AP Statistics

Brief Description of Course

This course is designed to present to students with material equivalent to a one-semester, non-calculus based introductory college course in statistics. The main purpose is to expose students to these four main statistical concepts; Exploring Data, Sampling and Experimentation, Anticipating Patterns and Statistical Inference. Students who complete this course will be prepared to take the AP Statistics Exam in order to qualify for college credit or advanced placement. Important prerequisite knowledge and skills for this course are an algebraic and graphical proficiency that would allow for higher level mathematical analysis of linear and non-linear functions. This course will closely follow the pacing guide provided in the main text The Practice of Statistics 6e: Pacing Guide, Chapter Objectives, and Suggested Assignments.

Textbook

Starnes, D. & Yates, D. *The Practice of Statistics* (2012). W. H. Freeman and Company

Other Course Materials

Material: Graphing Calculator

Description:
Students will use graphing calculators to quantify and display data and determine the strength of associations.

Material: Newspaper

Description:
Students will use the newspaper and the internet to gather data needed to complete quarterly projects. Students are encouraged to bring in statistics related articles for discussion.

Material: www.whfreeman.com/tps4e

Description:
Statistics applets

Standards

This course covers standards outlined in the [Pennsylvania Department of Education Academic Standards for Mathematics.](#)

Unit Information

Chapter 1 Exploring Data - 10 days

Content and/or Skills Taught:
Classify variables as categorical or quantitative-make bar graphs and compare related quantities-recognize when to use a pie chart, identifying deceptive graphs, answer questions about marginal and conditional distributions, make dot plot and stem plots and describe the overall patterns and distributions, interpret histograms as symmetric or skewed and identify modes, calculate and interpret measures of center, calculate and interpret measures of spread (IQR), identify outliers using the 1.5 x IQR formula, make a boxplot, calculate and interpret standard deviation, select appropriate measures of spread.

Major Assignments and/or Assessments:
Chapter 1 test

PA Standards:

CC.2.4.HS.B.1-Summarize, represent, and interpret data on a single count or measurement variable.

CC.2.4.HS.B.2 -Summarize, represent, and interpret data on two categorical and quantitative variables.

Chapter 2 Modeling Distributions of Data- 8 days

Content and/or Skills Taught:
Use percentile to locate individual values within a distribution, interpret a cumulative relative frequency graph, find the standardized value (z-score) and interpret z-score, describe the effect of adding or using scalars on distributions, approximating the location of the median on a density curve, use 68-95-99.7 rule on normal distribution curve, use a standard normal curve to determine z-score from a percentile, use a z-score table to find percentile of a value, asses normality of data by graphing, interpret a normal probability plot.

Major Assignments and/or Assessments:
Chapter 2 test

PA Standards:

CC.2.4.HS.B.1-Summarize, represent, and interpret data on a single count or measurement variable.

CC.2.4.HS.B.2 -Summarize, represent, and interpret data on two categorical and quantitative variables.

Chapter 3 Describing Relationships

Content and/or Skills Taught:
3.1- identify explanatory and response variables, make scatter plots to display quantitative data between two variable, describe direction, form and strength of the overall pattern of the scatter plot and recognize outliers, calculate and interpret correlation (r) in context and how it is influenced by extreme observations, interpret the slope and y intercept of a least - squares regression line in context, use the least squares regression line to predict y, recognize the dangers of extrapolation, calculate and interpret residuals in context, explain the concept of least squares, use technology to find the least squares regression line, find the slope and intercept of the least squares regression line from the means and standard deviation of x and y and their correlation, construct and interpret residual plots to assess if a linear model is appropriate, use the standard deviation of the residuals and r squared to assess how well the line fits the data and interpret them in context, identify the equation of the least squares regression line from computer output, explain how association does not imply causation and how extreme observations effect r squared.

PA Standards:

CC.2.4.HS.B.3- Analyze linear models to make interpretations based on the data.

Major Assignments and/or Assessments:
Chapter 3 test and first quarter project. Students create scatter plots to investigate to separate explanatory variables. They will begin with a hypothesis and use a least squares regression line, shape, form, strength, residuals, and correlation to support or refute their hypothesis.

Chapter 4 Designing Studies

Content and/or Skills Taught:
Identify population and sample, voluntary response and convenience samples. Explain how bad sampling methods can lead to bias, describe how to use a chart or technology to generate a simple random sample, distinguish simple random sample from a stratified or cluster sample and the advantages/disadvantages of each, explain how under coverage, nonresponse, and question wording can lead to bias, distinguish between an observational study and an experiment, explain how a lurking variable can lead to confounding, identify subjects, explanatory variables, treatments, and response variables in an experiment, describe a completely random design for an experiment and why it is important. Describe placebo effect and blinding, explain what "statistically significant" means. Distinguish between completely randomized design and randomized block design. Know when matched pairs experimental design is appropriate and how to implement it. Determine the scope of inference for a statistical study and to evaluate whether it has been carried out in an ethical manner.

PA Standards:

CC.2.4.HS.B.1- Summarize, represent, and interpret data on a single count or measurement variable.

Chapter 5 Probability: What are the chances?

Content and/or Skills Taught:
Interpret probability as a long run relative frequency in context. Use simulations to model random behavior. Describe a probability model for a chance process. Use basic probability rules, including the complement rule and the addition rule for mutually exclusive events. Use a Venn diagram to model a chance process involving two events, use the general addition rule, multiplication rule and a tree diagram. Determine whether two events are independent. Find probability using a two-way table. Compute conditional probabilities.

PA Standards:

CC.2.4.HS.B.4-Recognize and evaluate random processes underlying statistical experiments.

Major Assignments and/or Assessments:
Chapter 5 test and second quarter project: Students work in teams of 2 to design and carry out an experiment to investigate response bias, write a report and give a 10-minute oral synopsis to their classmates.

Chapter 6 Random Variables

Content and/or Skills Taught:
Use a probability distribution to answer questions about possible values of a random variable. Calculate the mean and standard deviation of a discrete random variable and interpret in context. Describe the effects of transforming a random variable by adding, subtracting, multiplying, or dividing a constant. Determine whether to random variables are independent and find probabilities involving the sum or difference of independent Normal random variables. Determine whether conditions for a binomial are met and compute probabilities involving binomial distributions. Calculate the mean and standard deviation of a binomial random variable and interpret values in context. Find probabilities involving geometric random variables.

PA Standards:

CC.2.4.HS.B.4-Recognize and evaluate random processes underlying statistical experiments.

Major Assignments and/or Assessments:
Chapter 6 test

Chapter 7 Sampling Distributions

Content and/or Skills Taught:
Distinguish between a parameter and a statistic. Understand the definition of a sampling distribution.

Distinguish between population distribution, sampling distribution, and the distribution of sample data. Determine whether a statistic is an unbiased estimator of a population parameter. Understand the relationship between sample size and the variability of an estimator. Find the mean and standard deviation of the sampling distribution of a sample proportion for an SRS of size n from a population having proportion p of successes. Check whether the 10% and Normal conditions are met in a given setting. Use Normal approximation to calculate probabilities involving. Use the sampling distribution of to evaluate a claim about a population proportion. Find the mean and standard deviation of the sampling distribution of a sample mean from an SRS of size n. Calculate probabilities involving a sample mean when the population distribution is Normal. Use the central limit theorem to help find probabilities involving a sample mean. Explain how the shape of the sampling distribution of is related to the shape of the population distribution.

PA Standards: CC.2.4.HS.B.2- Summarize, represent, and interpret data on two categorical and quantitative variables.

Major Assignments and/or Assessments:
Chapter 7 Test

Chapter 8 Estimating with Confidence

Content and/or Skills Taught:
Interpret a confidence level. Interpret a confidence interval in context. Understand that a confidence interval gives a range of plausible values for the parameter. Understand why each of the three inference conditions- Random, Normal, and Independent is important. Explain how practical issues like non-response, under coverage and response bias can affect the interpretation of a confidence interval. Construct and interpret a confidence interval for a population proportion. Determine critical values for calculating a confidence interval using a table or your calculator.

PA Standards: CC.2.4.HS.B.5 - Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

Major Assignments and/or Assessments:
Chapter 8 Test

Chapter 9 Testing a Claim

Content and/or Skills Taught:
Students will be able to: State correct hypotheses for a significant test about a population proportion or mean. Interpret P-values in context. Interpret a Type I error and a Type II error in context, and give the consequences of each. Understand the relationship between the significant level of a test, P(type II error) and power. Check conditions for carrying out a test about a population proportion. Check conditions for carrying out a test about a population mean. If conditions are met, conduct a significance test about a population proportion. Use a confidence interval to draw a conclusion for a two-sided test about a population mean. If conditions are met, conduct a one sample t-test about a population mean. Recognize paired data and use one sample t procedures to perform significance tests for such data.

PA Standards: CC.2.4.HS.B.5 - Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

Major Assignments and/or Assessments:
Chapter 9 test

Chapter 10 Comparing two Populations or Groups

Content and/or Skills Taught:
Describe the Characteristics of the sampling distribution of p-hat - p-hat and calculate the probabilities. Determine whether the conditions for performing inference are met. Construct and interpret a confidence interval to compare two proportions. Interpret the results of inference procedures in a randomized experiment. Describe the characteristics of the sampling mean generated by the difference of two sample means and calculate probabilities. Use two sample t procedures to compare two means based on summary statistics and from raw data. Interpret the standard computer output from the tests. Perform a significance test to compare two means. Check conditions for using two sample t procedures in a randomized experiment. Interpret the results of inference procedures in a randomized experiment. Determine the proper inference procedures to use in a given setting.

PA Standards: CC.2.4.HS.B.5 - Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

Major Assignments and/or Assessments:
Chapter 10 test

Chapter 11 Inference for Distributions of Categorical Data

Content and/or Skills Taught:
Students will be able to: Know how to compute expected counts, conditional distributions, and contributions to the chi-square statistic. Check the random, large sample size, and independent conditions before performing a chi-square test. Use chi-square goodness of fit test to determine whether sample data are consistent with specified distribution of a categorical variable. Examine individual components of the chi-square statistic as part of a follow-up analysis. Check the Random, Large sample size, and independent conditions before performing a chi-square test. Use a chi-square test for homogeneity to determine whether the distribution of a categorical variable differs for several populations or treatments. Interpret computer output for a chi-square test based on a two-way table. Examine individual components of the chi-square statistic as part of a follow up analysis. Show that the two-sample z test for comparing two proportions and the chi-square test for a 2-by-2 two-way table give equivalent results. Check the Random, Large Sample size and Independent conditions before performing a chi-square test. Use a chi-square test of association/independence to determine whether there is convincing evidence of an association between two categorical variables. Interpret computer output for a chi-square test based on a two-way table. Examine individual components of the chi-square statistic as part of a follow-up analysis. Distinguish between the three types of chi-square tests.

PA Standards: CC.2.4.HS.B.5 - Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

Major Assignments and/or Assessments:
Chapter 11 test

Chapter 12 More about Regression

Content and/or Skills Taught:
Check conditions for performing inference about slope of the population regression line. Interpret computer output from a least-squares regression analysis. Construct and interpret a confidence interval and perform a significance test for the slope of the population regression line. Use transformations involving powers and roots to achieve linearity for a relationship between two variables. Make predictions from a least-squares regression line involving transformed data. Use transformations involving logarithms to achieve linearity for a relationship between two variables. Determine which of several transformations does a better job of producing a linear relationship.

PA Standards: CC.2.4.HS.B.3- Analyze linear models to make interpretations based on the data.

Major Assignments and/or Assessments:
Chapter 12 test

AP Exam Review

Content and/or Skills Taught:
Practice AP Free Response Questions, Choose the correct inference procedure, Mock grading sessions, Practice Multiple choice questions.

Major Assignments and/or Assessments:
AP Exam