



Course Title:	Statistics	Course Number:	2509
Department / Grade Level:	Mathematics/ High School (11th/12th grade)	Date:	April 5, 2019

COURSE DESCRIPTION:

This course is a practical hands-on approach to the study of statistics and probability. The topics include the use of graphs such as histograms, stem plots, time plots, and scatter plots to display data, using numbers such as median, mean, and standard deviation to describe data, and evaluating data distribution. Students examine relationships using correlations and least square regressions. They calculate the probability of simple and compound events. They learn to estimate with confidence as well as to explore tests of significance and to evaluate the validity of statistics contained within published reports.

Materials: Graphing Calculator Recommended

PHILOSOPHY OF INSTRUCTION:

The Coeur d'Alene School District will challenge each student to develop and extend mathematical proficiency and literacy through a focused and coherent curriculum, highest quality mathematics teaching, and assessments that meet the learning needs of each student.

Using the Common Core Standards as a foundation, the curriculum will emphasize depth over breadth with a focus on the foundational concepts and processes of mathematics. In order to address the demands of a changing world, our district's mathematics instruction will prepare students to innovate, think critically, problem solve, communicate, and collaborate—therefore becoming inspired for future study.

SCOPE AND SEQUENCE:

Quarter 1 (9 Weeks) Sept-Oct	Quarter 2 (9 Weeks) Nov- ½ January	Quarter 3 (9 Weeks) Last ½ Jan-March	Quarter 4 (9 Weeks) April-June
<ul style="list-style-type: none"> Analyzing One-Variable Data Analyzing Two-Variable Data Collecting Data (Sampling and Surveys) 	<ul style="list-style-type: none"> Collecting Data (Studies and Experiments) Probability Random Variables 	<ul style="list-style-type: none"> Sampling Distributions Estimating a Parameter Testing a Claim 	<ul style="list-style-type: none"> Comparing 2 Populations or Treatments Inference for Distributions and Relationships Project



UNIT 1: ANALYZING ONE-VARIABLE DATA

Estimated Time Frame:	Weeks - 3 weeks	<u>Thinking Strategies:</u>	Problem Solving Synthesizing Information Determining Importance Asking Questions	
Enduring Understandings:	<ul style="list-style-type: none"> Analyze and compare sets of one-variable data Interpret and graphically represent frequency distributions Represent data sets both qualitative and quantitative Identify and interpret measures of central tendency Analyze and interpret measures of variation in a distribution. Utilize measures of position to represent and interpret data sets 			
<u>Idaho Content Standard</u>	Essential Questions	Key Terms	Resources Needed	<u>Assessment</u> (Tie to Enduring Understandings)
S-ID.1 S-ID.2 S-ID.3	<p>What are the various ways we can numerically and graphically represent data?</p> <p>What determines whether data is qualitative or quantitative?</p> <p>What are the measures of central tendency? How are they determined and which one is most appropriate in a given setting?</p> <p>How can measures of variation be determined and interpreted?</p> <p>How can measures of position be determined and interpreted?</p> <p>How do we compare two or more single-variable data sets using graphical representation and summary statistics?</p>	<ul style="list-style-type: none"> categorical variable quantitative variable distribution frequency table relative frequency table bar chart pie chart dotplot, stemplot boxplot histogram relative frequency histogram cumulative relative frequency graph outlier symmetric distribution skewed distribution range mean median mode deviation quartiles five-number summary interquartile range standardized score population variance percentile standard deviation 	<p>“Statistics and Probability with Applications”, Third Edition by Daren Starnes and Josh Tabor</p> <p>Graphing Calculator</p> <p>Chromebooks - access various applets</p> <p>Dice Interlocking cubes M&M’s</p>	<p>Summative Assessment: 2 quizzes Chapter test</p> <p>Formative assessment throughout unit</p>



UNIT 2: ANALYZING TWO-VARIABLE DATA

Estimated Time Frame:	Weeks - 3.5	<u>Thinking Strategies:</u>	Determining Importance Asking Questions Synthesizing Information Problem Solving	
Enduring Understandings:	<ul style="list-style-type: none"> ● Distinguish between explanatory and response variables for categorical data. ● Make a segmented bar chart to display the relationship between two categorical variables. ● Determine if there is an association between two categorical variables. ● Create scatterplots to analyze the relationship between two quantitative variables ● Estimate and interpret the correlation coefficient. ● Summarize the relationship of two-variable data with an appropriate regression model. ● Make predictions using regression lines, keeping in mind the dangers of extrapolation. ● Use a residual plot to determine whether a regression model is appropriate. ● Interpret slope and y-intercept of a regression line. ● Distinguish correlation from causation. ● Use technology to find the least squares regression line and two-variable statistics. 			
<u>Idaho Content Standard</u>	Essential Questions	Key Terms	Resources Needed	<u>Assessment</u> (Tie to Enduring Understandings)
S-ID.5 S-ID.6 S-ID.7 S-ID.8 S-ID.9	<p>How do we use technology to find the least squares regression line when displaying the relationship between two variables?</p> <p>How do we use technology to find and interpret the correlation coefficient?</p> <p>How are correlation and causation related to each other?</p> <p>If two variables are correlated, how can we predict one variable's value given the value of the other variable?</p> <p>How do we use a residual plot to determine whether a regression model is appropriate?</p>	<ul style="list-style-type: none"> ● Segmented bar chart ● Response variable ● Explanatory variable ● Association ● Scatterplot ● Correlation ● Regression line ● Extrapolation ● Residual ● Slope ● y-intercept ● Least-squares regression line ● Residual plot ● Standard deviation of the residuals ● Coefficient of determination ● Quadratic model ● Exponential model 	<p>"Statistics and Probability with Applications", Third Edition by Daren Starnes and Josh Tabor</p> <p>Graphing Calculator</p> <p>Chromebooks - access various applets</p> <p>Barbies Rubber Bands Measuring tape Yard sticks Golf Balls or toy cars</p>	<p>Summative Assessment: 2 quizzes Chapter test</p> <p>Formative assessment throughout unit</p>



UNIT 3: COLLECTION DATA

Estimated Time Frame:	Weeks - 4 weeks	<u>Thinking Strategies:</u>	Asking Questions Synthesizing Information Monitoring for Meaning	
Enduring Understandings:	<ul style="list-style-type: none"> ● Explain the concept of confounding and how it limits the ability to make cause-and-effect conclusions. ● Explain the purpose of comparison and blinding in an experiment. ● Explain the concept of statistical significance in the context of an experiment. ● Determine which sampling technique is best, given a particular context. ● Given a plan for a survey, identify possible sources of bias, and describe ways to reduce bias. ● Compare and contrast controlled experiments and observational studies and the conclusions one can draw from each. ● Compare and contrast population and sample and parameter and statistic. ● Identify biased sampling methods. ● Describe simple random sampling. ● Select a data collection method appropriate for a given context. 			
<u>Idaho Content Standard</u>	Essential Questions	Key Terms	Resources Needed	<u>Assessment</u> (Tie to Enduring Understandings)
S-IC.1 S-IC.2 S-IC.3 S-IC.4 S-IC.6	<p>What is the difference between random sampling and random assignment?</p> <p>How can you identify good and bad sampling methods?</p> <p>What types of random samples can be used to collect data that is representative of the population of interest?</p> <p>What sampling processes can lead to bias?</p> <p>How can we reduce or eliminate confounding variables?</p> <p>What does margin of error account for when estimating a population parameter?</p>	<ul style="list-style-type: none"> ● statistical question ● random selection ● random assignment ● population ● sample ● random sampling ● simple random sample ● sampling variability ● margin of error ● bias ● convenience sample ● voluntary response sample ● undercoverage ● nonresponse ● response bias ● observational study ● confounding treatment ● placebo effect ● double-blind ● single-blind ● control group ● random assignment ● completely randomized design ● statistically significant 	<p>“Statistics and Probability with Applications”, Third Edition by Daren Starnes and Josh Tabor</p> <p>Graphing Calculator</p> <p>Chromebooks - access various applets</p> <p>Access to video (against all odds)</p> <p>Access to 60 Minutes “Treating Depression”</p> <p>Paper Clips Dot Stickers Posters Colored gems beads</p>	<p>Summative Assessment: 2 quizzes Chapter test</p> <p>Formative assessment throughout unit</p>



UNIT 4: PROBABILITY

Estimated Time Frame:	Weeks - 3.5	Thinking Strategies:	Activating, utilizing, and building background knowledge Create Sensory Images Problem Solving Determining Importance	
Enduring Understandings:	<ul style="list-style-type: none"> ● Interpret probability as a long-run relative frequency. ● Use simulation to model chance behavior. ● Given two or more events in a problem setting, determine if the events are complementary, dependent, independent, and/or mutually exclusive. ● Use a Venn diagram and a two-way table to find probabilities. ● Find conditional probabilities for dependent, independent, and mutually exclusive events. ● Use a tree diagram to model a chance process involving a sequence of outcomes. ● Compute the number of permutations and combinations of n individuals taken k at a time. 			
Idaho Content Standard	Essential Questions	Key Terms	Resources Needed	Assessment (Tie to Enduring Understandings)
S-IC.2 S.CP.1 S.CP.2 S.CP.3 S.CP.4 S.CP.5 S.CP.6 S.CP.7 S.CP.8 S.CP.9	<p>What is the difference between experimental and theoretical probability?</p> <p>What determines whether an event is dependent or independent?</p> <p>How can we use a simulation to model chance behavior?</p> <p>How do we calculate and interpret conditional probabilities using two-way tables and tree diagrams?</p> <p>How do we calculate probabilities if events are independent, dependent, mutually exclusive, and non-mutually exclusive?</p> <p>What is the difference between a permutation and a combination ? How do we use permutations and combinations to find the total number of outcomes?</p> <p>When do we use the fundamental counting principle?</p>	<ul style="list-style-type: none"> ● Law of Large numbers ● simulation ● probability model ● sample space ● complement ● general addition rule ● two-way table ● Venn diagram ● conditional probability ● general multiplication rule ● tree diagram ● independent ● multiplication counting principle ● permutations ● factorial ● combination 	<p>“Statistics and Probability with Applications”, Third Edition by Daren Starnes and Josh Tabor</p> <p>Graphing Calculator</p> <p>Chromebooks - access various applets</p> <p>Dice Marbles Paper Clips Cards</p>	<p>Summative Assessment: 2 quizzes Chapter test</p> <p>Formative assessment throughout unit</p>



UNIT 5: RANDOM VARIABLES

Estimated Time Frame:	Weeks - 3	<u>Thinking Strategies:</u>	Synthesizing Information Problem Solving Monitoring for Meaning Asking Questions	
Enduring Understandings:	<ul style="list-style-type: none"> • Classify a random variable as discrete or continuous. • Calculate and interpret the mean and standard deviation of a discrete random variable. • Determine whether or not a given scenario describes a binomial setting. • Use the binomial distribution to calculate probabilities associated with experiments for which there are only two possible outcomes. • Design and conduct an experiment that simulates a binomial distribution. • Identify the properties of a normal probability distribution. • Use the 68-95-99.7 rule and technology to find probabilities in a normal distribution. • Describe how the standard deviation and the mean affect the graph of the normal distribution. • Determine the probability of a given event, using the normal distribution. • Find a value corresponding to a given probability in a normal distribution. 			
<u>Idaho Content Standard</u> S-MD.1 S-MD.2 S-MD.3 S-MD.5a S-MD.5b S-MD.6 S-MD.7 S-ID.4	Essential Questions What is the difference between continuous and discrete random variables? How do you find and interpret expected value (mean) of a discrete random variable? How do you determine whether a discrete variable is binomial? How do you find probabilities in a binomial setting? What are the characteristics of a density curve? How do you use the 68-95-99.7 rule to find probabilities in a normal distribution? How do I use Table A or technology to find a probability or a z-scores in a standard normal distribution?	Key Terms <ul style="list-style-type: none"> • random variable • probability distribution • discrete random variable • continuous random variable • expected value • standard deviation • binomial setting • binomial random variable • binomial distribution • normal distribution • standard normal distribution 	Resources Needed “Statistics and Probability with Applications”, Third Edition by Daren Starnes and Josh Tabor Graphing Calculator Chromebooks - access various applets	<u>Assessment</u> (Tie to Enduring Understandings) Summative Assessment: 2 quizzes Chapter test Formative assessment throughout unit



UNIT 6: SAMPLING DISTRIBUTIONS

Estimated Time Frame:	Weeks - 2	<u>Thinking Strategies:</u>	Asking Questions Drawing Inferences Problem Solving Synthesizing Information	
Enduring Understandings:	<ul style="list-style-type: none"> • Distinguish between a parameter and a statistic. • Use the sampling distribution of a statistic to evaluate a claim about a parameter. • Determine if a statistic is an unbiased estimator of a population parameter. • Calculate and interpret the mean and the standard deviation of the sampling distribution of a sample proportion and of a sample mean. • Use the Large Counts Condition to determine if the sampling distribution of a sample proportion is approximately normal and find probabilities. • Determine if the sampling distribution of a sample statistic is approximately normal and calculate probabilities. • Use the Central Limit Theorem to determine whether a sampling distribution of a sample mean (if the population shape is unknown) is approximately normal and find probabilities. 			
<u>Idaho Content Standard</u> S-IC.1 S-IC.2 S-ID.4 S-IC.4	Essential Questions What is a sampling distribution? How do you describe the center, variability, and shape of a sampling distribution? What is the relationship between sample size and variability of a statistic? How do you determine if a statistic is an unbiased estimator of a population parameter? How do you calculate the mean and the standard deviation of a sampling distribution of a sample mean or a sample proportion? How do you determine when a sampling distribution of a sample statistic (sample mean or sample proportion) is approximately normal?	Key Terms <ul style="list-style-type: none"> • statistics • parameter • sampling distribution • unbiased estimator • mean • standard deviation • Large Counts Condition • Central Limit Theorem • Normal/Large Sample 	Resources Needed "Statistics and Probability with Applications", Third Edition by Daren Starnes and Josh Tabor Graphing Calculator Chromebooks - access various applets Popsicle sticks Tacks Cups or small boxes	<u>Assessment</u> (Tie to Enduring Understandings) Summative Assessment: 2 quizzes Chapter test Formative assessment throughout unit

UNIT 7: ESTIMATING A PARAMETER



Estimated Time Frame:	Weeks - 3	<u>Thinking Strategies:</u>	Drawing Inferences Synthesizing Information Asking Questions Monitoring for Meaning Problem Solving	
Enduring Understandings:	<ul style="list-style-type: none"> ● Interpret a confidence interval and a confidence level in context. ● Determine the point estimate and the margin of error when given a confidence interval. ● Describe how the confidence level and sample size affect the margin of error. ● Explain how biased sampling methods can affect the interpretation of a confidence interval. ● Determine a critical value for calculating a C% confidence interval for a population proportion and population mean. ● Calculate a C% confidence interval for a population proportion and a population mean. ● Find a z^* or t^* critical value with a given confidence level using Table A or B or technology. ● Calculate a C% confidence interval for a population proportion and a population mean. ● Determine the sample size required to obtain a C% confidence interval for a population proportion or a population mean with a specified margin of error. 			
<u>Idaho Content Standard</u> S-IC.4 S-ID.4 S-IC.1	Essential Questions What is a confidence interval? Why is it necessary to apply confidence intervals when attempting to generalize results of a sample to the population? How do you interpret a confidence interval? What factors affect the margin of error? What is the difference between a confidence interval and a confidence level? How does the confidence level and the sample size affect the confidence interval? Why is it necessary to check conditions before constructing a confidence interval? How do you construct a confidence interval for a population mean and a population proportion? Why do we use a t^* critical value when constructing a confidence interval for the population mean? How do you determine the minimum sample size needed for a desired margin of error?	Key Terms <ul style="list-style-type: none"> ● confidence interval ● confidence level ● margin of error ● point estimate ● Large Counts Condition ● critical value ● standard error ● Normal/Large Sample 	Resources Needed “Statistics and Probability with Applications”, Third Edition by Daren Starnes and Josh Tabor Graphing Calculator Chromebooks - access various applets Hershey Kisses Globe Ball Oreos	<u>Assessment</u> (Tie to Enduring Understandings) Summative Assessment: 2 quizzes Chapter test Formative assessment throughout unit



UNIT 8: TESTING A CLAIM

Estimated Time Frame:	Weeks - 3 or 4.5 (project)	<u>Thinking Strategies:</u>	Drawing Inferences Synthesizing Information Asking Questions Monitoring for Meaning Problem Solving	
Enduring Understandings:	<ul style="list-style-type: none"> ● State the appropriate hypotheses for conducting a significance test ● Interpret a P-value in context. ● Make an appropriate conclusion for a significance test based on a P-value using a given significance level. ● Interpret a Type I error and a Type II error in context with consequences. ● Check conditions for performing significance test about a population mean and population proportion. ● Calculate the standardized test statistic (z or t) for a significance test about a population proportion and a population mean. ● Find a P-value for a one-sided and 2-sided significance test using Table A or B or technology. 			
<u>Idaho Content Standard</u> S-ID.4 S-IC.1 S-IC.4 S-IC.6	Essential Questions Why is the main purpose for conducting a significance test? How do we determine if the results of a study are statistically significant and make an appropriate conclusion? How do we interpret and identify a Type I and Type II error and why is this important to look at before we state a level of significance? Why is it necessary to check conditions before performing a significance test on a population parameter? How do we determine what type of test (one-sided, two-sided) as we are stating our hypotheses? What is P-value and how does it help us make a conclusion about the stated claim? What do we have to consider when finding the P-value of a two-sided test?	Key Terms <ul style="list-style-type: none"> ● significance test ● null hypothesis ● alternative hypothesis ● one-sided alternative hypothesis ● two-sided alternative hypothesis ● P-value ● significance level ● Type I error ● Type II error ● standardized test statistic ● t distribution ● degrees of freedom 	Resources Needed “Statistics and Probability with Applications”, Third Edition by Daren Starnes and Josh Tabor Graphing Calculator Chromebooks - access various applets Video - statistical significance vs. practical importance Paper Clips 10-section spinner	<u>Assessment</u> (Tie to Enduring Understandings) Summative Assessment: 2 quizzes Chapter test Hypothesis Testing Project Formative assessment throughout unit



UNIT 9: COMPARING TWO POPULATIONS OR TREATMENTS

Estimated Time Frame:	Weeks - 3 or 4.5 (project)	<u>Thinking Strategies:</u>	Drawing Inferences Synthesizing Information Asking Questions Monitoring for Meaning Problem Solving	
Enduring Understandings:	<ul style="list-style-type: none"> Describe the shape, center, and variability of the sampling distribution of the difference between two sample statistics (sample means and sample proportions). Check conditions for a confidence interval and a significance test between two sample statistics (sample means and sample proportions). Construct and interpret a confidence interval for the difference between two sample proportions and two sample means. Calculate the standardized test statistic and a P-value for a significance test about a difference between two sample proportions and two sample means. Perform a significance test about the difference between two sample proportions and two sample means. Calculate the mean and standard deviation of the differences in a paired data set, and interpret the mean difference in context. Construct a confidence interval and perform a hypothesis test for paired data (dependent samples) 			
<u>Idaho Content Standard</u> S-ID.4 S-IC.1 S-IC.4 S-IC.5 S-IC.6	Essential Questions How do we describe the shape, center, and variability of the sampling distribution of a difference between two sample proportions (or sample means)? How is a confidence interval for the difference between proportions (or means) computed and interpreted? How do you test a claim about a difference between two proportions (or means)? How do we compute the standardized test statistic and find the P-value for a significance test about the difference between two proportions (or means)? Given a study, is a one-sample, matched pairs, or two sample procedure needed?	Key Terms <ul style="list-style-type: none"> Large Counts standardized test statistic P-value Normal/Large Sample paired data shape center variability 	Resources Needed “Statistics and Probability with Applications”, Third Edition by Daren Starnes and Josh Tabor Graphing Calculator Chromebooks - access various applets	<u>Assessment</u> (Tie to Enduring Understandings) Summative Assessment: 2 quizzes Chapter test Formative assessment throughout unit



UNIT 10: INFERENCE FOR DISTRIBUTIONS AND RELATIONSHIPS

Estimated Time Frame:	Weeks - 3	<u>Thinking Strategies:</u>	Drawing Inferences Synthesizing Information Asking Questions Monitoring for Meaning Problem Solving	
Enduring Understandings:	<ul style="list-style-type: none"> ● State appropriate hypotheses and compute expected counts for a chi-square test for goodness of fit. ● Calculate the chi-square statistic, degrees of freedom and a P-value for a chi-square test for goodness of fit. ● Perform a chi-square test for goodness of fit. ● Compare conditional distributions for data in a two-way table. ● State appropriate hypotheses and compute expected counts for a chi-square test based on data in a two-way table. ● Calculate the chi-square statistic, degrees of freedom, and P-value for a chi-square statistic based on data in a two-way table. ● Perform a chi-square test for homogeneity and independence. ● Choose the appropriate chi-square test. ● Check conditions for performing inference about the slope of the population regression line. ● State hypotheses for a test about the relationship between two quantitative variables. ● Construct and interpret a confidence interval about the slope of the population regression line. ● Calculate the test statistic and P-value for a test about the relationship between two quantitative variables. ● Perform a significance test for the slope of the population regression line. 			
<u>Idaho Content Standard</u> S.ID.5 S-IC.1 S-IC.5 S-IC.6	Essential Questions Under what circumstances is a chi-square test appropriate to use? What conditions have to be met to use the chi-square distribution? What is the null hypothesis that the chi-square statistic tests in a two-way table? If a test is significant, what are the most important deviations between the observed and expected counts?	Key Terms <ul style="list-style-type: none"> ● chi-square test statistic ● chi-square distribution ● association ● expected count ● null hypothesis ● alternative hypothesis ● degrees of freedom ● P-value 	Resources Needed "Statistics and Probability with Applications", Third Edition by Daren Starnes and Josh Tabor Graphing Calculator Chromebooks - access various applets M&M's	<u>Assessment</u> (Tie to Enduring Understandings) Summative Assessment: 2 quizzes Chapter test Formative assessment throughout unit