AP Statistics

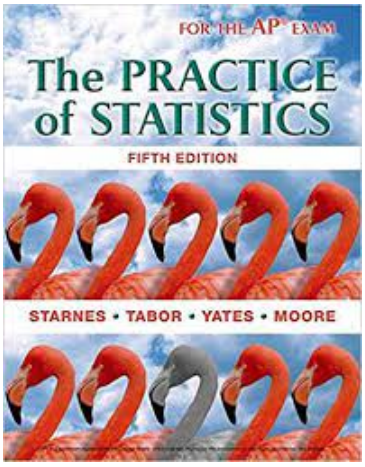
Description

This AP Statistics course introduces students to the major concepts and tools for collecting, analyzing, and drawing conclusions from data. There are four themes evident in the content, skills, and assessment in this course: exploring data, sampling and experimentation, probability and simulation, and statistical inference. 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. Students use technology, investigations, problem solving, and writing as they build conceptual understanding. This class will be using the resources provided from Math Medic (previously Stats Medic) which is approved by AP College Board.

Prerequisites

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 Algebra 2 and/or Pre-Calculus, including linear, quadratic, exponential, and logarithmic functions. In contrast to many math classes, this course will require reading of the text. It's extremely important that the student seek immediate assistance if they feel uncomfortable with the required mathematical skills.

Materials Needed



1. A large 3-ring binder for notes & handouts
2. College Statistics Textbook
3. A scientific calculator, preferably a graphing calculator
4. Red pen (recommended PaperMate Flair), pen and/or pencil

Topics

1. Exploring One Variable Data
2. Exploring Two Variable Data
3. Collecting Data
4. Probability, Random Variables, and Probability Distributions
5. Sampling Distributions
6. Inference for Categorical Data: Proportions
7. Inference for Quantitative Data: Means
8. Inference for Categorical Data: Chi-Square
9. Inference for Qualitative Data: Slopes

Additional details may be obtained from the AP College Board website by viewing the curriculum for AP Statistics at: http://apcentral.collegeboard.com

Rules of the Class

1. Be respectful to your classmates, the teacher, and all equipment
2. Follow directions the first time you are told
3. Come to class on time and prepared to learn
4. Cell phones are to stay in your backpack
5. All other Xavier High School rules apply

Attendance

Students are expected to attend school daily, and be **on time** for class. If a student is absent from class without a valid excuse or leaves class without the teacher's permission, he/she is considered unexcused. Students are expected to follow all attendance guidelines written in the Xavier student handbook.

Class Framework

Students will have the opportunity to meet the learning objectives in a variety of ways and to apply their knowledge to real world experiences and societal issues. Instructional time involves a variety of student-centered activities such as student-led discussions, class demonstrations, and lab work. Students also will have the opportunity to work cooperatively to solve challenging problems and to present their solutions to the class. Outside of class students read the assigned text, analyze/draw conclusions based on collected laboratory data and complete homework assignments that support and reinforce each lesson as well as what has been learned in the lab. Quizzes will be used to help the student access their understanding of the more challenging standards and will be based on previous homework assignments. A summative exam will be given at the end of each unit.

Homework

It is expected that you will do the problems that are assigned. The problems that are selected are designed to show you the different levels of questions that could be asked. There will be some basic questions about the day's topic, then some that ask you to apply it, and a few that require you to think critically and go a step beyond. Homework will NOT be collected or graded but will be checked for participation randomly throughout the year. An incomplete assignment means you are unable to participate in a class or group discussion about the questions.

If you have a few problems on an assignment that you did not understand or got wrong, DON'T PANIC. There will be ample time in class for you to ask questions before the quiz. However, it is your responsibility to ask questions if you don't understand how to do something.

Assessment

The students are assessed through quizzes and tests with the possibility of a project to apply information to a "real-world" situation. The quiz and test questions are modeled after questions from past AP® Statistics Exams and are written to give the students the opportunity to express their knowledge graphically, analytically, as well as using written explanations. The projects are assessed by the quality of their solution and also the quality of how they communicated their solution. If a student is absent on the day of an assessment, the student is expected to make up test or quiz the day the student returns to school. No assessments will be given before the scheduled date (ie, before a student leaves for planned absence).

Grading Criteria

Grades will be weighted in approximately the following percentages: Quizzes 30%, Tests 70%. These weights are subject to change based upon actual assignments. Participation in class and on homework assignments will be used to determine final grade rounding.

Xavier AP Grading Scale

95-100%	A+	65-69%	C
85-94%	A	60-64%	CD
75-84%	B	57-59%	D
70-74%	BC	0-56%	F

Extra Support

The class Google Site has links to helpful video channels for explanations on the topics. Mrs Dumke is available before and after school every day and also during x-period on Tuesdays & Thursdays to answer questions.

Learning Targets

Exploration of Data
Graphing and Numerical Distributions
The student will:
* Identify the individuals and variables in a set of data.
* Classify variables as categorical or quantitative.
* Calculate and display the marginal distribution of a categorical variable from a two-way table.
* Calculate and display the conditional distribution of a categorical variable for a particular value of the other categorical variable in a two-way table.
* Describe the association between two categorical variables by comparing appropriate conditional distributions.
* Make and interpret dotplots and stemplots of quantitative data.
* Describe the overall pattern (shape, center, and spread) of a distribution and identify any major departures from the pattern (outliers).
* Identify the shape of a distribution from a graph as roughly symmetric or skewed.
* Compare distributions of quantitative data using dotplots or stemplots.
* Make and interpret histograms of quantitative data.
* Compare distributions of quantitative data using histograms.
* Calculate measures of center (mean, median).
* Calculate and interpret measures of spread (range, *IQR*).
* Choose the most appropriate measure of center and spread in a given setting.
* Identify outliers using the 1.5×*IQR* rule.
* Make and interpret boxplots of quantitative data.
* Calculate and interpret measures of spread (standard deviation).
* Choose the most appropriate measure of center and spread in a given setting.
* Use appropriate graphs and numerical summaries to compare distributions of quantitative variables
* Graphing calculator is used to obtain summary statistics and to include the 5-number summary. Recognize outliers.
* Spreadsheet software is used to create pie charts and histograms.

The Normal Distribution
Density Curves and the Normal Distribution; Standard Normal Calculations
The student will:
* Find and interpret the percentile of an individual value within a distribution of data.
* Estimate percentiles and individual values using a cumulative relative frequency graph.
* Find and interpret the standardized score (*z*-score) of an individual value within a distribution of data.
* Describe the effect of adding, subtracting, multiplying by, or dividing by a constant on the shape, center, and spread of a distribution of data.
* Estimate the relative locations of the median and mean on a density curve.

* Use the 68–95–99.7 rule to estimate areas (proportions of values) in a Normal distribution.
* Use technology to find (i) the proportion of *z*-values in a specified interval, or (ii) a *z*-score from a percentile in the standard Normal distribution.
* Determine if a distribution of data is approximately Normal from graphical and numerical evidence.

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.

Two-Variable Data
Transformation of Relationships; Cautions About Correlation and Regression; Relations in Categorical Data
The student will:
*Identify explanatory and response variables in situations where one variable helps to explain or influences the other.
* Make a scatterplot to display the relationship between two quantitative variables.
* Describe the direction, form, and strength of a relationship displayed in a scatterplot and recognize outliers in a scatterplot.
* Interpret the correlation.
* Understand the basic properties of correlation, including how the correlation is influenced by outliers.
* Use technology to calculate correlation.
* Explain why association does not imply causation.
* Interpret the slope and *y* intercept of a least-squares regression line.
* Use the least-squares regression line to predict *y* for a given *x*.
* Explain the dangers of extrapolation.
* Calculate and interpret residuals.
* Explain the concept of least squares.
* Determine the equation of a least-squares regression line using technology.
* Construct and interpret residual plots to assess if a linear model is appropriate.
* Interpret the standard deviation of the residuals and r^2 and use these values to assess how well the least-squares regression line models the relationship between two variables.
* Determine the equation of a least-squares regression line using computer output.
* Describe how the slope, *y* intercept, standard deviation of the residuals, and r^2 are influenced by outliers.
* Find the slope and *y* intercept of the least-squares regression line from the means and standard deviations of *x* and *y* and their correlation.

Production of Data
Designing Samples; Designing Experiments; Simulating Experiments
The student will:
* Identify the population and sample in a statistical study.
* Identify voluntary response samples and convenience samples. * Explain how these sampling methods can lead to bias.
* Describe how to obtain a random sample using slips of paper, technology, or a table of random digits
* Distinguish a simple random sample from a stratified random sample or cluster sample. Give the advantages and disadvantages of each sampling method.
* Explain how undercoverage, nonresponse, question wording, and other aspects of a sample survey can lead to bias.
*Distinguish between an observational study and an experiment.
* Explain the concept of confounding and how it limits the ability to make cause-and-effect conclusions
* Identify the experimental units, explanatory and response variables, and treatments.
* Explain the purpose of comparison, random assignment, control, and replication in an experiment.
* Describe a completely randomized design for an experiment, including how to randomly assign treatments using slips of paper, technology, or a table of random digits.
* Describe the placebo effect and the purpose of blinding in an experiment.
* Interpret the meaning of statistically significant in the context of an experiment.
* Explain the purpose of blocking in an experiment.
* Describe a randomized block design or a matched pairs design for an experiment.
* Describe the scope of inference that is appropriate in a statistical study.

Probability

Idea of Probability; Probability Models; General Probability Rules
The student will:
* Interpret probability as a long-run relative frequency
* Use simulation to model chance behavior.
* Determine a probability model for a chance process.
* Use basic probability rules, including the complement rule and the addition rule for mutually exclusive events.
* Calculate and interpret conditional probabilities.
* Use the general multiplication rule to calculate probabilities.
* Use tree diagrams to model a chance process and calculate probabilities involving two or more events
* Determine whether two events are independent.
* When appropriate, use the multiplication rule for independent events to compute probabilities.

Random Variables
Discrete and Continuous Random Variables, Means, and Variances of Random Variables
The student will:
* Compute probabilities using the probability distribution of a discrete random variable.
* Calculate and interpret the mean (expected value) of a discrete random variable.
* Calculate and interpret the standard deviation of a discrete random variable.
* Compute probabilities using the probability distribution of a continuous random variable.
* Describe the effects of transforming a random variable by adding or subtracting a constant and multiplying or dividing by a constant.
* Find the mean and standard deviation of the sum or difference of independent random variables.
* Find probabilities involving the sum or difference of independent Normal random variables.

Binomial and Geometric Distributions
Binomial Distributions; Geometric Distributions
The student will:
* Determine whether the conditions for using a binomial random variable are met.
* Compute and interpret probabilities involving binomial distributions.
* Calculate the mean and standard deviation of a binomial random variable. Interpret these values in context.
* Find probabilities involving geometric random variables

Sampling Distributions
Sampling Distributions; Sample Proportions; Sample Means
The student will:
*Distinguish between a parameter and a statistic.
* Distinguish among the distribution of a population, the distribution of a sample, and the sampling distribution of a statistic.
* Use the sampling distribution of a statistic to evaluate a claim about a parameter.
* Determine whether or not a statistic is an unbiased estimator of a population parameter.
* Describe the relationship between sample size and the variability of a statistic.
* Find the mean and standard deviation of the sampling distribution of a sample proportion $\hat{p}$. Check the 10% condition before calculating $\sigma_{\hat{p}}$.
* Determine if the sampling distribution of $\hat{p}$ is approximately Normal.
* If appropriate, use a Normal distribution to calculate probabilities involving $\hat{p}$
* Find the mean and standard deviation of the sampling distribution of a sample mean $\overline{x}$. Check the 10% condition before calculating $\sigma_{\overline{x}}$.
* If appropriate, use a Normal distribution to calculate probabilities involving $\overline{x}$.
* Explain how the shape of the sampling distribution of $\overline{x}$ is affected by the shape of the population distribution and the sample size.
* If appropriate, use a Normal distribution to calculate probabilities involving $\overline{x}$.

Introduction to Inference
Estimating with Confidence, Tests of Significance, Interpreting Statistical Significance; Inference as Decision
The student will:
* Interpret a confidence interval in context.
* Interpret a confidence level in context.
* Determine the point estimate and margin of error from a confidence interval.
* Describe how the sample size and confidence level affect the length of a confidence interval.
* Explain how practical issues like nonresponse, undercoverage, and response bias can affect the interpretation of a confidence interval.

* State and check the Random, 10%, and Large Counts conditions for constructing a confidence interval for a population proportion.
* Determine critical values for calculating a *C*% confidence interval for a population proportion using a table or technology.
* Construct and interpret a confidence interval for a population proportion.
* Determine the sample size required to obtain a *C*% confidence interval for a population proportion with a specified margin of error.
* Explain how the *t* distributions are different from the standard * Normal distribution and why it is necessary to use a *t* distribution when calculating a confidence interval for a population mean.
* Determine critical values for calculating a *C*% confidence interval for a population mean using a table or technology.
* State and check the Random, 10%, and Normal/Large Sample conditions for constructing a confidence interval for a population mean.
* Construct and interpret a confidence interval for a population mean.
* Determine the sample size required to obtain a *C*% confidence interval for a population mean with a specified margin of error

Inference for Distributions

Inference for the Mean of a Population; Comparing Two Means

The student will:

* State the null and alternative hypotheses for a significance test about a population parameter.
* Interpret a *P*-value in context.
* Determine if the results of a study are statistically significant and draw an appropriate conclusion using a significance level.

Interpret a Type I and a Type II error in context, and give a consequence of each.

* State and check the Random, 10%, and Large Counts conditions for performing a significance test about a population proportion.
*Perform a significance test about a population proportion.
* Use a confidence interval to draw a conclusion for a two-sided test about a population parameter.
* Interpret the power of a test and describe what factors affect the power of a test.

Describe the relationship among the probability of a Type I error (significance level), the probability of a Type II error, and the power of a test.

* State and check the Random, 10%, and Normal/Large Sample conditions for performing a significance test about a population mean.
* Perform a significance test about a population mean.
* Use a confidence interval to draw a conclusion for a two-sided test about a population parameter.
* Perform a significance test about a mean difference using paired data.
* Use the graphing calculator to obtain confidence intervals and test hypotheses.

Inference for Proportions

Inference for a Population Proportion; Comparing Two Proportions

The student will:

* Describe the shape, center, and spread of the sampling distribution of $\hat{p}_1 - \hat{p}_2$.
* Determine whether the conditions are met for doing inference about $p_1 - p_2$.
* Construct and interpret a confidence interval to compare two proportions.

Perform a significance test to compare two proportions.

* Describe the shape, center, and spread of the sampling distribution of $\overline{x}_1 - \overline{x}_2$.
* Determine whether the conditions are met for doing inference about $\mu_1 - \mu_2$.
* Construct and interpret a confidence interval to compare two means.
* Perform a significance test to compare two means.
* Determine when it is appropriate to use two-sample *t* procedures versus paired *t* procedures.
* Use the graphing calculator to obtain confidence intervals and test hypotheses.

Inference for Tables

Test for Goodness of Fit; Inference for Two-Way Tables

The student will:

* State appropriate hypotheses and compute expected counts for a chi-square test for goodness of fit.
* Calculate the chi-square statistic, degrees of freedom, and *P*-value for a chi-square test for goodness of fit.
* Perform a chi-square test for goodness of fit.
* Conduct a follow-up analysis when the results of a chi-square test are statistically significant.
* Compare conditional distributions for data in a two-way table.
* State appropriate hypotheses and compute expected counts for a chi-square test based on data in a two-way table.
* Calculate the chi-square statistic, degrees of freedom, and *P*-value for a chi-square test based on data in a two-way table.
* Perform a chi-square test for homogeneity.
* Perform a chi-square test for independence.
* Choose the appropriate chi-square test.

* Interpret chi-square test results obtained from computer output. **[SC10]**
Inference for Regression *Inference About the Model, Predictions, and Conditions* *The student will:* * Check the conditions for performing inference about the slope β of the population (true) regression line. * Interpret the values of *a, b, s,* SE_b, and r^2 in context, and determine these values from computer output. * Construct and interpret a confidence interval for the slope β of the population (true) regression line * Perform a significance test about the slope β of the population (true) regression line. * Use transformations involving powers and roots to find a power model that describes the relationship between two variables, and use the model to make predictions. * Use transformations involving logarithms to find a power model or an exponential model that describes the relationship between two variables, and use the model to make predictions. * Determine which of several transformations does a better job of producing a linear relationship. * Interpret the results of computer output for regression.
AP Exam Review
Final Project?