Statistics
Content Standards
2016

Course Title: Statistics
Course/Unit Credit: 1
Course Number: 439090
Teacher Licensure: Please refer to the Course Code Management System (https://adedata.arkansas.gov/ccms/) for the most current licensure codes.
Grades: 9-12
Prerequisite: Algebra I, Algebra II

Linear Systems and Statistics

Statistics is a two-semester course designed for students who have successfully completed Algebra II and expect to further their studies in business, social sciences, or education. Statistics builds on knowledge of probability, randomness, and variability to provide students with an understanding of experimental design, estimation, hypothesis testing, and effective communication of experimental results. Statistical information collected and analyzed by students is used to investigate ways of collecting, displaying, and analyzing data. Statistics does not require Arkansas Department of Education approval.

Prerequisites: Algebra I, Algebra II

Strand	Content Standard
Making Inferences and Justifying Conclusions	
	1. Make inferences and justify conclusions from sample surveys, experiments, and observational studies.
Conditional Probability and the Rules of Probability	
	2. Understand independence and conditional probability and use them to interpret data.
	3. Use the rules of probability to compute probabilities of compound events.
Using Probability to Make Decisions	
	4. Calculate expected values and use them to solve problems.
	5. Use probability to evaluate outcomes of decisions.

Strand: Making Inferences and Justifying Conclusions

Content Standard 1: Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

IC.1.S.1	• 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*
IC.1.S.2	• Use data from a randomized experiment to compare two treatments • Use simulations to decide if differences between parameters are significant

Strand: Conditional Probability and the Rules of Probability

Content Standard 2: Understand independence and conditional probability and use them to interpret data.

CP.2.S.1	Describe events as subsets of a *sample space* (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not")
CP.2.S.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*
CP.2.S.3	Understand the *conditional probability* of A given B as P(A 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
CP.2.S.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 o 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.
CP.2.S.5	Recognize and explain the concepts of *conditional probability* and independence in everyday language and everyday situations 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.

Strand: Conditional Probability and the Rules of Probability

Content Standard 3: Use the rules of probability to compute probabilities of compound events..

CP.3.S.1	Find the *conditional probability* of A given B
CP.3.S.2	Apply the Addition Rule, P(A or B) = P(A) + P(B) - P(A and B), and interpret the answer in terms of the model
CP.3.S.3	(+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model
CP.3.S.4	Use permutations and combinations to compute probabilities of compound events and solve problems
CP.3.S.5	Use visual representations in counting (e.g. combinations, permutations) including but not limited to: • Venn Diagrams • Tree Diagrams

Strand: Using Probability to Make Decisions

Content Standard 4: Calculate expected values and use them to solve problems.

MD.4.S.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
MD.4.S.2	• (+) Calculate the *expected value* of a *random variable* • (+)Interpret the *expected value* of a *random variable* as the mean of the *probability distribution*
MD.4.S.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* 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.
MD.4.S.4	• (+) Develop a *probability distribution* for a *random variable* defined for a *sample space* in which probabilities are assigned *empirically* • (+)Find the *expected value* 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?

Strand: Using Probability to Make Decisions

Content Standard 5: Use probability to evaluate outcomes of decisions.

MD.5.S.1	(+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding *expected values* • Find the expected payoff for a game of chance For example: Find the expected winnings from a state lottery ticket or a game at a fast-food restaurant. In a Statistics course. • Evaluate and compare strategies on the basis of *expected values* 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.
MD.5.S.2	(+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator)
MD.5.S.3	(+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game)

Glossary

Conditional probability	The probability of an even (A), given that another (B) has already occurred; $P(A \mid B) = \frac{P(A \cap B)}{P(B)}$
Confidence interval	Measures the probability that a population parameter will fall between two set values
Empirical probability	The ratio of the number of outcomes in which a specified even occurs to the total number of tries (actual experiment)
Expected value	The mean of a probability distribution; $\mu = \sum xP(x)$
Independent event	Two events are independent if the occurrence or nonoccurrence of one does not change the probability that the other will occur; *P(A and B) = P(A)·P(B)*
Independent variable	The variable that is manipulated by the experimenter to determine its relationship to an observed phenomenon, the dependent variable
Margin of error	Expresses the maximum expected difference between the true population parameter and a sample estimate of that parameter
Population mean	Calculating a sample mean in an attempt to estimate a population you do not know; $\mu = \frac{\sum x}{N} = \frac{x_1 + x_2 + x_3 + ... + x_N}{N}$
Probability distribution	A table or an equation that links each outcome of a statistical experiment with its probability of occurrence
Qualitative variable	Variables that take on values that are names or labels
Quantitative variable	Variables that are numerical and represent a measurable quantity
Random sampling	A procedure for sampling from a population in which the selection of a sample unit is based on chance and every element of the population has a known, non-zero probability of being selected.
Random variable	When the value of a variable is the outcome of a statistical experiment
Sample mean	The average of *n* data points $\bar{x} = \frac{\sum x}{n} = \frac{x_1 + x_2 + x_3 + ... + x_n}{n}$
Sample space	A set of elements that represents all possible outcomes of a statistical experiment
Sample survey	A study that obtains data from a subset of a population, in order to estimate population attributes
Standard deviation	A numerical value used to indicate how widely individuals in a group vary
Theoretical probability	The number of favorable outcomes divided by the number of possible outcomes