Pocono Mountain School District
AP Statistics Course Audit

Course Description

The AP Statistics course at Pocono Mountain East High School is designed to integrate lecture, discussion and exploration. The instruction will be built upon the pillars of exploratory analysis, planning a study, probability and statistical inference. Students will work independently on about half of the assignments and all of the assessments. They will work cooperatively on about half of the assignments and projects. Focus will be given to analyzing raw data sets, calculating meaningful statistics and drawing conclusions. The course will also emphasize writing and original thought. Students will be given a packet of relevant formulas, tables and theorems at the beginning of the course, consistent with the College Board AP Statistics Course Description. This course meets for 180 days, 57 minutes per class.

Textbooks and Resources

Course Text
Yates, Daniel S., David S. Moore, and Daren S. Starnes. *The Practice of Statistics, 2*nd *edition, 3*rd *edition*. New York: W.H. Freeman.

Supplemental Texts
Bock, David E., Paul F. Velleman, and Richard D. DeVeaux. *Stats: Modeling the World, 1*st *and 2*nd *editions*. Boston: Pearson/Addison-Wesley.

Larson, Ron and Betsy Farber. *Elementary Statistics Picturing the World, 2009*. Upper Saddle River, NJ. Pearson/Prentice Hall.

MINITAB Statistical Software

TI-84 Plus Graphing Calculator

Technology

All students have the option of checking out a TI-84 Plus Graphing Calculator from the library for the duration of the course, as well as the option to purchase their own calculator with statistical capabilities. There is a computer lab available with MINITAB for use throughout the course. Also, students will utilize Microsoft Excel for quick analysis of data sets. Course instruction will include overhead display of the graphing calculator and MINITAB output.

Projects

The course will be project-intensive, and will include several projects that will reinforce concepts and promote analysis and original thought. Examples are included below:

1. Research Proposal

Students will be expected to complete a full length research proposal using APA Format. This project will focus on sampling methods, research design and data analysis. They will be given a template to follow, outlining all relevant sections of the proposal and what information should be included in each section. Students should choose a design appropriate for their study and complete a review of literature relevant to the study.

2. Manufacturer Consistency

Students will collect data from several sources provided by the teacher (could include M&Ms, Skittles, fruit snacks, chips or pretzels, etc…) The students will observe the number of items in each package and create a class data set. They will then perform analysis on one-variable statistics for each brand and comment on the consistency of packaging, with focus on standard deviation.

3. Linear Regression Project

Students will collect bivariate data from an approved online source. They will use technology to perform linear regression analysis on the data. They will create a scatterplot, calculate and interpret the correlation coefficient, find the least-squares regression line, calculate and interpret the coefficient of determination, calculate and plot the residuals, calculate and interpret the standard deviation of the residuals, and draw conclusions about the appropriateness of the model.

4. Final Project

Students may work with up to three per group to complete a comprehensive final project. Each group will be given a different packet of data and other information that they will analyze to answer the included question. The group will function as though they are given an assignment from a supervisor at work and the analysis is necessary for the company to make decisions. The teacher will provide support as needed, but the project is intended to be designed by the students. A set of minimum criteria and a grading rubric will be provided. The project will include graphical displays, linear regression analysis, confidence intervals, hypothesis testing and well-developed written analysis and conclusions.

Course Outline

Unit	Objectives	Resources	Timeframe
Exploration of Data	• Classify variables as qualitative or quantitative • Create and interpret graphical displays of data, including bar graphs, pie charts, dot plots, stem plots, frequency tables and histograms • Calculate measures of central tendency, including mean, median and mode • Explore and apply properties of mean and median • Apply linear transformation to measurements • Determine overall patterns of data sets and identify outliers • Calculate the five-number summary for a data set • Create and interpret box plots • Use TI-84, Excel and MINITAB to analyze data graphically	Microsoft Excel MINITAB TI-84 Plus Calculator Preliminary Chapter (all), Case Study (Magnets) Chapter 1, sections 1.1 – 1.2 Case Study (Ratings) Chapter 1 Test	12 blocks
Measures of spread and position	• Calculate range, standard deviation and variance • Explore and apply properties of standard deviation • Calculate standardized score (z-score) • Analyze distribution of univariate data, including shape, skewness, center, spread and outliers	Chapter 2, Section 2.1 Project: Manufacturer Consistency Quiz	10 blocks
The Normal Distribution	• Calculate areas and proportions under density curves • Recognize characteristics of a Normal Distribution	Chapter 2, Section 2.2 Case Study (SAT's) Assignment: Birth Rates in America Chapter 2 Test	12 blocks

	• Apply 68-95-99.7 Rule and Chebyshev's Theorem • Calculate proportions below, above or between a given measurement • Assess the normality of a data set using histogram, measures of center, standard deviation and 68-95-99.7 Rule • Calculate percentiles • Calculate measurement given an area under the normal curve	AP Free Response Practice	
Bivariate Data	• Create scatterplot by hand and with technology • Interpret strength and direction of correlation • Identify explanatory and response variable • Calculate and interpret correlation coefficient, r. • Calculate and interpret linear regression line (least squares line) • Make predictions from regression line • Calculate residuals • Create and interpret residual plots • Identify outliers and influential points • Apply transformations to achieve linearity • Identify lurking variables • Explain the difference between correlation and causation • Analyze relationships between categorical variables • Interpret output from a contingency table • Explain Simpson's paradox	Chapter 3, Sections 3.1 – 3.3 Chapter 4, Sections 4.1 – 4.3 Part I Review Exercises AP Free Response Practice Chapter 3 and 4 Exam Project: Linear Regression	15 blocks

Probability	• List sample space for random events • Apply basic rules of probability • Apply multiplication and addition rules of probability • Define disjoint, independent and complementary events • Create and interpret tree diagrams and Venn diagrams • Apply counting techniques to calculate probabilities • Simulate events using TI-84 to calculate experimental probabilities	Chapter 6, Sections 6.1 – 6.3 Activity 6A (Austin and Sara's game) Chapter 6 Exam AP Free Response Practice Reading: Missing Airplane (NPR)	12 blocks
Random Variables and Probability Distributions; Binomial and Geometric Distributions	• Identify discrete and continuous variables • Calculate probabilities of random variables • Calculate expected value and standard deviation for random variables • Create and interpret probability distributions of random variables • Calculate mean and variance of random variables • Apply rules for means and variances of random variables • Simulate events for random variables using technology • Verify conditions of a binomial distribution • Calculate probability for a binomial random variable • Calculate cumulative distribution tables of binomial random variables • Calculate mean and standard deviation for	Chapter 7, Sections 7.1, 7.2 Case Study (income and courts) Chapter 8, Sections 8.1,8.2 Chapter 7 and 8 Exam	10 blocks

	binomial random variable • Use normal approximation to calculate binomial probabilities • Verify conditions of a geometric distribution • Calculate probabilities of geometric random variables • Calculate cumulative distribution tables for geometric random variables • Calculate mean and standard deviation of geometric random variable		
Sampling Distributions	• Apply and explain Central Limit Theorem • Identify parameters and statistics in a sample or experiment • Explain sampling variability • Interpret a sampling distribution • Describe bias and variability and connect to sample size • Find the mean and standard deviation of the sampling distribution for sample proportion • Find the mean and standard deviation of the sampling distribution of a sample mean	Chapter 9, Section 9.1 – 9.3 Part III Review Exercises Case Study (Better batteries) AP Free Response Practice	5 blocks
Introduction to Inference: Confidence Intervals and Hypothesis Testing	• Calculate and interpret large and small sample confidence intervals for the mean • Calculate and interpret large and small sample confidence intervals for the proportion • Calculate sample size	Chapter 10, Sections 10.1 – 10.3 Case Study (Give us a call) Chapter 11, Sections 11.1 – 11.4 Case Study (headache) Chapter 10 and 11 Exam AP Free Response Practice Activity 11C	20 blocks

		using margin of error	Chapter 12, Sections 12.1 – 12.2	
		• Use technology to calculate confidence intervals	Activity 12	
		• Write null and alternative hypotheses for means and proportions	Chapter 12 Test	
		• Calculate z or t test-statistic for hypothesis test and draw conclusion		
		• Calculate p-value for hypothesis test and draw conclusion		
		• Preform one-sided and two-sided hypothesis tests for mean and proportion		
		• Determine statistical significance		
		• Explain Type I and Type II Error and power in significance testing		
Inferences involving two samples		• Perform and analyze a two-sample t test to compare two means	Chapter 13, Sections 13.1, 13.2	10 blocks
		• Calculate confidence intervals between two proportions	MINITAB Lab	
		• Perform significance tests for comparing two proportions		
		• Use the two-sample z procedure to test the hypothesis regarding the equality of two proportions		
		• Recognize the appropriate procedure for a study		
Inference for Tables		• Perform chi-square test for goodness of fit	Chapter 14, Sections 14.1,14.2	8 blocks
		• Interpret chi-square test results from computer output	Activity 14A	

Inference for Regression	- Calculate simple linear regression model - Estimate regression parameters - Calculate confidence interval for slope of regression model - Perform hypothesis test for slope of regression model - Interpret computer output for regression inference	Chapter 15 Case Study (Three-pointers)	11 blocks
Experimental Design	- Identify populations and samples - Identify methods of sampling (block, matched pairs, cluster, stratified, simple) - Identify strengths and weaknesses of sampling methods and possible bias - Explain bias, placebo, blind and double blind, randomization, replication and control - Contrast observational study and experiment - Design experiments - Write a complete research proposal	Chapter 5, Sections 5.1, 5.2 Case Study (eating chocolate) Project: Research Proposal Part II Review Exercises	15 blocks
AP Exam Review	Review and prepare for the AP Exam using practice exam and free response questions from the College Board	2007 College Board Practice Exam College Board Free Response Questions	15 blocks
ANOVA	- Interpret ANOVA tables - Recognize the meaning and appropriateness of comparing means using ANOVA	Chapter A www.whfreeman.com/tps3e	10 blocks
Final Project	Students may work alone, or with one or two others to complete a comprehensive final project	Textbook MINITAB TI-84 Plus Course Notes	15 blocks