling distribution for the difference between two means, assumptions and conditions, two-sample t-interval for the difference between means, two-sample t-test for the difference between means, pooled t-test (for the difference between means), equal variance assumption, similar spreads condition, pooled t-test and confidence interval for means	Sampling distribution of a difference between two independent sample means, estimating population parameters and margins of error, confidence interval for a difference between two means (unpaired and paired), test for a difference between two means (unpaired and paired)	Chapter 24 Exercises: #1, 7, 12, 15, 17, 22, 27, 36 Chapter 24 Quiz Investigative Task: SAT Performance (continued) WS: Cars' Fuel Efficiency

5	Chapter 25: Paired Samples and Blocks Paired data, paired t-test, assumptions and conditions, confidence intervals for matched pairs, paired t-interval formula, effect size, blocking	Estimating population parameters and margins of error, confidence interval for a difference between two means (unpaired and paired), test for a difference between two means (unpaired and paired)	Chapter 25 Exercises: #2, 3, 4, 16, 17, 20, 26, 28 Chapter 25 Quiz
5	Unit VI Review: Learning About the World (Chapters 23 – 25) Unit VI Test Group Inference Project	As stated above.	Group Inference Project
3	Chapter 26: Comparing Counts Goodness of fit, assumptions and conditions, chi-square statistic, chi-square models, one-sided or two-sided, the chi-square calculation, chi-square test of homogeneity, standardized residuals, chi-square components, contingency tables, chi-square test for independence, chi-square and causation Interpret chi-square test results obtained from computer output.	Chi-square distribution, chi-square test for goodness of fit, homogeneity of proportions, and independence (one- and two-way tables)	Chapter 26 Exercises: #1, 3, 4, 6, 10, 13, 23, 25, 33 Chapter 26 Quiz Investigative Task: ’97 AP Stat Scores STA: Return of the M&M’s
2	Unit VI Test Review & Chapter 8 regression concepts review (in preparation for final chapter)	As stated above.	FR - Selected AP Statistics Exam free-response questions will be administered

4	Chapter 27: Inferences for Regression Conditions for inference in regression (and checks for some of them), residual standard deviation, t-test for the regression slope, confidence interval for the regression slope	Estimating population parameters and margins of error, confidence interval for the slope of a least-squares regression line, test for the slope of a least-squares regression line	Chapter 27 Exercises: #2, 3, 5, 13, 15, 17, 19, 24, 29, 41 Chapter 27 Quiz Correlation & Regression Review Classwork: Regression Inference – Electricity
3	Unit VII Review and Test	As stated above	Unit VII Review Unit VII Test

Quarter 4 (approximately 45 days)

Approx. # of Days	*Topics*	*AP Statistics Course Topic Outline*	*Assignments/ Resources*
As needed	Preparing for the AP Statistics Exam Final Project		Preparing for the AP Exam: students will complete practice examinations and scoring of the exam is discussed. TPS – four practice tests will be administered and discussed.
After the test: Chapters 28 Analysis of Variance and Chapter 29 Multiple Regression will be covered. Also, a final exam will be administered.			