ACALANES UNION HIGH SCHOOL DISTRICT
COURSE OF STUDY: CURRICULAR AREA – MATH

COURSE TITLE:	STATISTICS
GRADE LEVEL:	10-12
COURSE LENGTH:	One Year
PREFERRED PREVIOUS COURSE OF STUDY:	Algebra 2
CREDIT:	10 Credits
UC/CSU CREDIT:	Pending UC/CSU credit for mathematics requirement; subject area (“c”)
GRADUATION REQUIREMENT:	Fulfills 10 units of mathematics credit (2 semesters beyond Algebra 1) required for graduation
STANDARDS AND BENCHMARKS:	California Common Core State Standards, Higher Mathematics Standards; Probability and Statistics
ADOPTED:	March 16, 2016
INSTRUCTIONAL MATERIALS:	Statistics Through Applications 2nd Ed., W.H. Freeman & Co. 2009

COURSE DESCRIPTION:

Introduction to Statistics is an activity- and project-based class that will familiarize students the collection and analysis of current real-world data. Students will learn reliable methods for obtaining sample data from a population, as well as various methods of visual and numerical description of the findings. Emphasis will be placed on forming original hypotheses, testing them, and then constructing formal written presentations of their conclusions. Students will also learn how to use statistical software and calculator applications to help facilitate they analysis.

COURSE OBJECTIVES:

Upon completion of the course, students will:

1. Display and interpret data using various graphical and numerical techniques.
2. Use scatterplot and regression analysis to draw conclusions and make predictions.
3. Apply techniques of sampling and experiment design.
4. Use counting principles and probability rules.
5. Use tables and diagrams to compute the probability of chance events.
6. Apply concepts of mean and standard deviation to various probability distributions.
7. Apply techniques probability statistical analysis to make inferences and test hypotheses about a population.

ASSESSMENT:

Assessments are designed to promote and evaluate mathematical thinking. Teachers use engaging activities that involve students in investigating, conjecturing, verifying, applying, evaluating, and communicating in various assessment modalities.

Formal and informal assessments cab ne made on the basis of both individual and group work. Assessments should be from a variety of means and could include performance tasks, quizzes, tests, projects, investigations, and daily assignments.

Assessments should be measuring the following claims:
Claim #1 – Concepts & Procedures
Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency.
Claim #2 – Problem Solving
Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem solving strategies.
Claim #3 – Communicating Reasoning
Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.
Claim #4 – Modeling and Data Analysis
Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.

Performance Tasks

Performance tasks are used to better measure capacities such as depth of understanding, research skills, and complex analysis, which cannot be adequately assessed with selected- or constructed-response items. These tasks may require students to evaluate, optimize, design, plan, model, transform, generalize, justify, interpret, represent, estimate, and calculate solutions. Performance Tasks can be used for a variety of purposes such as topic engagement, formative and evaluative assessment. They may be performed individually or in small groups, depending on the purpose of assessment.

Performance tasks should:

- Integrate knowledge and skills across multiple claims
- Require student-initiated planning and management of information and ideas
- Reflect a real-world task and/or scenario-based problem
- Allow for multiple approaches
- Represent content that is relevant and meaningful to students
- Be assessed using an understandable rubric that provides meaningful feedback for students and the teacher

GRADING GUIDELINES: See AUHSD Grading Guidelines: Final Mark Rubric and Final Course mark Determination Components

COURSE CONTENT:

Mathematical Practices

The Standards for Mathematical Practice are "habits of the mind of mathematically proficient students". They describe the attributes that mathematics educators at all levels are striving to develop in their students, as these practices are based on key mathematical processes and proficiencies. The goal of implementing these practices is to develop students who can use their knowledge of mathematics in flexible, sophisticated, and relevant ways across multiple disciplines.

#1 Make sense of problems and persevere in solving them (Hypothesize & Strategize)

- Students are:
  - Making conjectures about what the problem is asking and how they can begin to solve it
  - Checking for the reasonableness of the strategy as the work progresses and making adjustments as needed
- Teachers develop this skill by having students:
  - Explain the meaning of the problem and/or restate the problem
  - Analyze the given information and develop entry points into the problem and develop strategies for solving the problem
  - Execute and evaluate multiple strategies

#2 Reason abstractly and quantitatively (De/Contextualize)

- Students are:
  - Determining what numbers and symbols represent through the use of diagrams, graphs or equations
- Teachers develop this skill by having students:
  - Move between multiple representations to determine the meaning behind quantities
  - Express purely mathematical expressions with real world context and taking quantities out of context and representing them as abstract mathematical ideas or expressions

#3 Construct viable arguments; critique others' reasoning

- Students are:
  - Justifying their thinking by providing evidence based on mathematical properties and using that evidence to evaluate the reasoning of others
- Teachers develop this skill by having students:
  - Make conjectures, compare and contrast methods, and identify flawed logic by providing counter-example

#4 Model with Mathematics

- Students are:
  - Interpreting and constructing graphs, tables, number lines, diagrams or equations to model real-world situational data
- Teachers develop this skill by having students:
  - Use models to make interpolative and extrapolative inferences
  - Examine the effectiveness and appropriateness of a model

#5 Use appropriate tools strategically

- Students are:
  - Selecting appropriate math tools and technology to help solve problems including manipulatives, graphing utilities, tables, matrices, computer applications, compasses, etc.
- Teachers develop this skill by having students:
  - Identify the strengths and weaknesses of different tools in relation to solving a given problem and also use tools to explore, confirm or deepen understanding

#6 Attend to Precision

- Students are:
  - Calculating quantities accurately through proper rounding (based on context), labeling of units of measure, and checking their work
  - Selecting a problem solving method that allows for appropriate precision
- Teachers develop this skill by having students:
  - Formulate precise explanations of their work using vocabulary and justify their rounding process
  - Re-examine their work or thinking process, and then demonstrate the method by which they check their answers

#7 Look For and Make Use of Structure

- Students are:
  - Looking for patterns or relationships and using that structure to simplify complex ideas
- Teachers develop this skill by having students:
  - Extend prior knowledge of similar situations to novel ones or break down complex problems in smaller parts which resemble simpler, more familiar ideas

#8 Look for and express regularity in repeated reasoning (Generalize)

- Students are:
  - Developing general methods, rules, or short cuts and determining when they are appropriate
- Teachers develop this skill by:
  - Facilitating activities which allow for students' "aha!" moments and then helping them use it to develop "rules" based on repeated trials with a process

Common Core Course Standards:

S-ID **Interpreting Categorical and Quantitative Data**

1. Summarize, represent, and interpret data on a single count or measurement variable.
2. Summarize, represent, and interpret data on two categorical and quantitative variables.
3. Interpret linear models.

S-IC **Making Inferences and Justifying Conclusions**

1. Understand and evaluate random processes underlying statistical experiments
2. Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

S-CP **Conditional Probability and the Rules of Probability**

1. Understand independence and conditional probability and use them to interpret data.
2. Use the rules of probability to compute probabilities of compound events in a uniform probability model.

S-MD **Use Probability to Make Decisions**

1. Calculate expected values and use them to solve problems.
2. Use probability to evaluate outcomes of decisions.

Scope and Sequence

Topic 1:	Collecting Data
Topic 2:	Drawing Conclusions from Data
Topic 3:	Displaying Distributions with Graphs
Topic 4:	Describing Distributions with Numbers
Topic 5:	Measuring Location in a Distribution
Topic 6:	Normal Distributions
Topic 7:	Scatterplots and Correlation
Topic 8:	Regression and Prediction
Topic 9:	Sampling and Surveys
Topic 10:	Designing Experiments
Topic 11:	Probability Rules and Randomness
Topic 12:	Probability Distributions and Models
Topic 13:	Introduction to Inference
Topic 14:	Confidence Intervals
Topic 15:	Significance Tests
Topic 16:	Chi-Square Tests

Course Outline:

I. Introduction: What is Statistics?
- a. Randomness and Random Sampling
- b. Introduction to Sample and Experiment Design

II. Exploring and Organizing Data Graphically
- a. Frequency Distributions
- b. Bar Graphs and Histograms, Pie Charts
- c. Stem and Leaf Plots, Box Plots
- d. Comparative Techniques for Statistical Inference

III. Exploring Data Numerically
- a. Three measures of central tendency: mean, median, mode
- b. Measures of variation
- c. Percentiles and Cumulative Relative Frequency

IV. Correlation and Regression
- a. Scatter Plots and Linear Correlation
- b. Linear Regressions and Models for Prediction
- c. Residual Analysis

V. Elementary Probability Theory
- a. Counting Principles
- b. Basic Probability Rules
- c. Two-way Tables and Conditional Probability
- d. Tree Diagrams
- e. Binomial Distribution and its Applications

VI. Sampling Variability and Sampling Distributions
- a. Standard Normal Density Curve
- b. Probability and the Density Curve

c. Central Limit Theorem and its Implications
d. Standard Normal Calculations

VII. Sampling from a Population
a. Establishing Normality in a Collected Data Set
b. Estimating Population Parameters from a Sample
c. Controlling Variability through Better Sampling

VIII. Finding the Truth about Population through Sampling
a. Confidence Intervals
b. Estimating Means
c. Estimating Proportions
d. Comparing Parameters between Two Populations
e. Chi Square Tests

IX. Data Ethics
a. Privacy and Sensitive Data
b. Ethical Use of Data
c. Data and Deception: How to be Statistically Informed