FREEHOLD REGIONAL HIGH SCHOOL DISTRICT
OFFICE OF CURRICULUM AND INSTRUCTION
MATHEMATICS DEPARTMENT CURRICULUM

STATISTICS

Grade Level: 10 - 12

Credits: 5

BOARD OF EDUCATION ADOPTION DATE: August 26, 2019

FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

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Statistics

Course Description

"Statistics ... is the most important science in the whole world: for upon it depends the practical application of every other science and of every art; the one science essential to all political and social administration, all education, all organisation based upon experience, for it only gives the results of our experience." - Florence Nightingale

Statistics is the science of understanding data. If something can be measured, it can be analyzed with statistics. This course begins with an overview of statistical design, visual representations of data, and measures of central tendency. From there we explore how these elements can be applied to everyday real-life situations. We investigate how we can use probability to predict outcomes, such as the likelihood a medical test will produce a false positive. We explore how data comes together to form different distributions. We then use these distributions to test hypotheses, such as determining whether a new seed has a higher germination rate that its predecessor.

Course Sequence and Pacing

Unit Title	**Unit Essential Question**	**Suggested Pacing**
Unit 1: Experimental Design, Graphs and Measures of Central Tendency	What is data? What role does it play in statistics?	35 Sessions
Unit 2: Probability Theory	How can probability be used to accurately predict long-term behavior?	30 Sessions
Unit 3: Sampling Distributions	How can you use a probability distribution to make a prediction?	30 Sessions
Unit 4: Confidence Intervals and Hypothesis Testing	How can you test the validity of a claim?	15 Sessions
Unit 5: Linear Regression	How do you determine if there's a relationship between two different quantities?	8 Sessions
Unit 6: Chi-Square Analysis	How can you compare two or more distributions or parameters of more than two populations?	8 Sessions

Support Resources

Supporting resources and appendices for this curriculum:

- Appendix A: Accommodations and Modifications for Various Student Populations
- Appendix B: Assessment Evidence
- Appendix C: Interdisciplinary Connections
- Appendix D: Mathematics 2023 NJSLS Crosswalk
    - (*) in the front of NJSLS Indicates 2023 version.

Statistics
Unit 1: Experimental Design, Graphs and Measures of Central Tendency
Section 1.1 **Suggested Unit Pacing: 35 Sessions**

Essential Question: How is randomization of data important to drawing statistical conclusions?

Mathematical Modeling: How would a census of the entire population of the U.S. be conducted?

NJSLS-M Performance Expectations		**Enduring Understanding**
(*) S-IC.B.3	(*) S-IC.B.3* Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. (+ for 2023)	Randomization has two important uses in drawing statistical conclusions. First, collecting data from a random sample of a population makes it possible to draw valid conclusions about the whole population, taking variability into account. Second, randomly assigning individuals to different treatments allows a fair comparison of the effectiveness of those treatments.
(*) S-IC.B.6	(*) S-IC.B.6* Evaluate reports based on data (e.g. interrogate study design, data sources, randomization, the way the data are analyzed and displayed, inferences drawn and methods used; identify and explain misleading uses of data; recognize when arguments based on data are flawed). (+ for 2023)	The conditions under which data are collected are important in drawing conclusions from the data; in critically reviewing uses of statistics in public media and other reports, it is important to consider the study design, how the data were gathered, and the analyses employed as well as the data summaries and the conclusions drawn.

Standards-Aligned Objectives. Instruction and assessment will align to the following objectives:	
S-IC.B.3 [1]	Distinguish between the characteristics of a population and a sample with real world data. (+ for 2023)
S-IC.B.3 [2]	Choose an appropriate level of measurement (nominal, ordinal, interval, or ratio) to classify real world data. (+ for 2023)
S-IC.B.3 [3]	Recognize the <u>purpose</u> of surveys, experiments, and observational studies of real world data in making statistical inferences and justify conclusions. (+ for 2023)
S-IC.B.3 [4]	A. Recognize the <u>differences</u> among surveys, experiments, and observational studies of real world data in making statistical inferences and justify conclusions. B. Construct and explain a viable argument about how randomization relates to each of these methods of real world data collection. The argument and explanation: ○ Can be written or verbal ○ Attends to clear/precise definitions C. Critique other students' arguments for viability. (+ for 2023)
S-IC.B.6 [1]	Define the characteristics of experimental design (control, randomization, and replication) by attending to clear/precise definitions. (+ for 2023)
S-IC.B.6 [2]	Evaluate experimental study design, how data was gathered, and what analysis (numerical or graphical) was used by constructing viable arguments and critiquing the design, data gathering, and analysis for viability. (+ for 2023)
S-IC.B.6 [3]	Draw conclusions based on graphical and numerical summaries by constructing a viable argument while attending to clear/precise definitions. (+ for 2023)
S-IC.B.6 [4]	Construct a viable argument to support, with graphical and numerical summaries, the appropriateness of the report of real world data. (+ for 2023)

Statistics
Unit 1: Experimental Design, Graphs and Measures of Central Tendency
Section 1.2 **Suggested Unit Pacing: 35 Sessions**

Essential Question: How can data be used to discover patterns and deviations from patterns in the world around us?

Mathematical Modeling: How can we display and organize the raw U.S Census data so that we can observe trends, patterns and special characteristics?

NJSLS-M Performance Expectations		**Enduring Understanding**
S-ID.A.1*	(*) Represent data with plots on the real number line (dot plots, histograms, and box plots).	Quantitative data can be described in terms of key characteristics: measures of shape, center, and spread. The shape of a data distribution might be described as symmetric, skewed, flat, or bell shaped, and it might be summarized by a statistic measuring center (such as mean or median) and a statistic measuring spread (such as standard deviation or interquartile range).
S-ID.A.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	
S-ID.A.3*	(*) Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	

Standards-Aligned Objectives. Instruction and assessment will align to the following objectives:	
S-ID.A.1*[1]	Represent real world data with plots on the real number line by creating dot plots and box plots using various display types such as spreadsheets and graphing calculators.
S-ID.A.1*[2]	Represent real world data with plots on the real number line by creating histograms using various display types such as spreadsheets and graphing calculators.
S-ID.A.2*[1]	Choose the appropriate measure for center (mean, median) and spread (interquartile range, standard deviation) based on the shape of a real world data distribution.
S-ID.A.2*[2]	Use appropriate statistics for center and spread to compare two or more real world data sets quantitatively.
S-ID.A.3*[1]	Define the context of real world data sets as it relates to the identification of outliers.
S-ID.A.3*[2]	Interpret differences in shape, center, and spread in the context of real world datasets by looking for and making use of structure.
S-ID.A.3*[3]	Construct a viable argument to describe the possible effects the presence of outliers in a set of real world data can have on shape, center, and spread in the context of the data sets.

Statistics Unit 1 **NJSLS Career Readiness and Preparation and Educational Technology**			
NJSLS Career Readiness and Preparation and Educational Technology		**Sec 1.1**	**Sec 1.2**
CRP 2	Apply appropriate academic and technical skills.	X	X
CRP 7	Employ valid and reliable research strategies.	X	X
CRP 11	Use technology to enhance productivity.	X	X
8.1.12.A.4	Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.	X	X
9.2.12.C.3	Identify transferable career skills and design alternate career plans.	X	X

Statistics **Unit 2: Probability Theory** **Section 2.1**		**Suggested Unit Pacing: 30 Sessions**
Essential Question: How can probability be used to accurately predict long-term behavior?		
Mathematical Modeling: How does password length, and the characters available to use, affect how easily your password will be broken?		
NJSLS-M Performance Expectations		**Enduring Understanding**:
(*) S-CP.A.1	(*) S-CP.A.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”). (+ for 2023)	Random processes can be described mathematically by using a probability model: a list or description of the possible outcomes (the sample space), each of which is assigned a probability. In situations such as flipping a coin, rolling a number cube, or drawing a card, it might be reasonable to assume various outcomes are equally likely.
S-MD.B.6	(+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).	Decisions or predictions are often based on data—numbers in context.
Standards-Aligned Objectives. Instruction and assessment will align to the following objectives:		
S-CP.A.1 [1]	Define unions, intersections, and complements of events while attending to clear/precise definitions.	
S-CP.A.1 [2]	Describe real world 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 while attending to clear/precise definitions.	
S-MD.B.6 [1]	Recall, develop, and clearly/precisely define previous understandings of probability, such as the Law of Large Numbers (through the use of simulation models).	
S-MD.B.6 [2]	Use quantitative reasoning to compute, using an appropriate tool, theoretical probabilities of real world situations.	
S-MD.B.6 [3]	Use quantitative reasoning to compute, using an appropriate tool, experimental probabilities of real world situations.	
S-MD.B.6 [4]	Construct a viable argument using probabilities to make fair real world decisions.	

Statistics
Unit 2: Probability Theory
Section 2.2 **Suggested Unit Pacing: 30 Sessions**

Essential Question: How can probability be used to accurately predict long-term behavior?

Mathematical Modeling: Are mosquitoes infected with Dengue hungrier than usual? In other words, are hunger and Dengue infection in mosquitoes dependent or independent?

NJSLS-M Performance Expectations		**Enduring Understanding**
(*) S-CP.B.6	(*) S-CP.B.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. (+ for 2023)	Decisions or predictions are often based on data—numbers in context. In a probability model, sample points represent outcomes and combine to make up events; probabilities of events can be computed by applying the Addition and **Multiplication Rules**. Interpreting these probabilities relies on an understanding of independence and **conditional probability**, which can be approached through the analysis of two-way tables.
S-CP.B.8	(+) 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.	
(*) S-CP.A.3	(*) S-CP.A.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. (+ for 2023)	
S-CP.A.5	(*) S-CP.A.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. (+ for 2023)	

Standards-Aligned Objectives. Instruction and assessment will align to the following objectives:	
S-CP.B.6 [1]	Utilize quantitative reasoning to find the conditional probability of A given B as the fraction of B's outcomes that also belong to A while using an appropriate tool such as a graphing calculator.
S-CP.B.6 [2]	Construct a viable argument in order to interpret the conditional probability solution in terms of the real world model.
S-CP.B.8 [1]	Use the multiplication rule (with any number of events) with correct notation by looking for and expressing regularity in repeated reasoning.
S-CP.B.8 [2]	Apply and precisely define the general Multiplication Rule in a real world uniform probability model P(A and B) = P(A) P(B|A) = P(B)P(A|B).
S-CP.B.8 [3]	Construct a viable argument in order to interpret the Multiplication Rule solution in terms of the real world model.
S-CP.A.3 [1]	Know and precisely define the conditional probability of A given B as P(A and B)/P(B).
S-CP.A.3 [2]	Construct a viable argument in order to 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.
S-CP.A.5 [1]	Recognize the concepts of conditional probability and independence in everyday language and everyday real world situations.
S-CP.A.5 [2]	Explain, by constructing a viable argument and critiquing the reasoning of others, the concepts of conditional probability and independence in everyday language and everyday real world situations.

Statistics
Unit 2: Probability Theory
Section 2.3 **Suggested Unit Pacing: 30 Sessions**

Essential Question: How can probability be used to accurately predict long-term behavior?

Mathematical Modeling: Given sales patterns, how can future sales be predicted?

NJSLS-M Performance Expectations		**Enduring Understanding**
(*) S-CP.A.2	(*) S-CP.A.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. (+ for 2023)	Decisions or predictions are often based on data—numbers in context. In a probability model, sample points represent outcomes and combine to make up events; probabilities of events can be computed by applying the **Addition** and Multiplication Rules. Interpreting these probabilities relies on an understanding of independence and conditional probability, which can be approached through the analysis of two-way tables. Interpreting these probabilities relies on an understanding of independence and conditional probability, which can be approached through the analysis of two-way tables.
(*) S-CP.A.4	(*) S-CP.A.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. 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. (+ for 2023)	
S-ID.B.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.	
(*) S-CP.B.7	(*) S-CP.B.7 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. (+ for 2023)	
S-CP.B.9	(+) Use permutations and combinations to compute probabilities of compound events and solve problems.	Technology plays an important role in statistics and probability by making it possible to generate plots, regression functions, and correlation coefficients, and to simulate many possible outcomes in a short amount of time.

Standards-Aligned Objectives. Instruction and assessment will align to the following objectives:

S-CP.A.2 [1]	Categorize real world events as independent or not by attending to the precise definition that two events A and B are independent when the probability of A and B occurring together is the product of their probabilities.
S-CP.A.4 [1]	Use the two-way table as a sample space to decide, based on the precise definition, if real world events are independent.
S-CP.A.4 [2]	Develop understanding of conditional probability and independence by attending to clear and precise definitions.
S-CP.A.4 [3]	Construct a viable argument in order to interpret two-way frequency tables of real world data when two categories are associated with each object being classified.
S-ID.B.5*[1]	Recognize the differences between joint, marginal, and conditional relative real world frequencies.
S-ID.B.5*[2]	Calculate *using appropriate tools strategically,* relative frequencies including joint, marginal, and conditional relative frequencies.

S-ID.B.5*[3]	Summarize and make sense of real world categorical data for two categories in two-way frequency tables by calculating the proportions in each category.
S-ID.B.5*[4]	Interpret and make sense of relative frequencies in the context of the real world data.
S-ID.B.5*[5]	Recognize possible associations and trends in the real world data.
S-CP.B.7 [1]	Use the Addition Rule, P(A or B) = P(A) +P(B) - P(A and B) by looking for and expressing regularity in repeated reasoning.
S-CP.B.7 [2]	Interpret and make sense of the answer in terms of the real world model.
S-CP.B.9 [1]	Identify real world situations that are permutations and those that are combinations by attending to clear/precise definitions.
S-CP.B.9 [2]	Using an appropriate tool, use permutations to compute probabilities of compound events in order to make sense of, and persevere in solving real world problems.
S-CP.B.9 [3]	Using an appropriate tool, use combinations to compute probabilities of compound events in order to make sense of, and persevere in solving real world problems.

Statistics Unit 2 **NJSLS Career Readiness and Preparation and Educational Technology**				
NJSLS Career Readiness and Preparation and Educational Technology		**Sec 2.1**	**Sec 2.2**	**Sec 2.3**
CRP 2	Apply appropriate academic and technical skills.	X	X	X
CRP 11	Use technology to enhance productivity.	X	X	X

Statistics
Unit 3: Sampling Distributions
Section 3.1 **Suggested Unit Pacing: 30 sessions**

Essential Question: How can you use a probability distribution to make a prediction?

Mathematical Modeling: How can fire department use a probability distribution to help match a personality for a job?

NJSLS-M Performance Expectations		**Enduring Understanding**
S-MD.A.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.	Decisions or predictions are often based on data—numbers in context. These decisions or predictions would be easy if the data always sent a clear message, but the message is often obscured by variability. Statistics provides tools for describing variability in data and for making informed decisions that take it into account.
S-MD.A.2	(+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.	
S-MD.A.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.	
S-MD.B.7	(+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).	

Standards-Aligned Objectives. Instruction and assessment will align to the following objectives:

S-MD.A.1 [1]	Understand the difference between discrete and continuous random variables.
S-MD.A.1 [2]	Assign a numerical value to each discrete random variable for an event in a sample space.
S-MD.A.2 [1]	Calculate the expected value using a spreadsheet or graphing calculator of a real world random variable.
S-MD.A.2 [2]	Using a spreadsheet or graphing calculator, graph the corresponding binomial, geometric, or poisson probability distribution using the same graphical displays used for data distributions.
S-MD.A.3 [1]	Utilize quantitative reasoning to find the expected value of a random variable for a real world probability distribution using an appropriate tool such as a graphing calculator.
S-MD.A.3 [2]	Develop a probability distribution for a real world random variable defined for a sample space in which theoretical probabilities can be calculated.
S-MD.B.7 [1]	Recall and clearly/precisely define previous understandings of probability.
S-MD.B.7 [2]	Analyze decisions and strategies using probability concepts by constructing viable arguments and critiquing other students' arguments.

Statistics **Unit 3: Sampling Distributions** **Section 3.2**	**Suggested Unit Pacing: 30 Sessions**
Essential Question: How can you use a probability distribution to make a prediction?	
Mathematical Modeling: What percent of the U.S population has an IQ of 120 or greater? Is having an IQ of 120 or greater considered unusual?	

NJSLS-M Performance Expectations		**Enduring Understanding**
S-ID.A.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.	Decisions or predictions are often based on data—numbers in context. These decisions or predictions would be easy if the data always sent a clear message, but the message is often obscured by variability. Statistics provides tools for describing variability in data and for making informed decisions that take it into account.
S-MD.B.7	(+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).	

Standards-Aligned Objectives. Instruction and assessment will align to the following objectives:	
S-ID.A.4*[1]	Describe the characteristics of a normal distribution with clear and precise definitions.
S-ID.A.4*[2]	Recognize, by attending to clear and precise definitions, that there are data sets where a normal distribution is not appropriate.
S-ID.A.4*[3]	Use a calculator, spreadsheet, and table to estimate areas under the normal curve.
S-ID.A.4*[4]	Use the mean and standard deviation of a real world data set to fit it to a normal distribution by reasoning abstractly.
S-ID.A.4*[5]	Use a normal distribution to estimate and/or calculate (using z-scores) real world population percentages and make sense of the estimates.
S-ID.A.4*[6]	Use the Central Limit Theorem to find the probability of a sample mean.
S-MD.B.7 [1]	Recall and clearly/precisely define previous understandings of probability.
S-MD.B.7 [2]	Analyze real world decisions and strategies using probability concepts by constructing viable arguments and critiquing other students' arguments.

Statistics Unit 3 **NJSLS Career Readiness and Preparation and Educational Technology**				
NJSLS Career Readiness and Preparation and Educational Technology		**Sec 3.1**	**Sec 3.2**	**Sec 3.3**
CRP 11	Use technology to enhance productivity.	X	X	X
8.1.12.A.4	Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.			X
9.2.12.C.3	Identify transferable career skills and design alternate career plans.		X	X

Statistics **Unit 4: Confidence Intervals and Hypothesis Testing** **Section 4.1**		**Suggested Unit Pacing: 15 Sessions**
Essential Question: How can you test the validity of a claim?		
Mathematical Modeling: How many students need to be in a class before there is over a 50% chance that two students share the same birthday?		
NJSLS-M Performance Expectations		**Enduring Understanding**
(*) S-IC.B.4	(*) S-IC.B.4 Use data from a sample survey to estimate a population mean or proportion; develop a margin of error (+ for 2023)	Statistical tools allow us to represent and describe patterns in data and to classify departures from patterns. Simulation and probabilistic reasoning allow us to anticipate patterns in data and to determine the likelihood of errors in inference.
(*) S-IC.A.1*	(*) Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	
Standards-Aligned Objectives. Instruction and assessment will align to the following objectives:		
S-IC.B.4 [1]	Define, using clear and precise language, margin of error.	
S-IC.B.4 [2]	Explain the connection of margin of error to variation within a data set or population using clear and precise definitions.	
S-IC.B.4 [3]	Use data from a real world sample survey to estimate a population mean or proportion using a confidence interval and make sense of the estimate.	
S-IC.B.4 [4]	Interpret the solution of the confidence interval in the context of the real world data.	
S-IC.B.4 [5]	Develop a margin of error, assuming certain population parameters/characteristics, through the use of simulation models for random sampling created with appropriate tools.	
S-IC.A.1*[1]	Explain using a viably constructed argument that statistics is a process for making inferences about population parameters or characteristics, such as when calculating confidence intervals or utilizing hypothesis testing.	
S-IC.A.1*[2]	Explain using a viably constructed argument that statistical inferences about population characteristics are based on random samples from that population, such as when calculating confidence intervals or utilizing hypothesis testing.	

Statistics **Unit 4: Confidence Intervals and Hypothesis Testing** **Section 4.2**	**Suggested Unit Pacing: 15 Sessions**
Essential Question: How can you test the validity of a claim?	
Mathematical Modeling: Test the claim that the proportion of U.S. adults that think that there is a link between playing video games and teenagers showing violent behavior is 0.53, given the sample statistic is 0.58.	

NJSLS-M Performance Expectations		**Enduring Understanding**
S-IC.A.1*	(*) Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	Statistical tools allow us to represent and describe patterns in data and to classify departures from patterns. Simulation and probabilistic reasoning allow us to anticipate patterns in data and to determine the likelihood of errors in inference.
(*) S-IC.A.2*	(*) S-IC.A.2* Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. 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? (+ for 2023)	

Standards-Aligned Objectives. Instruction and assessment will align to the following objectives:	
S-IC.A.1*[1]	Explain using a viably constructed argument that statistics is a process for making inferences about population parameters or characteristics, such as when calculating confidence intervals or utilizing hypothesis testing.
S-IC.A.1*[2]	Explain using a viably constructed argument that statistical inferences about population characteristics are based on random samples from that population, such as when calculating confidence intervals or utilizing hypothesis testing.
S-IC.A.2*[1]	Identify, using clear and precise definitions, Type I and Type II errors.
S-IC.A.2*[2]	Determine whether a z-test or a t-test is appropriate for a specified model.
S-IC.A.2*[3]	Calculate and interpret the P-values to determine if the specified model is consistent with results from a given data-generating process by rejecting or failing to reject the hypothesis.

Statistics Unit 4 **NJSLS Career Readiness and Preparation and Educational Technology**			
NJSLS Career Readiness and Preparation and Educational Technology		**Sec 4.1**	**Sec 4.2**
CRP 4	Communicate clearly and effectively and with reason	X	X
CRP 8	Utilize critical thinking to make sense of problems and persevere in solving them.	X	X
CRP 11	Use technology to enhance productivity.	X	X
9.2.12.C.3	Identify transferable career skills and design alternate career plans.		X

Statistics
Unit 5: Linear Regression
Section 5.1 **Suggested Unit Pacing: 8**

Essential Question: How do you determine if there's a relationship between two different quantities?

Mathematical Modeling: How does time spent studying impact grades?
Is there enough evidence at the 5% level of significance to conclude there is significant linear correlation between duration of Old Faithful's eruptions and time between eruptions?

NJSLS-M Performance Expectations		**Enduring Understanding**
S-ID.B.6a*	(*) Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.	Data-based regression models describe relationships between variables and are a tool for making predictions for values of a response variable. Collecting data using random sampling or randomized experimental design means that findings may be generalized to the part of the population from which the selection was made. Statistical inference allows us to make data-based decisions.
S-ID.B.6b*	(*) Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.	
S-ID.B.6c*	(*) Fit a linear function for a scatter plot that suggests a linear association.	
S-ID.C.7*	(*) Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	
S-ID.C.8*	(*) Compute (using technology) and interpret the correlation coefficient of a linear fit.	
S-ID.C.9*	(*) Distinguish between correlation and causation.	

Standards-Aligned Objectives. Instruction and assessment will align to the following objectives:	
S-ID.B.6a*[1]	Represent real world data on a scatter plot (two quantitative variables) using appropriate tools.
S-ID.B.6a*[2]	Fit a given function class (e.g., linear, exponential) to a real world data set by looking for and making use of structure.
S-ID.B.6a*[3]	Using given real world scatter plot data represented on the coordinate plane, informally describe how the two quantitative variables are related by making sense of the data.
S-ID.B.6a*[4]	Determine, using clear and precise definitions, which function best models scatter plot data represented on the coordinate plane, and describe how the two quantitative variables are related by constructing a viable argument.
S-ID.B.6a*[5]	Use functions fitted to data to *look for and make use of structure to* solve problems in the context of the data.
S-ID.B.6b*[1]	Represent the residuals from a function and the real world data set it models, numerically and graphically using appropriate tools.
S-ID.B.6b*[2]	Informally assess the fit of a function by looking for and making use of structure in analyzing residuals from the residual plot.
S-ID.B.6c*[1]	*Look for and make use of structure to* fit a linear function for a scatter plot that suggests a linear association.
S-ID.C.7*[1]	Interpret and make sense of the slope (rate of change) and the intercept (constant term) of a linear model in the context of the real world data.
S-ID.C.8*[1]	Define, using clear and precise terminology, the correlation coefficient.
S-ID.C.8*[2]	Using appropriate technology, compute the correlation coefficient of a linear fit.
S-ID.C.8*[3]	Interpret and make sense of the correlation coefficient of a linear fit as a measure of how well the real world data

	fit the relationship.
S-ID.C.9*[1]	Define causation using precise terminology.
S-ID.C.9*[2]	Distinguish between correlation and causation using clear and precise definitions.
S-ID.C.9*[3]	Define precisely positive, negative, and no correlation and explain why correlation does not imply causation by constructing a viable argument.

Statistics Unit 5 **NJSLS Career Readiness and Preparation and Educational Technology**		
NJSLS Career Readiness and Preparation and Educational Technology		**Sec 5.1**
CRP 11	Use technology to enhance productivity.	X
8.1.12.A.4	Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.	X
9.2.12.C.3	Identify transferable career skills and design alternate career plans.	X

Statistics **Unit 6: Chi-Square Analysis** **Section 6.1**		**Suggested Unit Pacing: 8 Sessions**
Essential Question: How can you compare two or more distributions or parameters of more than two populations?		
Mathematical Modeling: Is the age distribution for the residents of a city different from that of 10 years ago?		
NJSLS-M Performance Expectations		**Enduring Understanding**
(*) S-IC.A.2	(*) S-IC.A.2* Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. 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? (+ for 2023)	Data-based regression models describe relationships between variables and are a tool for making predictions for values of a response variable. Collecting data using random sampling or randomized experimental design means that findings may be generalized to the part of the population from which the selection was made. Statistical inference allows us to make data-based decisions.
Standards-Aligned Objectives. Instruction and assessment will align to the following objectives:		
S-IC.A.2 [1]	Determine the degrees of freedom relative to the real world data for the specified model.	
S-IC.A.2 [2]	Identify data or discrepancies, using the chi-square goodness-of-fit test, that provide the basis for rejecting a statistical model.	
S-IC.A.2 [3]	Decide, by constructing a viable argument using the chi-square goodness-of-fit test, if a specified model is consistent with results from a given data-generating process, e.g., using simulation.	

Statistics **Unit 6: Chi-Square Analysis** **Section 6.2**		**Suggested Unit Pacing: 8 Sessions**
Essential Question: How can you compare two or more distributions or parameters of more than two populations?		
Mathematical Modeling: Can average household income be used to predict SAT scores?		
NJSLS-M Performance Expectations		**Enduring Understanding**
(*) S-IC.A.2	(*) S-IC.A.2* Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. 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? (+ for 2023)	Data-based regression models describe relationships between variables and are a tool for making predictions for values of a response variable. Collecting data using random sampling or randomized experimental design means that findings may be generalized to the part of the population from which the selection was made. Statistical inference allows us to make data-based decisions.
Standards-Aligned Objectives. Instruction and assessment will align to the following objectives:		
S-IC.A.2 [4]	Use contingency tables to find expected frequencies for a given real world data set.	
S-IC.A.2 [5]	Identify data or discrepancies, using the chi-square test for independence, that provide the basis for rejecting a statistical model.	
S-IC.A.2 [6]	Decide, by constructing a viable argument using the chi-square test for independence, if a specified model is consistent with results from a given data-generating process, e.g., using simulation.	

NJSLS Career Readiness and Preparation and Educational Technology		Sec 6.1	Sec 6.2
CRP 4	Communicate clearly and effectively and with reason	X	X
CRP 8	Utilize critical thinking to make sense of problems and persevere in solving them.	X	X
CRP 11	Use technology to enhance productivity.	X	X
8.1.12.A.4	Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.	X	X
9.2.12.C.3	Identify transferable career skills and design alternate career plans.	X	X

NJSLS Career Awareness, Exploration, Preparation, and Training, and Life Literacies and Key Skills		Unit
9.2.12.CAP.1	Analyze unemployment rates for workers with different levels of education and how the economic, social, and political conditions of a time period are affected by a recession.	
9.2.12.CAP.2	Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.	
9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.	
9.2.12.CAP.4	Evaluate different careers and develop various plans (e.g. costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.	
9.2.12.CAP.5	Assess and modify a personal plan to support current interests and postsecondary plans.	
9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.	
9.2.12.CAP.7	Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest.	
9.2.12.CAP.8	Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.	
9.2.12.CAP.9	Locate information on working papers, what is required to obtain them, and who must sign them.	
9.2.12.CAP.10	Identify strategies for reducing overall costs of postsecondary education (e.g., tuition assistance, loans, grants, scholarships, and student loans).	
9.2.12.CAP.11	Demonstrate an understanding of Free Application for Federal Student Aid (FAFSA) requirements to apply for postsecondary education	
9.2.12.CAP.11*	Explain how compulsory government programs (e.g., Social Security, Medicare) provide insurance against some loss of income and benefits to eligible recipients.	
9.2.12.CAP.12	Analyze how the economic, social, and political conditions of a time period can affect the labor market.	
9.2.12.CAP.13	Analyze and critique various sources of income and available resources (e.g., financial assets, property, and transfer payments) and how they may substitute for earned income.	
9.2.12.CAP.14	Demonstrate how exemptions, deductions, and deferred income (e.g. retirement or medical) can reduce taxable income.	
9.2.12.CAP.15	Explain why taxes are withheld from income and the relationship of federal, state, and local taxes (e.g. property, income, excise, and sales) and how the money collected is used by local, county, state, and federal governments.	
9.2.12.CAP.16	Analyze the impact of the collective bargaining process on benefits, income, and fair labor practice.	
9.2.12.CAP.17	Differentiate between taxable and nontaxable income from various forms of employment (e.g. cash business, tips, tax filing and withholding).	
9.2.12.CAP.18	Explain the purpose of payroll deductions and why fees for various benefits (e.g., medical benefits) are taken out of pay, including the cost of employee benefits to employers and self-employment income.	

9.2.12.CAP.19	Analyze a Federal and State Income Tax Return	
9.2.12.CAP.20	Explain low-cost and low-risk ways to start a business.	
9.2.12.CAP.21	Compare risk and reward potential and use the comparison to decide whether starting a business is feasible.	
9.2.12.CAP.22	Identify different ways to obtain capital for starting a business	
9.4.12.CI.1	Demonstrate the ability to reflect, analyze and use creative skills and ideas.	
9.4.12.CI.2	Identify career pathways that highlight personal talents, skills and abilities.	
9.4.12.CI.3	Investigate new challenges and opportunities for personal growth, advancement and transition	
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice.	
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving.	
9.4.12.CT.3	Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why solutions may work better than others (e.g., political. economic, cultural).	
9.4.12.CT.4	Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice).	
9.4.12.CT.5	Participate in online strategy and planning sessions for course-based, school-based or other project and determine the strategies that contribute to effective outcomes	
9.4.12.DC.1	Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content.	
9.4.12.DC.2	Compare and contrast international differences in copyright laws and ethics.	
9.4.12.DC.3	Evaluate the social and economic implications of privacy in the context of safety, law, or ethics.	
9.4.12.DC.4	Explain the privacy concerns related to the collection of data (e.g. cookies) and generation of data through automated processes that may not be evident to users	
9.4.12.DC.5	Debate laws and regulations that impact the development and use of software	
9.4.12.DC.6	Select information to post online that positively impacts personal image and future college and career opportunities.	
9.4.12.DC.7	Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society.	
9.4.12.DC.8	Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection.	
9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specified task	
9.4.12.TL.2	Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.	
9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.	
9.4.12.TL.4	Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.	
9.4.12.GCA.1	Collaborate with individuals analyze a variety of potential solutions to climate change effects and determine why solutions may work better than others (e.g., political. economic, cultural).	
9.4.12.IML.1	Compare search browsers and recognize features that allow for filtering of information.	
9.4.12.IML.2	Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.	
9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.	
9.4.12.IML.4	Assess and critique the appropriateness and impact of existing data visualizations for an intended audience.	
9.4.12.IML.5	Evaluate, synthesize and apply information on climate change from various sources appropriately.	

9.4.12.IML.6	Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender and age diversity.	
9.4.12.IML.7	Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change.	
9.4.12.IML.9	Evaluate media sources for point of view, bias and motivations.	
9.4.12.IML.10	Analyze the decisions creators make to reveal explicit and implicit messages within information and media.	

* ID 9.2.12.CAP.11 duplicated in NJDOE NJSLS file page 1 and 2