

CHINO VALLEY UNIFIED SCHOOL DISTRICT
INSTRUCTIONAL GUIDE
STATISTICS ADVANCED PLACEMENT

Course Number	5119
Department	Mathematics
Prerequisites	Successful completion of Algebra II and teacher recommendation
Length of Course	Two (2) semesters/One (1) year
Grade Level	10-12
Credit	5 units per semester/10 total credits - math
UC/CSU	Meets "c" math requirement
Board Approved	November 6, 2008

Description of Course – Statistics Advanced Placement (AP) is the science of collecting and analyzing data and turning data into information. The curriculum of this statistics course includes data analysis and statistical inference. The topics involved in data analysis include basic descriptive statistics (mean, median, mode, range, standard deviation, and percentiles), interpretation of data given in graphs and tables, elementary probability, the ability to synthesize information, to select appropriate data for answering a question, and to determine whether or not the data provided are sufficient to answer a given question. This course of study has been prepared in conjunction with the California State Frameworks for Mathematics, the National Council for Teachers of Mathematical Standards for Curriculum and Evaluation, and the Advanced Placement course Description Guide for Statistics published by the College Board.

Rationale for this Course – The goal of the AP course in Statistics in high school is to introduce students to major concepts and tools for collecting, analyzing, and drawing conclusions from data. Students who successfully complete the course and Advanced Placement examination may receive credit and/or advanced placement for a one-semester introductory college statistics course.

Student Selection - Admission to an AP course should depend on the student interest in the subject as well as on such formal credentials as an outstanding record of academic performance. Many highly motivated students with less-than-outstanding records have successfully completed AP courses and have obtained college credit, advanced placement, or both, through an AP Examination.

Standard 1 - Students can describe patterns and departures from patterns (20%–30%). Students can use exploratory analysis of graphical and numerical techniques to study patterns and departures from patterns. Emphasis should be placed on interpreting information from graphical and numerical displays and summaries.

- 1.1 Objective: Construct and interpret graphical displays of distributions of univariate data (dotplot, stemplot, histogram, and cumulative frequency plot).

- 1.1.1 Performance Indicator: Students understand center and spread.
- 1.1.2 Performance Indicator: Students understand clusters and gaps.
- 1.1.3 Performance Indicator: Students understand outliers and other unusual features.
- 1.1.4 Performance Indicator: Students can describe shape.
- 1.2 Objective: Summarize distributions of univariate data.
 - 1.2.1 Performance Indicator: Students can measure center, median, and mean.
 - 1.2.2 Performance Indicator: Students can measure spreads: range, interquartile range, and standard deviation.
 - 1.2.3 Performance Indicator: Students can measure positions: quartiles, percentiles, and standardized scores (z-scores).
 - 1.2.4 Performance Indicator: Students can create boxplots.
 - 1.2.5 Performance Indicator: Students can analyze the effect of changing units on summary measures.
- 1.3 Objective: Compare distributions of univariate data (dotplots, back-to-back stemplots, and parallel boxplots).
 - 1.3.1 Performance Indicator: Students can compare center and spread: within group, and between group variation.
 - 1.3.2 Performance Indicator: Students can compare clusters and gaps.
 - 1.3.3 Performance Indicator: Students can compare outliers and other unusual features.
 - 1.3.4 Performance Indicator: Students can compare shapes.
- 1.4 Objective: Explore bivariate data.
 - 1.4.1 Performance Indicator: Students can analyze patterns in scatterplots.
 - 1.4.2 Performance Indicator: Students can analyze correlation and linearity.
 - 1.4.3 Performance Indicator: Students can analyze least-squares regression lines.

- 1.4.4 Performance Indicator: Students can analyze residual plots, outliers, and influential points.
- 1.4.5 Performance Indicator: Students can analyze transformations to achieve linearity: logarithmic and power transformations.
- 1.5 Objective: Explore categorical data.
 - 1.5.1 Performance Indicator: Students can analyze frequency tables and bar charts.
 - 1.5.2 Performance Indicator: Students can analyze marginal and joint frequencies for two-way tables.
 - 1.5.3 Performance Indicator: Students can analyze conditional relative frequencies and association.
 - 1.5.4 Performance Indicator: Students can compare distributions using bar charts.

Standard 2 - Students can sample and conduct experimentation: Planning and conducting a study (10%–15%). Students must collect data according to a well-developed plan if valid information on a conjecture is to be obtained. This plan includes clarifying the question and deciding upon a method of data collection and analysis.

- 2.1 Objective: Comprehend methods of data collection.
 - 2.1.1 Performance Indicator: Students can comprehend and create census.
 - 2.1.2 Performance Indicator: Students can comprehend and create sample survey.
 - 2.2.3 Performance Indicator: Students can conduct experiment.
 - 2.2.4 Performance Indicator: Students can conduct observational study.
- 2.2 Objective: Plan and conduct surveys.
 - 2.2.1 Performance Indicator: Students can analyze characteristics of a well-designed and well-conducted survey.
 - 2.2.2 Performance Indicator: Students understand populations, samples, and random selection.
 - 2.2.3 Performance Indicator: Students can comprehend sources of bias in sampling and surveys.

- 2.2.4 Performance Indicator: Students can apply sampling methods, including simple random sampling, and stratified random sampling, and cluster sampling.
- 2.3 Objective: Plan and conduct experiments.
 - 2.3.1 Performance Indicator: Students can analyze characteristics of a well-designed and well-conducted experiment.
 - 2.3.2 Performance Indicator: Students understand treatments, control groups, experimental units, random assignments, and replication.
 - 2.3.3 Performance Indicator: Students can analyze sources of bias and confounding, including placebo effect and blinding.
 - 2.3.4 Performance Indicator: Students understand completely randomize design.
 - 2.3.5 Performance Indicator: Students understand randomize block design, including matched pairs design.
- 2.4 Objective: Comprehend generalized results and types of conclusions that can be drawn from observational studies, experiments, and surveys.
 - 2.4.1 Performance Indicator: Students can draw conclusions from observational studies, experiments and surveys.

Standard 3 - Students can anticipate patterns. Students can explore random phenomena using probability and simulation (20%–30%). Students comprehend that probability is the tool used for anticipating what the distribution of data should look like under a given model.

- 3.1 Objective: Comprehend probability.
 - 3.1.1 Performance Indicator: Students understand probability, including long-run relative frequency interpretation.
 - 3.1.2 Performance Indicator: Students can comprehend “Law of Large Numbers” concept.
 - 3.1.3 Performance Indicator: Students can comprehend addition rule, multiplication rule, conditional probability, and independence.
 - 3.1.4 Performance Indicator: Students can comprehend discrete random variables and their probability distributions, including binomial and geometric.
 - 3.1.5 Performance Indicator: Students can run a simulation of random behavior and probability distributions.

- 3.1.6 Performance Indicator: Students can comprehend mean (expected value) and standard deviation of a random variable, and linear transformation of a random variable.
- 3.2 Objective: Combine independent random variables.
 - 3.2.1 Performance Indicator: Students can comprehend notion of independence versus dependence.
 - 3.2.2 Performance Indicator: Students can comprehend mean and standard deviation for sums and differences of independent random variables.
- 3.3 Objective: Comprehend normal distribution.
 - 3.3.1 Performance Indicator: Students can comprehend properties of the normal distribution.
 - 3.3.2 Performance Indicator: Students can use tables of the normal distribution.
 - 3.3.3 Performance Indicator: Students can apply normal distribution as a model for measurements.
- 3.4 Objective: Comprehend sampling distributions.
 - 3.4.1 Performance Indicator: Students can comprehend sampling distribution of a sample proportion.
 - 3.4.2 Performance Indicator: Students can comprehend sampling distribution of a sample mean.
 - 3.4.3 Performance Indicator: Students can comprehend Central Limit Theorem.
 - 3.4.4 Performance Indicator: Students can comprehend sampling distribution of a difference between two independent sample proportions.
 - 3.4.5 Performance Indicator: Students can comprehend sampling distribution of a difference between two independent sample means.
 - 3.4.6 Performance Indicator: Students can comprehend simulation of sampling distributions.
 - 3.4.7 Performance Indicator: Students can comprehend and apply t-distribution.
 - 3.4.8 Performance Indicator: Students can comprehend and apply Chi-square distribution.

Standard 4 - Students can comprehend statistical inference: Estimating population parameters and testing hypotheses (30%–40%). Statistical inference guides the selection of appropriate models.

4.1 Objective: Apply estimation (point estimators and confidence intervals).

4.1.1 Performance Indicator: Students can estimate population parameters and margins of error.

4.1.2 Performance Indicator: Students can apply properties of point estimators, including unbiasedness and variability.

4.1.3 Performance Indicator: Students can apply logic of confidence intervals, meaning of confidence level and confidence intervals, and properties of confidence intervals.

4.1.4 Performance Indicator: Students can create a large sample confidence interval for a proportion.

4.1.5 Performance Indicator: Students create a large sample confidence interval for a difference between two proportions.

4.1.6 Performance Indicator: Students can create a confidence interval for a mean.

4.1.7 Performance Indicator: Students can create a confidence interval for a difference between two means (unpaired and paired).

4.1.8 Performance Indicator: Students can create a confidence interval for the slope of a least-squares regression line.

4.2 Objective: Comprehend and apply tests of significance.

4.2.1 Performance Indicator: Students can comprehend logic of significance testing, null and alternative hypotheses; p-values; one- and two-sided tests; concepts of Type I and Type II errors; and concept of power.

4.2.2 Performance Indicator: Students can apply large sample test for a proportion.

4.2.3 Performance Indicator: Students can apply large sample test for a difference between two proportions.

4.2.4 Performance Indicator: Students can conduct a test for a mean.

4.2.5 Performance Indicator: Students can conduct a test for a difference between two means (unpaired and paired).

- 4.2.6 Performance Indicator: Students can apply Chi-square test for goodness of fit, homogeneity of proportions, and independence (one- and two-way tables).
- 4.2.7 Performance Indicator: Students can conduct a test for the slope of a least-squares regression line.