

# FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

## Course Outline

### AP Statistics

**Date: March 2006**

**Subject Area: Mathematics**

**Proposed Grade Level(s): 11-12**

**Course Length: 1 Year**

**Grading: A-F**

**Number of Credits: 5 Per Semester**

**Prerequisites: 'C or better in Algebra 2**

#### **COURSE DESCRIPTION:**

The topics of AP Statistics are divided into four major themes: exploratory analysis, planning and conducting a study, probability, and statistical inference. Exploratory analysis of data makes use of graphical and numerical techniques to study patterns and departure from patterns. Probability is the tool used for anticipating what the distribution of data should look like under a given model. Statistical inference techniques include confidence intervals and a variety of hypothesis test techniques.

#### **GENERAL GOALS / PURPOSES:**

Statistics is about data. Data are numbers with a context. Our modern world is filled with statistical information. The primary goal of this course is provide students with basic tools and techniques to understand how data is obtained and used and to view the results with an educated and critical eye. A second objective of the class is to prepare students for the Advanced Placement Statistics exam. Most universities award credit to students based upon their scores on this exam. Students will be encouraged to participate in the national exam. The course will also be consistent with a college "Stat 1" course.

#### **STUDENT READING COMPONENT:**

Problems in this course are typically presented in written form where effective reading and analysis must take place in order to solve the problem; these techniques are taught as part of the course.

#### **STUDENT WRITING/ORAL COMPONENT:**

Students will be required to present their results in writing, as well as presenting work orally in class discussions. Additionally, Students will complete a variety of projects, individually and in small groups, that will require a written report and oral presentation. Written reports will include a description of methods used, data collected with results, and detailed analysis of results and methodology.

## **FINAL ASSESSMENT:**

Final exams covering all material will be given. A simulated AP Statistics exam will be given. A final individual project where students must plan and complete a statistical study, write a detailed report, and make an oral presentation will be required each semester. Fall semester project will focus on descriptive statistics; spring semester project will include the use of inferential statistical techniques.

## **DETAILED UNITS OF INSTRUCTION:**

### **Note:**

- Topics may be taught in different order and enriched by additional topics.
- Fall semester will focus on descriptive statistics techniques and probability
- Spring semester will focus on applications involving inferential statistics

### I. Exploring Data: Describing patterns and departure from patterns

- A. Constructing and interpreting graphical displays of distributions
  - Dot plot, stem plot, histogram, cumulative frequency histograms
  - Center and spread
  - Clusters and gaps
  - Outliers
  - Shape
- B. Summarizing univariate distributions
  - Measuring Center: median, mean
  - Measuring spread: Range interquartile range, standard deviation
  - Measuring position: quartiles, percentiles, standardized scores (z-scores)
  - Box plots
  - The effect of changing units on summary displays
- C. Comparing distributions
  - Dot plots, back-to-back stem plots, parallel box plots
  - Comparing center and spread within and between groups
  - Comparing clusters and gaps
  - Comparing outliers and other unusual features
  - Comparing shapes
- D. Bivariate data
  - Frequency tables and bar charts
  - Marginal and joint frequencies for 2-way tables
  - Conditional relative frequencies and association
  - Comparing using bar charts

### II. Sampling and Experimentation: Planning and Conducting a Survey

- A. Types of Data
  - Quantitative, qualitative
  - Discrete, continuous
- B. Overview of methods of data collection
  - Census
  - Sample survey
  - Experiment
  - Observational

- C. Planning and conducting surveys
  - Characteristics of a well-designed and well-conducted survey
  - Populations, samples, and random selection
  - Sources of bias in sampling and surveys
  - Sampling methods, including simple random sampling, stratified random sampling and cluster sampling
- D. Planning and conducting experiments
  - Characteristics of a well-designed and well-conducted survey
  - Treatments, control groups, experimental units, random assignments, and replication
  - Sources of bias and confounding, including placebo effect and blinding
  - Completely randomized design
  - Randomized block design, including matched pairs design
  - Generalization of results and types of conclusions that can be drawn from observational studies, experiments, and survey

### III. Anticipating Patterns: Exploring random phenomena using probability and simulation

- A. Probability
  - Interpreting probability, including relative frequency interpretation
  - “Law of Large Numbers”
  - Addition rule, multiplication rule, conditional probability and independence
  - Discrete random variables and their probability distributions, including Binomial and Poisson Distributions
  - Simulation of random behavior and probability distributions
  - Mean and standard deviation of a random variable, and linear transformations of a random variable
- B. Combining independent random variables
  - Independence vs. dependence
  - Mean and standard deviation for sums and differences of independent random variables
- C. The normal distribution
  - Properties of the normal distribution
  - Using tables of the normal distribution
  - The normal distribution as a model for measurements
  - Approximation of Binomial distribution
- D. Sampling distributions
  - Sampling distribution of a sample proportion
  - Sampling distribution of a sample mean
  - Central Limit Theorem
  - Sampling distribution of a difference between two independent sample proportions
  - Sampling distribution of a difference between two independent sample means
  - Simulation of sampling distributions
  - T-distribution
  - Chi-square distribution

### IV. Statistical Inference: Estimating population parameters and testing hypotheses

- A. Estimation (point estimators and confidence intervals)
  - Estimating population parameters and margins of error
  - Properties of point estimators including un-biasness and variability
  - Logic of confidence intervals, meaning of confidence level and confidence intervals, and properties of confidence intervals
  - Large sample confidence interval for a proportion

- Large sample confidence interval for a difference between two proportions
  - Confidence interval for a mean
  - Confidence interval for a difference between two means (unpaired and paired)
  - Confidence interval for the slope of a least-squares regression line
- B. Tests of significance
- Logic of significance testing, null and alternative hypotheses; p-values; one- and two-sided tests; concepts of Type I and Type II errors
  - Large sample test for a proportion
  - Large sample test for a difference between two proportions
  - Test for a mean
  - Test for a difference between two means (paired and unpaired)
  - Chi-square test for goodness of fit, homogeneity of proportions, and independence (one- and two-way tables)
  - Test for the slope of a least-squares regression line

**THIS COURSE WILL PREPARE STUDENTS FOR THE CAHSEE AND/OR THE FCUSD EXIT EXAMS:**

Mathematics

**LAB FEE, IF REQUIRED:**

None

**SUBJECT AREA CONTENT STANDARDS TO BE ADDRESSED:**

Topics above are consistent with the AP course outline as well as a typical 1<sup>st</sup> year college statistics course. Topics also meet and exceed all eight standards listed under “Probability and Statistics” in the CA math standards

**DISTRICT ESLRs TO BE ADDRESSED:**

Students will be:

- **Self-Directed Learners:** who will be able to use notes and a textbook to assist them in continuing their learning outside of the classroom.
- **Effective Communicators:** who can explain mathematical concepts to others and use mathematics to organize and explain data.
- **Quality Producers:** who understand the importance of neat, organized work that demonstrates their thinking and understanding of the solution they’ve formed to solve a problem.
- **Constructive Thinkers:** who are able to attack problems with organization, logic, and mathematical skills they’ve developed in a systematic fashion.
- **Collaborative Workers:** who can work in a variety of settings in culturally diverse groups. They will be able to form and use study groups to strengthen their own understanding in addition to providing the same service for classmates.
- **Responsible Citizens:** who accept the consequences of their actions, and who demonstrate their understanding of their role in the learning process.

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