AP STATISTICS SYLLABUS/AUDIT

COURSE DESCRIPTION

AP Statistics is a project-based course in which students actively develop a thorough understanding of the concepts and techniques used in statistics. The class will primarily consist of projects, activities, and classroom discussions. Students are expected to participate in the activities and discussions and to maintain an open line of communication with their peers and instructor to help better assist them in successful completion of the course. The "big picture" view of AP Statistics may best described by highlighting the four major statistical topics which will be taught in thorough detail, which include:

- ✓ Exploring Data
- ✓ Planning and Design of a Study
- ✓ Anticipating Patterns
- ✓ Statistical Inference.

This course has been designed with the development of competent users of statistics in real-world scenarios. Students will be immersed in real-world problems using data that can be meaningfully explored only with statistical methods. As in real situations, students will be expected to justify the techniques they use, fully explain their process, and interpret their results in the context of the problem. The course will culminate with a thorough review of all major topics through the utilization of past released AP exam materials in order to be best prepared for the rigor of the AP exam.

COURSE TEXT AND SUPPLEMENTS

PRIMARY TEXT

Yates, Moore, & Starnes. The Practice of Statistics. 3rd ed., W.H. Freeman & Co., 2008.

SUPPLEMENTARY TEXTS

Yates, Moore, & Starnes. The Practice of Statistics. 4th ed., W.H. Freeman & Co., 2010.

Bock, Velleman, De Veaux. Stats. Modeling the World. 3rd ed., Pearson, 2010

TECHNOLOGY

Technology, with a particular emphasis on the TI -83/84 graphing calculators, is incorporated on a regular basis into daily class activities. All students are required to obtain a graphing utility, which can be purchased on their own or borrowed from the school just as a textbook would be. Students are expected to have their graphing calculator with them at all times. An overhead graphing calculator display, in combination with a SmartBoard, will be utilized on a daily basis for class demonstrations. The graphing calculator is allowed on all tests, although students must show all necessary work and any statistical formulas that were used to support all calculator answers as well as calculator notation. Pending technology: FATHOM, MINITAB.

ASSESSMENT

Students will be assessed along the way through the use of homework, quizzes, and exams on each topic covered (Holistic Grading). Students will be provided with the exact formula sheet which will be given to them during the AP exam for all assessments in order to gain familiarity with said reference sheet. Students will also be required to use their graphing calculators on all assessments. Their grade will also be comprised of projects, papers, activities, and presentations. In mid-December students will take an AP exam style midterm examination which will cover all topics on the AP exam, with the exception of statistical inference. Students will also be given at least one open-ended question each week to work on in order to develop a good system for solving these types of problems on the AP exam.

Throughout the year students will continually develop their own "student edition" of the textbook. Students will be graded quarterly on their progress and at the completion of the course will use this "textbook" to study for the AP exam. Within each book the students will keep sample AP problems, theorems, definitions, examples and notes.

COURSE PHILOSOPHY

AP Statistics is a course which is equivalent to a non-calculus introductory college level statistics course. This is an extremely advanced high school course intended for the student who excels in mathematics, reasoning, logic, and writing. Students who enroll in this course may often desire to enter a field in the sciences or mathematics upon completion of their higher level education. The scope of topics covered throughout the year will match or exceed that which is required by the College Board. Each student is not only responsible for understanding and regurgitating the material learned, but must also master the ability to apply theories learned into real-world applications. Group projects, physical explorations, simulations and technological applications are stressed, ultimately preparing each student for the challenge of successfully passing the Advanced Placement exam. The curriculum for this course matches the goals set forth by NCTM and meets NJCCCS and NJCCWRS, as well as the goals of the Midland Park School District. The assessment in AP Statistics responds to the changes prescribed by all of the above and includes traditional and alternative assessment. The alternatives may include but are not limited to: holistic grading, performance based assessment, and authentic/portfolio assessment. Students will be assessed along the way through the use of homework, quizzes and exams on each topic covered. Each exam will require the use of a graphing calculator and the exact formula sheet given during the AP exam. All exams are to be given in the same format as the AP exam in addition to weekly free-response questions which will develop a good system for solving these types of problems in preparation for the Advanced Placement exam.

COURSE CONTENT OUTLINE AND PACING

**** All topics will include the use of a graphing utility. ****

PACE	CONTENT
	UNIT I: COURSE OVERVIEW
1 WEEK	Review Summer Activity: Students are to read the book, "How To Lie With Statistics" and complete questions related to the reading. Activity: Dolphin Therapy Activity: Distracted Driver a. Simulations will be completed by hand (magic hat) and then within a graphing utility (RandInt). b. Basic statistically useful calculator functions will be explored.
	UNIT II: SIMULATIONS
2 WEEKS	**Closed Simulations** a. Simulation of random behavior and various probability/sampling distributions. b. Use simulation to estimate the expected value of a random variable. c. Use simulation to answer a question/make a decision. **Open-ended Simulation** a. Simulation of random behavior and various probability/sampling distributions. b. Use simulation to estimate the expected value of a random variable. c. Use simulation to answer a question/make a decision. d. Use a graphing calculator to run a simulation using the random number generator.
	UNIT III: EXPLORING DATA
2 WEEKS	**One Variable Data** a. Construct and interpret graphical displays of univariate distributions (including dot plot, stem/leaf plot, histogram, and relative cumulative frequency plot). b. Measures of central tendency (including mean, median, mode, and mid-range). c. Measures of spread (including range, interquartile range, variance, standard deviation and mean deviation). d. Measures of position (including quartiles, percentiles, and standardized scores) e. Summarize/describe the shape, center and spread of the distribution of a variable (including any clusters, gaps, outliers and other unusual features). f. Determine the effects of changing units on summary measures. g. Compare two or more distributions with respect to shape, center, spread (including any clusters, gaps, outliers and other unusual features): within group variation and between group variation. h. Properties of the normal distribution. i. Use tables of the normal distribution (standard normal tables) to calculate the probability of an event. j. Use the normal distribution as a model for measurements. k. Use a graphing calculator to construct all graphical displays and determine all measures mentioned above.

4 WEEKS	**Two Variable Data** a. Analyze patterns in scatter plots between two variables. b. Describe the shape (linear, curved, and outliers), center (line of best fit) and spread (strength of the relationship/correlation) between two variables and whether the strength is constant across all values of x. c. Describe how the r measures the strength of the relationship. d. To understand that the least squares regression line minimizes the sum of the squared errors (residuals) e. To interpret the slope and y-intercept in the context of the situation. f. Construct/interpret residual plots and identify any outliers and influential points. g. Read/interpret regression output from various statistical software packages. h. Perform basic transformations to achieve linearity: logarithmic and power transformations. i. To decide whether the pattern in a scatter plot can be generalized to other cases and to propose possible explanations for the pattern. j. Use a graphing calculator to explore scatter plots, regression lines, residual plots, etc... **Categorical Data** a. Construct frequency tables and bar graphs by hand and in the graphing calculator. b. Construct marginal and joint frequencies (probabilities) for two-way tables. c. Construct conditional relative frequencies and determine if there is an association (dependence) between the two variables. d. Compare two or more categorical variables using bar/ribbon graphs.
UNIT IV: SAMPLING AND EXPERIMENTATION	
2 WEEKS	**Planning and Conducting a Survey** a. Compare/contrast censuses and sample surveys. b. Compare/contrast populations and samples and how randomization is used in sampling. c. Characteristics of well designed/conducted surveys. d. Identify sources of bias in sampling and surveys. e. Sampling Methods – simple random sample, stratified random sample, cluster sampling, multistage sampling. f. When can you generalize results/conclusions from observational studies and surveys? g. Use a graphing calculator and the random number generator when discussing randomization.
2 WEEKS	**Planning and Conducting Experiments** a. Compare/contrast experiments and observational studies. b. Characteristics of well-designed/conducted experiments – treatments, control groups, experimental units, role of randomization and replication. c. Identify sources of bias and confounding (including placebo effect and blinding) in experiments. d. Experimental Designs – completely randomized design, randomized block design, matched pairs design (including repeated measures design). e. Use a graphing calculator and the random number generator when discussing randomization. f. When can you generalize results/conclusions from experiments?

UNIT V: ANTICIPATING PATTERNS	
3 WEEKS	**Sampling Distributions** a. Mean (expected value) and standard deviation of random variable. b. Simulation of sampling distributions, using a graphing calculator to conduct the simulation. c. Sampling distribution of a sample mean. d. Sampling distribution of a sample proportion. e. Central Limit Theorem. f. Sampling distribution of a sum/difference of two independent sample means. g. Sampling distribution of a sum/difference of two independent sample proportions.
3 WEEKS	**Basic Probability/Measures of Central Tendency** a. Interpreting probability using a long-run relative frequency interpretation. b. "Law of Large Numbers" c. Construct Venn diagrams, two-way tables, and tree diagrams to develop the basic rules of Probability d. Addition rule, multiplication rule, conditional probability, test for independence. e. Disjoint/mutually exclusive events vs. independent/dependent events. f. Mean (expected value) and standard deviation of a random variable, and linear transformation of a random variable. g. Mean and standard deviation for sums and differences of independent random variables.
1 WEEK	**Probability Distributions** a. Discrete random variables and their probability distributions. b. Mean (expected value) and standard deviation of a random variable, and linear transformation of a random variable. c. Properties of the binomial distribution. d. Properties of the geometric distribution. e. Simulation of the binomial and geometric distribution.
UNIT VI: STATISTICAL INFERENCE	
3 WEEKS	**Inference for Proportions** a. Understand a confidence interval as consisting of those population proportions for which the result from the sample is reasonably likely. b. Understand the logic of a confidence interval, meaning of "confidence", and the properties of confidence intervals for population proportions. c. Construct/interpret a confidence interval for estimating the proportion of successes in a binomial population. d. Understand the logic of a significance test/hypothesis test, statistical significance, null hypothesis, alternate hypothesis, test statistic, level of significance, one-tailed test, and two-tailed test, p-value, concepts of Type I and Type II errors. e. Construct/interpret a significance test to decide whether you should reject the claim that your sample has been drawn from a binomial population with a specified proportion of successes. f. Construct/interpret a confidence interval for the difference of two proportions. g. Construct/interpret a test of significance to decide whether you should reject the claim that two samples were drawn from two binomial populations with the same proportion of successes. h. Understand how randomization differs in surveys and experiments when comparing two proportions. i. All aspects of hypothesis testing, especially when determining the test value, will be completed using a graphing calculator.

3 WEEKS	**Inference for Means** a. Understand a confidence interval as consisting of those population means for which the result from the sample is reasonably likely. b. Understand the logic of a confidence interval, meaning of "confidence", and the properties of confidence intervals for population means. c. Understand that the capture rate for a confidence interval is less than advertised when the population standard deviation is estimated by the sample standard deviation unless you adjust by using the *t* distribution instead of the *z* distribution (normal curve). d. Construct/interpret a confidence interval for estimating a population mean using both *z* procedures (population standard deviation) and *t* procedures (sample standard deviation). e. Construct/interpret a significance test for a mean using both *z* procedures (population standard deviation) and *t* procedures (sample standard deviation). f. Construct/interpret a confidence interval for the difference of two means (unpaired and paired) using both *z* procedures (population standard deviation) and *t* procedures (sample standard deviation). g. Construct/interpret a test of significance for a difference between two means (unpaired and paired) using both *z* procedures (population standard deviation) and *t* procedures (sample standard deviation). h. All hypothesis testing will be completed within the graphing calculator.
2 WEEKS	**Chi-Square Tests** a. Be able to describe the chi-square statistic's distribution and describe how its distribution changes as the degrees of freedom change. b. Conduct a chi-square goodness-of-fit test to answer the question "Does this look like a random sample from a population in which the proportions that fall into these categories are the same as those hypothesized?" c. Recognize the chi-square test for goodness-of-fit as an extension of a significance test on a single proportion. d. Conduct a chi-square test of homogeneity to answer the question "Do these samples from different populations look like samples from populations in which the proportions that fall into the different categories are equal?" e. Recognize the chi-square test for homogeneity as an extension of the significance test of equality of two population proportions. f. Conduct a chi-square test of independence to answer the question "Does this sample look like it came from a population in which these two categorical variables are independent (not associated)?" g. Recognize that the chi-square test of independence is not an extension of any previous significance test, even though it looks similar to the test for homogeneity. h. All hypothesis testing will be completed within the graphing calculator.
1 WEEK	**Inference for Regression** a. Recognize that the regression line is only an estimate of a true, underlying linear model and that the slope will vary from sample to sample. b. Recognize and check the conditions/assumptions necessary for inference for linear regression. c. Construct and interpret a confidence interval for the slope of the regression line. d. Perform a test of significance for the slope of the regression line. e. Interpret the test of significance for the slope. f. Create regression lines and confidence intervals within the graphing calculator.

UNIT VII: AP EXAM REVIEW	
5 WEEKS	Content will be chosen from the College Board Acorn Booklet and from the most recently released AP tests. The purpose of this unit is to make students familiar with the format of the exam as well as give closure to the material and how all the topics eventually blend together. Students will be able to answer all questions on practice AP exams and have a sufficient knowledge of the past year's topics, with a specific emphasis on the use of the graphing calculator throughout. **Instructional Activities** a. Students will simulate the AP exam by completing three practice AP tests from previous years and will be given the opportunity to ask questions about any material that they are not yet completely familiar with. b. Students will be assigned into groups, no larger than three, to work collaboratively on practice sets of problems that will specifically be designed to address key areas that will most likely be tested on during the AP exam. c. Students concentrate on putting together what they have learned throughout the year by working former AP free-response questions/investigative tasks and grading their work with the AP rubric (holistic grading). d. Student responses from previous AP Free Response Exams are graded in groups by the students, holistically, and then are critiqued using the AP rubric.
UNIT VIII: PROJECTS	
2-3 WEEKS	There will be several projects assigned throughout the year, the following are examples of such tasks: **Case Study/Simulation** Students will create a question which can be answered by creating their own statistical model. Students will collect all data, interpret the results, and develop a conclusion based on their findings and statistical work. **Game of Chance** Students will create their own game of chance to be demonstrated during free periods for the rest of the student body. Students will develop the theoretical statistics woven into each of the created games of chance, and then determine the experimental statistics based on the outcomes of the actual games played.