Advanced Placement Statistics Syllabus

I. **Purpose and Overview**

This course is designed to equal one semester of introductory college statistics. It is taught over a full year, allowing a little more time to fully assure student understanding of statistics. The purpose of this course is to introduce students to major concepts and tools for collecting, analyzing and drawing conclusions from data. There are four major themes of AP Statistics that are covered in this course. They are:

1. Exploring Data: Describing patterns and departures from patterns.

2. Sampling and Experimentation: Planning and conducting a study.

3. Anticipating Patterns: Exploring random phenomena using probability and statistics.

4. Statistical Inference: Estimating population parameters and testing hypotheses.

For success in this course, it is helpful if students have an understanding of previous mathematical concepts. This course is more focused on the how's and why's of calculations rather than the calculations themselves. However, previous understanding of mathematical topics, especially Algebra 2, makes the calculations performed much easier for students. This course is a combination of lecture, problem solving, and projects. Lectures provide students with the basic information they need to proceed. Problem solving involves students applying the lecture information to actual situations and interpreting the results. The calculations used in this course are taught manually first, then using technology. Students are encouraged to perform calculations on their calculators, as the focus of this course is not just calculating the answer, but rather interpreting the results of their calculations. The interpretation of the results is the major theme of the course. There are also 2 large projects in this course, one each semester. These allow students to opportunity to use everything they have learned and further their understanding of the applications of statistics.

The fall semester project will involve designing a well-controlled experiment. Students must then carry out the experiment, calculate the summary statistics,

and write a report connecting all aspects. The report must include computer generated graphs of the data.

The spring semester project will involve gathering data from a well controlled experiment or survey, analyzing the data including descriptive and inferential statistics, and writing a report connecting the design with the analysis of the data. The report must include computer generated graphs of the data.

II. **Required Materials**

The textbook for this course is <u>Stats: Modeling the World</u> (2nd Edition), written by David E. Bock, Paul F. Velleman, and Richard D. De Veaux. It is published by Pearson.

This course also requires use and knowledge of the Texas Instrument TI 84 graphing calculator. This calculator will be provided.

Students also use statistical software (Statcrunch, etc.) to create computer generated graphs and to analyze data.

III. **Assessments**

Students will be graded on daily work and participation. In addition there will be a minimum of two tests per six weeks. There will also be cumulative examinations at the end of each semester. Each examination will assess understanding of all concepts covered to that point. Each exam will consist of a multiple choice section, as well as a free response section. This is designed to help student be prepared for the AP examination. The free response questions require students to explain and justify their responses using statistical vocabulary and methods. In addition, there will be at least one major project per semester. They will consist of the following:

The fall semester project will involve designing a well-controlled experiment. Students must then carry out the experiment, calculate the summary statistics, and write a report connecting all aspects. The report must include computer generated graphs of the data.

The spring semester project will involve gathering data from a well controlled experiment or survey, analyzing the data including descriptive and inferential statistics, and writing a report connecting the design with the analysis of the data. The report must include computer generated graphs of the data.

IV. **Course and Curriculum Guide**

First Six weeks

- Types of Data

- Displaying and Describing Categorical Data

- Displaying and Describing Quantitative Data

  ➢ Activity – Gather data to explore the shapes of various distributions.

- Describing Distributions Numerically

  ➢ Measures of Center

  ➢ Measures of Spread

  ➢ Outliers

  ➢ Activity – Explore various aspects of a distribution (center, shape, spread, outliers)

  ➢ Activity – Match histograms, boxplots, and summary statistics.

- ➢ Activity – Explore the linear transformations of random variables and sums/differences of independent random variables.

- Standard Deviation as a Ruler

  - ➢ Statistics

  - ➢ Parameters

    - o Calculate one variable statistics on the calculator.

- The Normal Model

  - ➢ 68-95-99.7 Rule

  - ➢ Z-scores

    - o Performing z-tests using the calculator.

  - ➢ Normal Probability Plots

- AP Review Questions – Work a portion of an AP Exam including free response questions covering the skills we have learned so far.

Second Six Weeks

- Scatterplots

  - ➢ Association

  - ➢ Correlation

  - ➢ Correlation Coefficents

    - o Using Calculator to calculate the correlation coefficient.

  - ➢ Activity – Matching scatterplots activity.

- Linear Regression

  - ➢ Predicting Values

  - ➢ Line of Best Fit

    - o Find least squares regression line on a calculator.

- Regression

- Residuals

- Activity – Explore what happens to LSRL and correlation coefficient when different points are added to the data.

- Activity – Investigate the importance of graphing data.

- Regression Wisdom

  - Extrapolation

  - Lurking Variables

  - Outlier Condition

- Re-Expressing Data

- AP Review Questions – Work a portion of an AP Exam including free response questions covering the skills we have learned so far.

Third Six Weeks

- Understanding Randomness

  - Random Numbers

    o Using the random number generator on a calculator.

  - Simulations

    o Using random numbers on a calculator as a simulation.

- Sample Surveys

  - Bias

  - Population vs Samples

  - Sample Size

  - Randomizing

  - Census

- ➤ Simple Random Samples

- ➤ Stratified Random Sampling

- ➤ Cluster Sampling

- Experiments and Observational Studies

  - ➤ Observational Studies

  - ➤ Experiments

  - ➤ Controls

  - ➤ Experimental Design

  - ➤ Blinding

  - ➤ Placebos

  - ➤ Confounding

  - ➤ Activity – Design and experiment to test given items.

  - ➤ Project – Gummy Bear Project – design a well-controlled experiment, analyze data (summary statistics), and write a report with computer-generated graphs.

- AP Review Questions – Work a portion of an AP Exam including free response questions covering the skills we have learned so far.

Fourth Six Weeks

- Randomness and Probability

  - ➤ Law of Large Numbers

  - ➤ Mutually Exclusive

  - ➤ Addition Rule

  - ➤ Multiplication Rule

- Probability Rules

  - General Addition Rule

  - Conditional Probability

  - Independent Events

  - Tree Diagrams

- Random Variables

  - Means

  - Variances

    - Calculating random variable statistics on calculator.

- Probability Models

  - Geometric Model

    - Test a Geometric distribution on calculator.

    - Activity – Using graphing calculator, investigate how the histograms of geometric distributions behave when the probability of success increases.

  - Binomial Model

    - Test a Binomial Distribution on calculator.

    - Activity – Using graphing calculator, investigate how the histograms of binomial distributions behave when the probability of success increases.

  - Poisson Distributions

    - Test a Poisson Distribution on calculator.

    - Activity – Using graphing calculator, investigate how the histograms of poisson distributions behave when the probability of success increases.

  - Continuous Random Variables

- AP Review Questions – Work a portion of an AP Exam including free response questions covering the skills we have learned so far.

Fifth Six Weeks

- Sampling Distribution Models

  - Sampling Proportions

  - Sampling Distribution Model

  - Sampling Means

  - Central Limit Theorem

  - Standard Error

  - Activity – perform sampling from a population to explore the relation between sample size and variance of sampling distribution.

- Confidence Intervals for Proportions

  - Confidence Interval

  - Margin of Error

  - Activity – Explore the effect of sample size on width of interval.

  - Activity – gather data with flying frogs.

- Testing Hypotheses About Proportions

  - Testing Hypotheses

  - Alternatives

  - P-values

- More About Tests

  - One Proportion z-test

    - Perform a one proportion z-test on calculator.

  - Confidence Intervals and Hypothesis Tests

- ➢ Errors

- Comparing Two Proportions

  - ➢ Standard Deviations

  - ➢ Two Proportion z-test

    - o Run a two proportion z-test on calculator.

- AP Review Questions – Work a portion of an AP Exam including free response questions covering the skills we have learned so far.

Sixth Six Weeks

- Inferences About Means

  - ➢ Degrees of Freedom

  - ➢ T-values

    - o Finding probability of t-values on the calculator.

  - ➢ One Sample t-test

    - o Use a calculator to find confidence intervals for means.

- Comparing Means

  - ➢ Comparing two means

  - ➢ Two sample t-interval

  - ➢ Test the Difference Between Means

    - o Hypothesis testing for difference between two means using a calculator.

  - ➢ Activity – simulate sampling distribution difference of means and proportions.

- Paired Samples and Blocks

- ➢ Paired t-test

  - ○ Testing a hypothesis for the mean of paired differences on the calculator.

  - ➢ Confidence Intervals for Matched Pairs

- Comparing Counts

  - ➢ Chi-Square test

    - ○ Performing Chi-Square tests on the calculator.

  - ➢ Activity – Use "crooked" dice or round dice to perform goodness of fit test.

  - ➢ Activity – Explore the difference between the Chi-Square tests.

- Inferences For Regression

  - ➢ Confidence Intervals for Predicted Values

    - ○ Calculating confidence intervals using calculator.

- AP Review Questions – Work a full AP Exam including free response questions.

- AP Exam Review and practice – cover any materials students need help with.

- Final Project – Design a study, gather data, analyze the data, and write a report including computer generated results and graphs.