

**Mathematics Standard
Catalina Foothills School District
High School: Statistics/Discrete Mathematics**

Statistics and Discrete Mathematics is a rigorous study of statistics and discrete mathematics topics, and is designed to be beneficial to students who are interested in pursuing studies/careers in a variety of areas, including the social sciences, medical fields, business, and economics. Students will study key components of statistics such as frequency distributions, data description, probability distributions, confidence intervals, and hypothesis testing. The discrete mathematics units taught during second semester include the mathematics of voting, fair division, and graph theory. This study will prepare students for AP Statistics and/or future college level coursework in statistics.

Standard for Statistics/Discrete Mathematics by Unit and Measurement Topic

UNIT 1: THE NATURE OF PROBABILITY AND STATISTICS	
Statistics and Probability: Making Inferences and Justifying Conclusions (S-IC)	
HS.S-IC.1	Understand statistics as a process for making inferences to be made about population parameters based on a random sample from that population.
HS.S-IC.2	Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. <i>For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?</i>
HS.S-IC.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
HS.S-IC.6	Evaluate reports based on data.
UNIT 2: FREQUENCY AND DISTRIBUTIONS GRAPHS	
Statistics and Probability: Interpreting Categorical and Quantitative Data (S-ID)	
HS.S-ID.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
HS.S-ID.5	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
UNIT 3: DATA DESCRIPTION CORRELATION AND REGRESSION	
Statistics and Probability: Interpreting Categorical and Quantitative Data (S-ID)	
HS.S-ID.2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
HS.S-ID.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
HS.S-ID.9	Distinguish between correlation and causation.
UNIT 4: PROBABILITY AND COUNTING RULES	
Statistics and Probability: Conditional Probability and the Rules of Probability (S-CP)	
HS.S-CP.2	Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
HS.S-CP.3	Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A , and the conditional probability of B given A is the same as the probability of B .
HS.S-CP.4	Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. <i>For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.</i>

HS.S-CP.5	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. <i>For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.</i>
HS.S-CP.6	Find the conditional probability of A given B as the fraction of B 's outcomes that also belong to A , and interpret the answer in terms of the model.
HS.S-CP.7	Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.
HS.S-CP.8	Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B A) = P(B)P(A B)$, and interpret the answer in terms of the model.
HS.S-CP.9	Use permutations and combinations to compute probabilities of compound events and solve problems.
UNIT 5: DISCRETE PROBABILITY DISTRIBUTIONS	
Statistics and Probability: Using Probability to Make Decisions (S-MD)	
HS.S-MD.1	Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.
HS.S-MD.2	Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.
HS.S-MD.3	Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. <i>For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.</i>
HS.S-MD.4	Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. <i>For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?</i>
HS.S-MD.5	Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. <ul style="list-style-type: none"> a. Find the expected payoff for a game of chance. <i>For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.</i> b. Evaluate and compare strategies on the basis of expected values. <i>For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.</i>
HS.S-MD.6	Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
HS.S-MD.7	Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).
UNIT 6: NORMAL DISTRIBUTION	
Statistics and Probability: Interpreting Categorical and Quantitative Data (S-ID)	
HS.S-ID.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
UNIT 7: CONFIDENCE INTERVALS	
Statistics and Probability: Interpreting Categorical and Quantitative Data (S-ID)	
HS.S-ID.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
Statistics and Probability: Making Inferences and Justifying Conclusions (S-IC)	
HS.S-IC.4	Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
UNIT 8: HYPOTHESIS TESTING	
Statistics and Probability: Making Inferences and Justifying Conclusions (S-IC)	
HS.S-IC.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
UNIT 9: TESTING THE DIFFERENCE BETWEEN TWO MEANS, VARIANCES, AND PROPORTIONS	
Statistics and Probability: Making Inferences and Justifying Conclusions (S-IC)	
HS.S-IC.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
Statistics and Probability: Interpreting Categorical and Quantitative Data (S-ID)	
HS.S-ID.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use

	calculators, spreadsheets, and tables to estimate areas under the normal curve.
UNIT 10: DISCRETE – THE MATHEMATICS OF VOTING	
Contemporary Mathematics: Voting Methods	
CFSD.HS.VM-DM.1-3	Use election theory techniques to analyze election data.
UNIT 11: WEIGHTED VOTING SYSTEMS	
Contemporary Mathematics: Weighted Voting Methods	
CFSD.HS.WVS-DM.1-3	Use weighted voting techniques to decide voting power within a group.
UNIT 12: FAIR DIVISION	
Contemporary Mathematics: Fair Division	
CFSD.HS.FD-DM.1-3	Analyze and describe the issue of fair division. Apply fair division techniques to continuous and discrete cases.
UNIT 13: EULER CIRCUITS	
Contemporary Mathematics: Discrete Mathematics (CM-DM)	
AZ.HS.CM-DM.1	Study the following topics related to vertex-edge graphs: Euler circuits, Hamilton circuits, the Traveling Salesperson Problem (TSP), minimum weight spanning trees, shortest paths, vertex coloring, and adjacency matrices. <i>(The Traveling Salesperson Problem is the focus of Unit 14.)</i>
AZ.HS.CM-DM.2	Understand, analyze, and apply vertex-edge graphs to model and solve problems related to paths, circuits, networks, and relationships among a finite number of elements, in real-world and abstract settings.
AZ.HS.CM-DM.3	Devise, analyze, and apply algorithms for solving vertex-edge graph problems.
AZ.HS.CM-DM.4	Extend work with adjacency matrices for graphs, such as interpreting row sums and using the n th power of the adjacency matrix to count paths of length n in a graph.
UNIT 14: THE TRAVELING SALESMAN PROBLEM	
Contemporary Mathematics: Discrete Mathematics (CM-DM)	
AZ.HS.CM-DM.1	Study the following topics related to vertex-edge graphs: Euler circuits, Hamilton circuits, the Traveling Salesperson Problem (TSP), minimum weight spanning trees, shortest paths, vertex coloring, and adjacency matrices. <i>(The focus in this unit is on the Traveling Salesman Problem.)</i>
AZ.HS.CM-DM.2	Understand, analyze, and apply vertex-edge graphs to model and solve problems related to paths, circuits, networks, and relationships among a finite number of elements, in real-world and abstract settings.
AZ.HS.CM-DM.3	Devise, analyze, and apply algorithms for solving vertex-edge graph problems.
AZ.HS.CM-DM.4	Extend work with adjacency matrices for graphs, such as interpreting row sums and using the n th power of the adjacency matrix to count paths of length n in a graph.
STANDARDS FOR MATHEMATICAL PRACTICE	
HS.MP.1	Make sense of problems and persevere in solving them.
HS.MP.2	Reason abstractly and quantitatively.
HS.MP.3	Construct viable arguments and critique the reasoning of others.
HS.MP.4	Model with mathematics.
HS.MP.5	Use appropriate tools strategically.
HS.MP.6	Attend to precision.
HS.MP.7	Look for and make use of structure.
HS.MP.8	Look for an express regularity in repeated reasoning.