AP Statistics

Semester A Summary:

In this first semester course, the student will become familiar with the vocabulary, method, and meaning in the statistics that exist in the world. This is an applied course in which the student will actively construct his own understanding of the methods, interpretation, communication, and application of statistics. All topics, including univariate and bivariate data, studies and experiments, probability, and distributions, are framed by enduring understandings and essential questions designed to allow the student a deep understanding of the concepts at hand rather than memorization and emulation.

The student will also complete several performance tasks throughout the first semester of AP Statistics consisting of relevant, open-ended tasks requiring the student to connect multiple statistical topics together. The TI-83+/84 OR 89 calculator and computers will be used to explore the world of data and the patterns which can be found by analyzing this information as well as statistical relationships. General topics of study include exploring data, planning and design of a study, anticipating patterns, and statistical inference.

Semester A Outline

1. **Welcome**
    1. Welcome
    2. Note Taking Skills
    3. Calculators
    4. Rubric for Grading Quizzes and Test Essay Question
2. **Exploring Univariate Data**
    1. Introduction to Univariate Data
    2. Graphical Displays of Categorical Data
        - By the end of this lesson, you will learn to create and interpret bar charts and pie graphs
    3. Graphical Displays of Quantitative Data 1
        - Graphically display quantitative univariate data using dotplots and stemplots
        - Create dotplots and stemplots (often called stem and leaf plots) and describe these plots
    4. Graphical Displays of Quantitative Data 2
        - Create proper histograms and time plots
        - Graphically display quantitative univariate data using histograms and time plots
    5. Graphical Displays of Quantitative Data 3
        - By the end of this lesson, you will learn to read, interpret and create cumulative frequency plots
    6. Measuring the Center
        - In this lesson, you will learn to quantitatively describe the center of a distribution using the mean and median

7. Measuring the Spread
    - Quantitatively describe the spread of a distribution
    - Compute the standard deviation and range of a distribution and data set
    - Measure the spread of a distribution using the standard deviation and range
8. The Five-number Summary and Boxplots
    - Quantitatively describe the center and spread of a distribution
    - Determine if an extreme value is an outlier or not
    - Describe the center and spread of a distribution using the five-number summary and its boxplot
9. Review of Describing Distributions
10. Density Curves
    - Describe distributions using density curves
    - Calculate probabilities based on simple density curves
11. The Normal Distribution
    - Recognize different normal distributions
    - Understand and apply the empirical rule to determine probabilities and proportions
12. Standardized Scores
    - Understand the necessity of standardization and standardized or z-scores
    - Compare data points (such as test scores) from different distributions
    - Compute z-scores in order to make comparisons between data points and distributions
13. Normal Distribution Calculations
    - Calculate normal distribution probabilities and scores and z-scores given normal proportions
    - Use these properties of the normal distribution to answer important questions
    - Calculate standardized and other scores based upon probabilities in the normal distribution
14. Assessing Normality
    - By the end of this lesson, you will learn to assess normality through a histogram, the empirical rule, and a special new graph called the normal probability plot
15. Unit Two Test

3. **Exploring Bivariate and Categorical Data**
    1. Introduction to Bivariate Data
    2. Creating Scatterplots
        - Graphically display bivariate data
        - Create scatterplots
        - Use a calculator to create scatterplots
    3. Interpreting Scatterplots
        - Interpret scatterplots
        - Identify and describe scatterplot association (or direction), form, strength
        - Identify outliers
    4. Correlation
        - Calculate correlation, both with and without technology
        - Properly interpret the correlation
        - Quantify the strength of an association
    5. The Least Squares Regression Line (LSRL)
        - Model data with the least squares regression line
        - Find, use, and interpret the least squares regression line, both with and without technology

- Calculate r, the correlation, with technology

6. Residuals and Residual Plots
    - Evaluate a regression through residuals and the residual plot
    - Assess the quality of a linear regression
7. Correlation and Regression Details
    - Recognize the details and cautions and limitations of correlations and regressions
    - Interpret scatterplots and regression
    - Recognize outliers (in one or both directions), influential points, and the coefficient of determination (also known as r-squared)
8. Non-Linear Data
    - By the end of this lesson, you will understand when and how to move beyond linear regression
9. Exponential Models
    - By the end of this lesson, you will model exponential data such as populations, bacteria, and money
10. Power Models
    - By the end of this lesson, you will recognize when and how to model with power functions
11. Bivariate, Categorical Data
    - By the end of this lesson, you will analyze bivariate data that is categorical
12. Simpson's Paradox and Other Cautions
    - By the end of this lesson, you will understand Simpson's Paradox, lurking variables, causation, and extrapolation
13. Unit Three Review and Test

4. **Conducting Studies and Experiments**
    1. Introduction to Studies, Experiments, and Simulations
    2. Designing Samples and Surveys
        - Explain the basics of designing a sample and survey
        - Identify the characteristics of a well-designed and well-conducted survey
        - Design a sample for a survey
    3. The SRS
        - Define the Simple Random Sample and its significance
        - Select individuals using a Simple Random Sample (SRS)
    4. Bad Sampling
        - Recognize poor sampling designs
        - Carefully interpret the data that results
    5. Good Sampling
        - By the end of this lesson, you will recognize stratified, cluster, and systematic sampling
    6. Cautions about Sampling
        - Demonstrate awareness of bias and pitfalls in sampling design and learn how to avoid and account for error
        - Identify how bias presents itself in sampling
        - Discover voluntary response bias, response bias, undercoverage, question wording, and sampling error
    7. Experimental Design
        - Identify the basic terminology of experiments
        - Discern the purpose and feasibility of conducting an experiment
        - Discover the basic structure of experimental design and what role randomization plays
        - Design a completely randomized experiment

8. Different Experimental Designs
    - Identify the placebo effect and decide how to account for it
    - Design more complicated experiments using the concepts of matching and blocking
9. Cautions about Experiments
    - By the end of this lesson, you will be able to recognize confounding variables, bias, and blinding
10. Simulations
    - Conduct a simulation using probabilities and either a random digit table or calculator to obtain your data
    - Describe the conditions for and details of conducting a simulation
11. Generalizability
    - By the end of this lesson, you will be able to understand when and how to generalize results
12. Unit Four Review and Test

5. **Probability and Random Variables**
    1. Introduction and Definition of Probability
    2. Sample Spaces and Counting
        - Identify the sample space for a probability setting
        - Recognize replacement
        - Demonstrate how to count using the multiplication principle and see its connection to a tree diagram
    3. Complements, Disjoint Events, and the Addition Rule
        - Recognize the basic rules of probability
        - Define Venn diagrams
        - Demonstrate Benford's law
    4. Independence and the Multiplication Rule
        - Identify probability and the multiplication rule
        - Explain independence and how it affects probability models
        - Illustrate how probability can model more realistic settings
    5. Unions, Venn Diagrams, and more Probability
        - Understand Union notation
        - Use Venn diagrams to understand overlapping events
    6. Conditional Probability
        - Recognize how the concept of independence and conditional probability are related
        - Calculate conditional probabilities
    7. Tree Diagrams and More Practice
        - Organize data into a tree diagram
        - Use a tree diagram to find probability
    8. Discrete Random Variables
        - Define and notate random variables
        - Recognize discrete random variables
        - Identify and use discrete probability distributions
    9. Continuous Random Variables
        - Distinguish between discrete and continuous random variables
        - Construct and use continuous probability distributions and review the normal distribution
        - Correctly make normal distribution calculations
    10. Mean and Variance of a Random Variable
        - Determine the mean, or expected value, of a random variable
        - Identify if a game is fair using statistics

- Calculate the variance and standard deviation of a random variable

11. The Law of Large Numbers and Rules for Means and Variances
    - Recognize and understand the applicability of the Law of Large Numbers
    - Use and apply the rules for means and variances when combining random variables
12. Unit Five Review and Test

6. **Binomial, Geometric, and Sampling Distributions**
    1. Introduction to Binomial Settings
    2. Finding Binomial Probabilities
        - By the end of this lesson, you will be able to recognize binomial probabilities
    3. The Binomial Formula, Mean, and Standard Deviation
        - Use and apply the binomial formula and the mean and standard deviation of binomial distributions
        - Interpret and manipulate the binomial formula
        - Calculate and understand the binomial mean and standard deviation
    4. Practice with Binomial Distributions
    5. Geometric Settings
        - Recognize geometric settings and distinguish them from binomial settings
        - Understand the four conditions necessary for a geometric setting
        - Distinguish between binomial and geometric setting
    6. Calculating Geometric Probabilities, Mean, and Standard Deviation
        - Calculate probabilities within geometric settings as well as apply the geometric mean and standard deviation
        - Use geometric probabilities to model this and other geometric distributions
    7. Additional Practice with Binomial and Geometric Distributions
    8. Introduction to Sampling Distributions
        - Understand what a sampling distribution is as well as how it is affected by sampling variability
        - Understand the characteristics of bias and variability
    9. Sample Proportions
        - Define the characteristics of a sampling distribution based upon proportions and categorical data
        - Determine the conditions under which we may estimate the standard deviation of the distribution and assume normality in order to make calculations and decisions
    10. Sample Means
        - Determine the characteristics of a sampling distribution based on means and quantitative data
        - Select the details of sampling distributions of quantitative data
        - Discover the conditions under which you may assume normality in order to make calculations and decisions
    11. The Central Limit Theorem
        - Determine the significance and necessity of the Central Limit Theorem to the study of statistics
        - Understand how it is that nearly every sampling distribution approaches a normal distribution
    12. Review of Random Variables and Sampling Distributions
    13. Unit Six Review and Test
    14. Semester 1 Exam

Semester B Summary:

In this second semester course, the student continues to study the vocabulary, methods, and meaning in the statistics that exist in the world. This is an applied course in which the student will actively construct his or her own understanding of the methods, interpretation, communication, and application of statistics. All topics, including inferences, probability distributions, means, confidence intervals, and significance tests, are framed by enduring understandings and essential questions designed to allow the student a deep understanding of the concepts at hand rather than by memorization and emulation. The student will also complete several performance tasks throughout the second semester course consisting of relevant, open-ended tasks requiring the student to connect multiple statistical topics together.

The TI-83+/84 OR 89 calculator and computers will be used to explore the world of data and the patterns that can be found by analyzing this information as well as statistical relationships. General topics of study include exploring data, planning and design of a study, anticipating patterns, and statistical inference.

Semester B Outline

1. **Introduction to Inference**
    1. Confidence Intervals
    2. Sample Size and Confidence Interval Behavior
        - Recognize the relationship between sample size, confidence level, and confidence intervals
        - Learn how sample sizes are determined
        - Demonstrate how the size of a confidence interval may increase or decrease
    3. Confidence Intervals and the Calculator
        - By the end of this lesson, you will be able to effectively use your calculator to construct confidence intervals
    4. The Significance Test
        - By the end of this lesson, you will be able to understand the structure and logic of the significance test
    5. Statistical Significance
        - By the end of this lesson, you will be able to understand the meaning of statistical significance, level of significance, and the p-value
    6. Connecting Confidence Intervals and Tests of Sign
        - By the end of this lesson, you will be able to understand the connection between a two-sided significance test and the confidence interval
    7. Significance Tests and Decision Making
        - By the end of this lesson, you will be able to understand how significance tests are utilized to make decisions and understand the risk of such decisions
    8. Errors and Power
        - By the end of this lesson, you will be able to describe both Type I and Type II errors in context as well as finding the probability of a Type I error
    9. Review of Confidence Intervals and Significance Tests
    10. Unit 1 Review and Test
2. **Inference for Means and Proportions**
    1. Confidence Intervals for T
    2. Significance Tests for T
        - Carry out significance tests for unknown populations
        - Apply significance testing for the matched pairs experimental design
        - Conduct complete t-tests for one sample data and matched pairs data
    3. Conditions for T Testing

- By the end of this lesson, you will understand the conditions that must be met prior to conducting any testing or constructing any intervals.

4. T Distributions and the Calculator
    - By the end of this lesson, you will know how to use the calculator to construct t intervals and carry out t tests.
5. T Intervals for Comparing Two Means
    - Recognize how the procedures of constructing t intervals changes when comparing two means from two populations
    - Demonstrate the new t distribution and two sample statistics
6. T Tests for Comparing Two Means
    - By the end of this lesson, you will know how to carry out significant tests for comparing two means.
7. Review, Two Means, and the Calculator
    - Understand the conditions for two sample estimating and testing
    - Understand the calculator's role with two means
8. Confidence Intervals for Proportions
    - Properly construct confidence intervals for proportions
    - Recognize the conditions under which confidence intervals may be created
9. Significance Tests for Proportions
    - Conduct complete significance tests for a proportion
    - Determine the conditions under which such tests are carried out
10. Choosing Sample Size and Using Your Calculator
    - Determine a sample size to obtain a given margin of error
    - Construct intervals and conduct significance tests proficiently using your calculator
11. Confidence Intervals and Two Proportions
    - Construct two proportion confidence intervals in order to compare proportions
    - Use your calculator to construct these intervals
12. Significance Tests for Two Proportions
    - By the end of this lesson, you will conduct two proportion significance tests.
13. Unit 2 Review and Test

3. **Inference for Goodness of Fit**
    1. Chi-Squared Test for Goodness of Fit
    2. Goodness of Fit Conditions and the Calculator
        - By the end of this lesson, you will discover the conditions or assumptions under which we may perform the Goodness of Fit test. You are also going to learn the calculator's role. Those of you with a TI-89 are at a bit of an advantage, for a change, with the Goodness of Fit test.
    3. Chi-Squared Test of Association/Independence
        - By the end of this lesson, you will use chi-square to determine if there is an association or independence between two categorical variables.
    4. Chi-Squared Test of Independence: Conditions and the Calculator
    5. Inference for Regression: Estimating Slope
    6. Regression and Testing Slope
    7. Unit 3 Review and Test
4. **Review**
    1. Course Review
    2. AP Test Review
    3. How to Choose the Right Test
5. **Culminating Project**
    1. Project Proposal

2. Scoring and Check Point
3. Cumulative Project
4. Semester Two Exam

