

Statistics

Grade 12

Prepared by:

Jessica Lee

Superintendent of Schools:

Marie C. Cirasella, Ed.D.

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Statistics

Course Description:

Statistics is a full year study designed primarily as a preparation course for college, technical school or junior college. The key components in probability are probability terms, the concept of the probability of an event, predicting and determining probabilities, expected value, the relationship between theoretical and experimental probabilities, and compound events. In statistics, the key components are data collection, organization, representation, sampling, central tendency, variance and correlation, and analysis and inference.

Course topics will include the study of introduction to statistics, summarizing and graphing data, statistics for describing, exploring, and comparing data, probability, discrete probability distributions, normal probability distributions, estimates and sample sizes, hypothesis testing, inferences from two samples, and correlation and regression. Graphing calculators are used throughout the course to develop conceptual understanding and analysis of data.

Upon completion of this course, a student will:

1. Understand the essential techniques and skills for analyzing data (graphing and numerical summaries), producing data (surveys, experiments, observational studies, simulations), anticipating patterns (probability, random variables, sampling distributions), and drawing conclusions from data (inference procedures – confidence intervals and significance tests).
2. Understand when and how to use technology as a tool in solving statistical problems.
3. Create strong oral and written statistical arguments, using appropriate terminology, to give meaning to data in a variety of real-life situations.
4. Develop a framework for statistical reasoning, allowing him or her to regard published statistical results critically and with a heightened awareness of how statistics can be manipulated in order to deceive, confuse, or distort the truth.

Course Sequence:

Unit 1: Collecting and Organizing Data (26 days)

Unit 2: Measuring Center and Spread (18 days)

Unit 3: Correlation and Regression (18 days)

Unit 4: Probability (31 days)

Unit 5: Normal Probability Distributions: (19 days)

Unit 6: Confidence Intervals & Hypothesis Testing: (33 days)

Prerequisite:

Algebra I and Algebra 2

Unit # 1 - Overview**Content Area:** Statistics**Unit Title:** Collecting and Organizing Data**Grade Level:** 12

Core Ideas: Students will work to understand the different types of data, ways that data can be collected, the two branches of statistics, and the basics of experimental design. Students will also take a look at how to organize data using tables and graphs and describe the distributions.

Unit # 1 - Standards**Standards** (Content and Technology):**CPI#:****Statement:****Performance Expectations (NJSLS)**

NJSLS.S-IC.A.1

Understand statistics as a process for making inferences about population parameters based on a random sample from that population

NJSLS.S-IC.B.3

Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization related to each

NJSLS.S-ID.A.1

Represent data with plots on the real number line (dot plots, histograms, and box plots)

NJSLS.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.

Career Readiness, Life Literacies, and Key Skills

9.2.12.CAP.5

Assess and modify a personal plan to support current interests and postsecondary plans.

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.8

Evaluate media sources for point of view, bias, and motivations

9.4.12.TL.2

Generate data using formula-based calculations in a spreadsheet and draw conclusions about data

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 problems

Computer Science and Design Thinking

8.1.12.CS.2

Model interactions between application software, system software, and hardware

8.1.12.DA.1

Create interactive data visualizations using software tools to help other better understand real world phenomena, including climate change

8.1.12.DA.5

Create data visualizations from large data sets to summarize, communicate, and

	support different interpretations of real world phenomena
8.1.12.DA.6	Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process
8.2.12.ITH.3	Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture
8.2.12.EC.2	Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded
Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
LGBTQ and Disabilities NJSA 18A:35-4.35	Explore mathematicians in the LGBTQ and disabled community, including but not limited to Juliette Bruce, NSF Postdoctoral Fellow at University of California, Berkeley and Stephen Hawking, former Director of Research at the University of Cambridge.
Amistad Law NJSA 18A:35-4.43	Explore African-American mathematicians and scientists, including but not limited to Martha Euphemia Lofton Haynes, the first African-American woman to earn a Ph.D in mathematics, and Elbert Frank Cox, the first African-American man to earn a Ph.D in mathematics in the world.
	Discuss and analyze the movie <i>Hidden Figures</i> , the story of female African-American mathematicians and engineers who worked for NASA
Holocaust Law NJSA 18A:35-28	Explore Jewish mathematicians using the article " <i>Jewish Mathematicians Who Changed the Course of History</i> " from jewishjournal.com

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AAPI Law NJSA 18A:25-4.44	Explore Asian-American and Pacific Islander mathematicians and scientists, including but not limited to Dr. Peter Tsai, inventor of the N95 respirator and Diana Ma, data scientist and statistician for the Lakers
Companion Standards	
WHST.9-12.1	Write arguments focused on discipline-specific content.
WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden an inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research
RST.9-10.8	Determine if reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem
RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information

SL.11-12.4	Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.	
Interdisciplinary Connection		
6.1.12.HistorySE.14.a	Explore the various ways women, racial and ethnic minorities, the LGBTQ community, and individuals with disabilities have contributed to the American economy, politics and society	
6.1.12.HistorySE.14.b	Use a variety of sources from diverse perspective to analyze the social, economic and political contributions of marginalized and underrepresented groups and/or individuals.	
CASEL 5 SEL Framework		
Self-Awareness	-Demonstrate honesty and integrity -Experience self-efficacy -Develop interests and a sense of purpose	
Social Awareness	-Recognize strengths in others -Understand and express gratitude	
Self-Management	-Identify and use stress management strategies -Exhibit self-discipline and self-motivation -Use planning and organizational skills	
Relationship Skills	-Communicate effectively -Practice teamwork and collaborative problem-solving -Seek or offer support and help when needed	
Responsible Decision Making	-Demonstrate curiosity and open-mindedness -Learn to make a reasoned judgment after analyzing information, data, facts -Recognize how critical thinking skills are useful both inside & outside of school	
Unit Essential Question(s): <ul style="list-style-type: none">• How can collecting and organizing data clarify what the data is revealing?• What is statistics?• How is data categorized?• What are the different ways data can be visualized?• How can you describe the distributions of data?		Unit Enduring Understandings: <ul style="list-style-type: none">• Appropriate statistical methods are necessary to become intelligent consumers.• The collection, organization, and display of data are used to answer questions.• The choice of data display can affect the visual message communicated.
Evidence of Learning		
Formative Assessments: Do Now, Homework, On-spot Checking for Understanding, Teacher Feedback Summative/Benchmark Assessment(s): Quizzes, Chapter Reviews, Chapter Tests Alternative Assessments: Projects, Online Assignments		
Resources/Materials: Bluman, Allan G. <i>Elementary Statistics: A Step by Step Approach</i> ,		Key Vocabulary: statistics, discrete, continuous, population, sample, quantitative, qualitative, random sampling, systematic

sampling, stratified sampling, cluster sampling, sampling error, observational study, confounding variable, lurking variable, nominal, ordinal, interval, ratio, frequency distribution, histogram, frequency polygon, ogives, bar graphs, dotplots, pie graphs, stem and leaf plots

Suggested Pacing Guide

Lesson Name/Topic	Student Learning Objective(s)	Suggested Tasks/Activities:	Day(s) to Complete
Descriptive and Inferential Statistics	-Demonstrating knowledge of statistical terms -Differentiating between the two branches of statistics	Lesson, Application, Review	1 day
Variables and Types of Data	-Identifying types of data -Identifying the measurement level for each variable	Lesson, Application, Review	2 days
Data Collection and Sampling Techniques	-Identifying the four basic sampling techniques	Lesson, Application, Review	2 days
Experimental Design	-Explaining the difference between an observational study and an experimental study -Explaining how statistics can be used and misused	Lesson, Application, Review	2 days
Computers and Calculations	-Explaining the importance of computers and calculators in statistics	Lesson, Application, Review	2 days
Organizing Data	-Organizing data using a frequency distribution	Lesson, Application, Review	3 days
Histograms, Frequency Polygons, and Ogives	-Representing data in frequency distributions graphically, using histograms, frequency polygons, and ogives	Lesson, Application, Review	3 days
Other Types of Graphs	-Representing data using bar graphs, pie graphs, and dotplots -Drawing and interpreting stem and leaf plots	Lesson, Application, Review	3 days
Common Sampling Techniques	-Demonstrating a knowledge of the four basic sampling methods	Lesson, Application, Review	2 days
Surveys and Questionnaire Design	-Recognizing faulty questions on a survey and other factors that can bias responses	Lesson, Application, Review	1 day
Simulation Techniques and the Monte Carlo Method	-Solving problems, using simulation techniques	Lesson, Application, Review	2 days

Teacher Notes: 26 total days including assessment days (quizzes, test)				
Additional Resources:				
Differentiation/Modification Strategies				
Students with Disabilities	English Language Learners	Gifted and Talented Students	Students at Risk	504 Students
-Rephrase questions, directions, and explanations -Allow extended time on assessments -Consult with Case Managers and follow IEP modifications/accommodations	-Allow errors in speaking -Rephrase questions, directions, and explanations -Allow extended time on assessments	-Provide extension activities -Build on students' intrinsic motivations	-Consult with Guidance Counselors and follow I&RS procedures and action plans -Consult with classroom teacher(s) for specific behavior interventions -Provide extended time to complete tasks (on need basis)	-Rephrase questions, directions, and explanations -Allow extended time on assessments -Consult with Guidance Counselors and 504 Committees to come up with procedures/504 accommodations

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Unit # 2 - Overview	
Content Area: Statistics	
Unit Title: Measuring Center and Spread	
Grade Level: 12	
Core Ideas: Students will be able to determine and analyze measures of central tendencies, measures of variation and measures of position. Depending on the set of data provided and its distribution, students will determine which measure is best suited to describe the data set.	
Unit # 2 - Standards	
Standards (Content and Technology):	
CPI#:	Statement:
Performance Expectations (NJSLs)	
NJSLs.S-ID.A.2	Use statistics appropriate to the shape of the data distributions to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets
NJSLs.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)

Career Readiness, Life Literacies, and Key Skills	
9.2.12.CAP.5	Assess and modify a personal plan to support current interests and postsecondary plans.
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.8	Evaluate media sources for point of view, bias, and motivations
9.4.12.TL.2	Generate data using formula-based calculations in a spreadsheet and draw conclusions about data
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
Computer Science and Design Thinking	
8.1.12.CS.2	Model interactions between application software, system software, and hardware
8.1.12.DA.1	Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change
8.1.12.DA.5	Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real world phenomena
8.1.12.DA.6	Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process
8.2.12.ITH.3	Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture
8.2.12.EC.2	Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded
Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
LGBTQ and Disabilities NJSA 18A:35-4.35	Explore mathematicians in the LGBTQ and disabled community, including but not limited to Juliette Bruce, NSF Postdoctoral Fellow at University of California, Berkeley and Stephen Hawking, former Director of Research at the University of Cambridge.
Amistad Law NJSA 18A:35-4.43	Explore African-American mathematicians and scientists, including but not limited to Martha Euphemia Lofton Haynes, the first African-American woman to earn a Ph.D in mathematics, and Elbert Frank Cox, the first African-American man to earn a Ph.D in mathematics in the world.
	Discuss and analyze the movie <i>Hidden Figures</i> , the story of female African-American mathematicians and engineers who worked for NASA
Holocaust Law NJSA 18A:35-28	Explore Jewish mathematicians using the article " <i>Jewish Mathematicians Who Changed the Course of History</i> " from <i>jewishjournal.com</i>
AAPI Law NJSA 18A:25-4.44	Explore Asian-American and Pacific Islander mathematicians and scientists, including but not limited to Dr. Peter Tsai, inventor of the N95 respirator and Diana

	Ma, data scientist and statistician for the Lakers
Companion Standards	
WHST.9-12.1	Write arguments focused on discipline-specific content.

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WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden an inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research
RST.9-10.8	Determine if reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem
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SL.11-12.4	Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.

Interdisciplinary Connection

6.1.12.HistorySE.14.a	Explore the various ways women, racial and ethnic minorities, the LGBTQ community, and individuals with disabilities have contributed to the American economy, politics and society
6.1.12.HistorySE.14.b	Use a variety of sources from diverse perspective to analyze the social, economic and political contributions of marginalized and underrepresented groups and/or individuals.

CASEL 5 SEL Framework

Self-Awareness	<ul style="list-style-type: none"> -Demonstrate honesty and integrity -Experience self-efficacy -Develop interests and a sense of purpose
Social Awareness	<ul style="list-style-type: none"> -Recognize strengths in others -Understand and express gratitude
Self-Management	<ul style="list-style-type: none"> -Identify and use stress management strategies -Exhibit self-discipline and self-motivation -Use planning and organizational skills
Relationship Skills	<ul style="list-style-type: none"> -Communicate effectively -Practice teamwork and collaborative problem-solving -Seek or offer support and help when needed
Responsible Decision Making	<ul style="list-style-type: none"> -Demonstrate curiosity and open-mindedness -Learn to make a reasoned judgment after analyzing information, data, facts

	-Recognize how critical thinking skills are useful both inside & outside of school
Unit Essential Question(s): <ul style="list-style-type: none"> • What are the properties and uses of measures of central tendency? • What are the properties and uses of measures of spread? • What are the properties and uses of measures of position? • When will you use the common measures of central tendency and spread? • How will they help you solve problems? 	Unit Enduring Understandings: <ul style="list-style-type: none"> • Real-world situations can be represented using mathematical models to analyze quantitative relationships. • The choice of data display can affect the visual message communicated.
Evidence of Learning	
Formative Assessments: Do Now, Homework, On-spot Checking for Understanding, Teacher Feedback Summative/Benchmark Assessment(s): Quizzes, Chapter Reviews, Chapter Tests Alternative Assessments: Projects, Online Assignments	
Resources/Materials: Bluman, Allan G. <i>Elementary Statistics: A Step by Step Approach</i> ,	Key Vocabulary: statistic, parameter, mean, median, mode, midrange, weighted mean, skewed distributions, range, variance, standard deviation, coefficient of variation, Chebyshev's Theorem, Empirical Rule, z-score, percentiles, quartiles, interquartile range, outlier, boxplot, five-number summary

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Suggested Pacing Guide			
Lesson Name/Topic	Student Learning Objective(s)	Suggested Tasks/Activities:	Day(s) to Complete
Measures of Central Tendency	-Summarizing data, using measures of central tendency, such as the mean, median, mode, and midrange	Lesson, Application Review	4 days
Measures of Variation	-Describing data, using measures of variation, such as the range, variance, and standard deviation	Lesson, Application Review	4 days
Measures of Position	-Identifying the position of a data value in a data set, using various measures of position, such as percentiles, deciles and quartiles	Lesson, Application Review	4 days
Exploratory Data Analysis	-Using the techniques of exploratory data analysis, including boxplots, and five-number summaries, to discover various aspects of data	Lesson, Application Review	3 days
Teacher Notes: 18 total days including assessment days (quizzes, test)			

Additional Resources:				
Differentiation/Modification Strategies				
Students with Disabilities	English Language Learners	Gifted and Talented Students	Students at Risk	504 Students
-Rephrase questions, directions, and explanations -Allow extended time on assessments -Consult with Case Managers and follow IEP modifications/accommodations	-Allow errors in speaking -Rephrase questions, directions, and explanations -Allow extended time on assessments	-Provide extension activities -Build on students' intrinsic motivations	-Consult with Guidance Counselors and follow I&RS procedures and action plans -Consult with classroom teacher(s) for specific behavior interventions -Provide extended time to complete tasks (on need basis)	-Rephrase questions, directions, and explanations -Allow extended time on assessments -Consult with Guidance Counselors and 504 Committees to come up with procedures/504 accommodations

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Unit # 3 - Overview	
Content Area: Statistics	
Unit Title: Correlation and Regression	
Grade Level: 12	
Core Ideas: Students will be able to create a scatter plot and calculate a correlation coefficient for two variable data, and, if a correlation exists, be able to determine an equation that is the “best fit” model for the data.	
Unit # 3 - Standards	
Standards (Content and Technology):	
CPI#:	Statement:
Performance Expectations (NJSLs)	
NJSLs.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. 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. <i>Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.</i> b. Informally assess the fit of a functions by plotting and analyzing residuals, including with the use of technology. c. Fit a linear function for a scatter plot that suggests a linear association

NJSLS.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.
NJSLS.S-ID.C.8	Compute (using technology) and interpret the correlation coefficient of a linear fit.
NJSLS.S-ID.C.9	Distinguish between correlation and causation.
Career Readiness, Life Literacies, and Key Skills	
9.2.12.CAP.5	Assess and modify a personal plan to support current interests and postsecondary plans.
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.8	Evaluate media sources for point of view, bias, and motivations
9.4.12.TL.2	Generate data using formula-based calculations in a spreadsheet and draw conclusions about data
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Computer Science and Design Thinking	
8.1.12.CS.2	Model interactions between application software, system software, and hardware
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Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
LGBTQ and Disabilities NJSA 18A:35-4.35	Explore mathematicians in the LGBTQ and disabled community, including but not limited to Juliette Bruce, NSF Postdoctoral Fellow at University of California, Berkeley and Stephen Hawking, former Director of Research at the University of Cambridge.
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	Discuss and analyze the movie <i>Hidden Figures</i> , the story of female

	African-American mathematicians and engineers who worked for NASA
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Companion Standards

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Interdisciplinary Connection

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CASEL 5 SEL Framework

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Self-Management	-Identify and use stress management strategies -Exhibit self-discipline and self-motivation -Use planning and organizational skills

Relationship Skills	<ul style="list-style-type: none"> -Communicate effectively -Practice teamwork and collaborative problem-solving -Seek or offer support and help when needed
Responsible Decision Making	<ul style="list-style-type: none"> -Demonstrate curiosity and open-mindedness -Learn to make a reasoned judgment after analyzing information, data, facts -Recognize how critical thinking skills are useful both inside & outside of school
Unit Essential Question(s): <ul style="list-style-type: none"> • How can I organize and interpret paired data to predict future events? • How do we determine if there is a statistically significant correlation between two variables and, if so, how can we obtain an approximation? 	Unit Enduring Understandings: <ul style="list-style-type: none"> • Computing fluently and making reasonable estimates increases the ability to solve realistic problems encountered in everyday life. • The choice of data display can affect the visual message communicated.
Evidence of Learning	
Formative Assessments: Do Now, Homework, On-spot Checking for Understanding, Teacher Feedback Summative/Benchmark Assessment(s): Quizzes, Chapter Reviews, Chapter Tests Alternative Assessments: Projects, Online Assignments	
Resources/Materials: Bluman, Allan G. <i>Elementary Statistics: A Step by Step Approach</i> ,	Key Vocabulary: Scatter plots, independent variable, dependent variable, correlation, correlation coefficient, causation, regression

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	line, residual, extrapolation, influential points, residual plots, coefficient of determination, standard error of the estimate, prediction interval		
Suggested Pacing Guide			
Lesson Name/Topic	Student Learning Objective(s)	Suggested Tasks/Activities:	Day(s) to Complete
Scatter Plots and Correlation	-Drawing a scatter plot for a set of ordered pairs -Computing the correlation coefficient -Testing the hypothesis $H_0: \rho=0$	Lesson, Application, Review	5 days
Regression	-Computing the equation of the regression line -Interpreting the slope and the y-intercept in the context of the given situation	Lesson, Application, Review	5 days
Coefficient of Determination and Standard Error of the Estimate	-Computing the coefficient of determination -Computing the standard error of the estimate -Finding the prediction interval	Lesson, Application, Review	5 days
Teacher Notes: 18 total days including assessment days (quizzes, test)			
Additional Resources:			

Differentiation/Modification Strategies				
Students with Disabilities	English Language Learners	Gifted and Talented Students	Students at Risk	504 Students
-Rephrase questions, directions, and explanations -Allow extended time on assessments -Consult with Case Managers and follow IEP modifications/accommodations	-Allow errors in speaking -Rephrase questions, directions, and explanations -Allow extended time on assessments	-Provide extension activities -Build on students' intrinsic motivations	-Consult with Guidance Counselors and follow I&RS procedures and action plans -Consult with classroom teacher(s) for specific behavior interventions -Provide extended time to complete tasks (on need basis)	-Rephrase questions, directions, and explanations -Allow extended time on assessments -Consult with Guidance Counselors and 504 Committees to come up with procedures/504 accommodations

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Unit # 4 - Overview	
Content Area: Statistics	
Unit Title: Probability	
Grade Level: 12	
Core Ideas: Students will know the definition of probability, how to use counting methods to calculate probabilities and how to calculate probabilities of simple and compound events. Using the probabilities, students will take a look at probability distributions and the characteristics of the different types (binomial, geometric).	
Unit # 4 - Standards	
Standards (Content and Technology):	
CPI#:	Statement:
Performance Expectations (NJSL)	
NJSL.S-IC.A.2	Decide if a specified model is consistent with results from a given data-generating process.
NJSL.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”)
NJSL.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.

NJSLS.S-CP.A.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.
NJSLS.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
NJSLS.S-CP.A.5	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations
NJSLS.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
NJSLS.S-CP.B.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
NJSLS.S-CP.B.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
NJSLS.S-CP.B.9 (+)	Use permutations and combinations to compute probabilities of compound events and solve problems

Career Readiness, Life Literacies, and Key Skills

9.2.12.CAP.5	Assess and modify a personal plan to support current interests and postsecondary plans.
9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions
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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 problems

Computer Science and Design Thinking

8.1.12.CS.2	Model interactions between application software, system software, and hardware
8.1.12.DA.1	Create interactive data visualizations using software tools to help other better understand real world phenomena, including climate change
8.1.12.DA.5	Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real world phenomena
8.1.12.DA.6	Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process

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8.2.12.ITH.3	Analyze the impact that globalization, social media, and access to open source
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	technologies has had on innovation and on a society's economy, politics, and culture
8.2.12.EC.2	Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded
Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
LGBTQ and Disabilities NJSA 18A:35-4.35	Explore mathematicians in the LGBTQ and disabled community, including but not limited to Juliette Bruce, NSF Postdoctoral Fellow at University of California, Berkeley and Stephen Hawking, former Director of Research at the University of Cambridge.
Amistad Law NJSA 18A:35-4.43	Explore African-American mathematicians and scientists, including but not limited to Martha Euphemia Lofton Haynes, the first African-American woman to earn a Ph.D in mathematics, and Elbert Frank Cox, the first African-American man to earn a Ph.D in mathematics in the world.
	Discuss and analyze the movie <i>Hidden Figures</i> , the story of female African-American mathematicians and engineers who worked for NASA
Holocaust Law NJSA 18A:35-28	Explore Jewish mathematicians using the article " <i>Jewish Mathematicians Who Changed the Course of History</i> " from <i>jewishjournal.com</i>
AAPI Law NJSA 18A:25-4.44	Explore Asian-American and Pacific Islander mathematicians and scientists, including but not limited to Dr. Peter Tsai, inventor of the N95 respirator and Diana Ma, data scientist and statistician for the Lakers
Companion Standards	
WHST.9-12.1	Write arguments focused on discipline-specific content.
WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden an inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research
RST.9-10.8	Determine if reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem
RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information
SL.11-12.4	Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
Interdisciplinary Connection	
6.1.12.HistorySE.14.a	Explore the various ways women, racial and ethnic minorities, the LGBTQ community, and individuals with disabilities have contributed to the American economy, politics and society

6.1.12.HistorySE.14.b	Use a variety of sources from diverse perspective to analyze the social, economic and political contributions of marginalized and underrepresented groups and/or individuals.
CASEL 5 SEL Framework	
Self-Awareness	-Demonstrate honesty and integrity -Experience self-efficacy -Develop interests and a sense of purpose
Social Awareness	-Recognize strengths in others -Understand and express gratitude
Self-Management	-Identify and use stress management strategies -Exhibit self-discipline and self-motivation -Use planning and organizational skills
Relationship Skills	-Communicate effectively -Practice teamwork and collaborative problem-solving -Seek or offer support and help when needed
Responsible Decision Making	-Demonstrate curiosity and open-mindedness -Learn to make a reasoned judgment after analyzing information, data, facts

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	-Recognize how critical thinking skills are useful both inside & outside of school
Unit Essential Question(s): <ul style="list-style-type: none"> • What is probability and how is it applied across disciplines? • How can I use probability to make predictions about the outcome of events? 	Unit Enduring Understandings: <ul style="list-style-type: none"> • Probability can be used to make decisions, predictions, or choices. • Proportional reasoning is a tool for modeling and solving problems encountered in everyday situations.
Evidence of Learning	
Formative Assessments: Do Now, Homework, On-spot Checking for Understanding, Teacher Feedback Summative/Benchmark Assessment(s): Quizzes, Chapter Reviews, Chapter Tests Alternative Assessments: Projects, Online Assignments	
Resources/Materials: Bluman, Allan G. <i>Elementary Statistics: A Step by Step Approach</i> ,	Key Vocabulary: probability, outcome, sample space, tree diagram, theoretical probability, complementary events, experimental probability, law of large numbers, mutually exclusive events, independent events, dependent events, conditional probability, Fundamental Counting Rule, permutation, combination, random variable, probability distribution, random variable, expected value, binomial distribution, geometric distributions
Suggested Pacing Guide	

Lesson Name/Topic	Student Learning Objective(s)	Suggested Tasks/Activities:	Day(s) to Complete
Sample Spaces and Probability	-Determining sample spaces and finding the probability of an event, using classical probability or empirical probability	Lesson, Application, Review	3 days
The Addition Rules for Probability	-Finding the probability of compound events, using the addition rules	Lesson, Application, Review	2 days
The Multiplication Rules and Conditional Probability	-Finding the probability of compound events, using the multiplication rules -Finding the conditional probability of an event	Lesson, Application, Review	3 days
Counting Rules	-Finding the total number of outcomes in a sequences of events, using the fundamental counting rule -Finding the number of ways that r objects can be selected from n objects, using the permutation rule -Finding the number of way that r objects can be selected from n objects without regard to order, using the combination rule	Lesson, Application, Review	3 days
Probability and Counting Rules	-Finding the probability of an even, using the counting rules	Lesson, Application, Review	4 days
Probability Distributions	-Constructing a probability distribution for a random variable	Lesson, Application, Review	2 days
Mean, Variance, Standard Deviation, and Expectation	-Finding the mean, variance, standard deviation, and expected value for a discrete random variable	Lesson, Application, Review	3 days
The Binomial Distribution	-Finding the exact probability for X successes in n trials of a binomial experiment -Finding the mean, variance, and standard deviation of a binomial distribution	Lesson, Application, Review	4 days
Other Types of Distributions	-Finding probabilities for outcomes of variables, using geometric and multinomial distributions	Lesson, Application, Review	4 days
Teacher Notes: 31 total days including assessment days (quizzes, test)			

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Additional Resources:
Differentiation/Modification Strategies

Students with Disabilities	English Language Learners	Gifted and Talented Students	Students at Risk	504 Students
-Rephrase questions, directions, and explanations -Allow extended time on assessments -Consult with Case Managers and follow IEP modifications/accommodations	-Allow errors in speaking -Rephrase questions, directions, and explanations -Allow extended time on assessments	-Provide extension activities -Build on students' intrinsic motivations	-Consult with Guidance Counselors and follow I&RS procedures and action plans -Consult with classroom teacher(s) for specific behavior interventions -Provide extended time to complete tasks (on need basis)	-Rephrase questions, directions, and explanations -Allow extended time on assessments -Consult with Guidance Counselors and 504 Committees to come up with procedures/504 accommodations

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Unit # 5 - Overview	
Content Area: Statistics	
Unit Title: Normal Probability Distributions	
Grade Level: 12	
Core Ideas: Students will be able to use a table or technology to determine probabilities for the Normal Probability Distribution and understand the Standard Normal Probability Distribution.	
Unit # 5 - Standards	
Standards (Content and Technology):	
CPI#:	Statement:
Performance Expectations (NJSL)	
NJSLS.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.
NJSLS.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.

NJSLS.S-ID.B.6	<p>Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.</p> <p>a. 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, quadratic, and exponential models.</p> <p>b. Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology</p> <p>c. Fit a linear function for a scatter plot that suggests a linear association.</p>
NJSLS.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
NJSLS.S-IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
NJSLS.S-IC.B.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.
Career Readiness, Life Literacies, and Key Skills	
9.2.12.CAP.5	Assess and modify a personal plan to support current interests and postsecondary plans.
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.8	Evaluate media sources for point of view, bias, and motivations
9.4.12.TL.2	Generate data using formula-based calculations in a spreadsheet and draw conclusions about data
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 problems
Computer Science and Design Thinking	
8.1.12.CS.2	Model interactions between application software, system software, and hardware
8.1.12.DA.1	Create interactive data visualizations using software tools to help other better understand real world phenomena, including climate change
8.1.12.DA.5	Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real world phenomena
8.1.12.DA.6	Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process
8.2.12.ITH.3	Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture
8.2.12.EC.2	Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded

Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
LGBTQ and Disabilities NJSA 18A:35-4.35	Explore mathematicians in the LGBTQ and disabled community, including but not limited to Juliette Bruce, NSF Postdoctoral Fellow at University of California, Berkeley and Stephen Hawking, former Director of Research at the University of Cambridge.
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	Discuss and analyze the movie <i>Hidden Figures</i> , the story of female African-American mathematicians and engineers who worked for NASA
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Companion Standards	
WHST.9-12.1	Write arguments focused on discipline-specific content.
WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden an inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation
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SL.11-12.4	Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
Interdisciplinary Connection	
6.1.12.HistorySE.14.a	Explore the various ways women, racial and ethnic minorities, the LGBTQ community, and individuals with disabilities have contributed to the American economy, politics and society
6.1.12.HistorySE.14.b	Use a variety of sources from diverse perspective to analyze the social, economic and political contributions of marginalized and underrepresented groups and/or individuals.
CASEL 5 SEL Framework	

Self-Awareness	-Demonstrate honesty and integrity -Experience self-efficacy -Develop interests and a sense of purpose
Social Awareness	-Recognize strengths in others -Understand and express gratitude
Self-Management	-Identify and use stress management strategies -Exhibit self-discipline and self-motivation -Use planning and organizational skills
Relationship Skills	-Communicate effectively -Practice teamwork and collaborative problem-solving -Seek or offer support and help when needed
Responsible Decision Making	-Demonstrate curiosity and open-mindedness -Learn to make a reasoned judgment after analyzing information, data, facts -Recognize how critical thinking skills are useful both inside & outside of school
Unit Essential Question(s): • What types of events are normally distributed and how do we calculate the probabilities of these events?	
Unit Enduring Understandings: • Measurable attributes of objects and the units, systems, and processes of measurement are powerful tools for making sense of the world around them.	

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• What is normal distribution and how can it help me understand the distribution of data?		• Measurements are determined by using appropriate techniques, tools, and formulas.	
Evidence of Learning			
Formative Assessments: Do Now, Homework, On-spot Checking for Understanding, Teacher Feedback Summative/Benchmark Assessment(s): Quizzes, Chapter Reviews, Chapter Tests Alternative Assessments: Projects, Online Assignments			
Resources/Materials: Bluman, Allan G. <i>Elementary Statistics: A Step by Step Approach</i> ,		Key Vocabulary: normal distribution, standard normal distribution, z-score, symmetric, skewed, Pearson coefficient, sampling distribution of sample means, sampling error, Central Limit Theorem, standard error of the mean	
Suggested Pacing Guide			
Lesson Name/Topic	Student Learning Objective(s)	Suggested Tasks/Activities:	Day(s) to Complete
Normal Distributions	-Identifying the properties of a normal distribution -Identifying distributions as symmetric or skewed -Finding the area under the standard normal distribution, given various	Lesson, Application, Review	4 days

	z-values		
Applications of the Normal Distribution	-Finding probabilities for a normally distributed variable by transforming it into a standard normal variable -Finding specific data values for given percentages, using the standard normal distribution	Lesson, Application, Review	4 days
The Central Limit Theorem	-Using the central limit theorem to solve problems involving sample means for large samples	Lesson, Application, Review	4 days
The Normal Approximation to the Binomial Distribution	-Using the normal approximation to compute probabilities for a binomial variable	Lesson, Application, Review	4 days

Teacher Notes: 19 total days including assessment days (quizzes, test)

Additional Resources:

Differentiation/Modification Strategies

Students with Disabilities	English Language Learners	Gifted and Talented Students	Students at Risk	504 Students
-Rephrase questions, directions, and explanations -Allow extended time on assessments -Consult with Case Managers and follow IEP modifications/accommodations	-Allow errors in speaking -Rephrase questions, directions, and explanations -Allow extended time on assessments	-Provide extension activities -Build on students' intrinsic motivations	-Consult with Guidance Counselors and follow I&RS procedures and action plans -Consult with classroom teacher(s) for specific behavior interventions -Provide extended time to complete tasks (on need basis)	-Rephrase questions, directions, and explanations -Allow extended time on assessments -Consult with Guidance Counselors and 504 Committees to come up with procedures/504 accommodations

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Unit # 6 - Overview

Content Area: Statistics

Unit Title: Confidence Intervals and Hypothesis Testing

Grade Level: 12

Core Ideas: Students will be able to construct an interval of values of a sample statistic that has a fixed probability of containing the associated population parameter. Students will be able to use probabilistic methods to accept or reject a certain hypothesis by looking at sample data that is relative to the claim.

Unit # 6 - Standards

Standards (Content and Technology):

CPI#:

Statement:

Performance Expectations (NJSLS)

NJSLS.S-IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
NJSLS.S-IC.B.6	Evaluate reports based on data.
NJSLS.S-IC.B.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.

Career Readiness, Life Literacies, and Key Skills

9.2.12.CAP.5	Assess and modify a personal plan to support current interests and postsecondary plans.
9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions
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CASEL 5 SEL Framework	
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Relationship Skills	-Communicate effectively -Practice teamwork and collaborative problem-solving -Seek or offer support and help when needed
Responsible Decision Making	-Demonstrate curiosity and open-mindedness -Learn to make a reasoned judgment after analyzing information, data, facts -Recognize how critical thinking skills are useful both inside & outside of school
Unit Essential Question(s): <ul style="list-style-type: none"> • How do we use probability and the error involved in using a sample to find an estimate for a population parameter? • How can we accept or reject a claim about a population by looking at an appropriate sample? 	Unit Enduring Understandings: <ul style="list-style-type: none"> • Inferences and predictions from data are used to make critical and informed decisions. • The collection, organization, and display of data are used to answer questions.
Evidence of Learning	
Formative Assessments: Do Now, Homework, On-spot Checking for Understanding, Teacher Feedback Summative/Benchmark Assessment(s): Quizzes, Chapter Reviews, Chapter Tests Alternative Assessments: Projects, Online Assignments	
Resources/Materials: Bluman, Allan G. <i>Elementary Statistics: A Step by Step Approach</i> ,	Key Vocabulary: point estimator, confidence level, confidence interval, margin of error, t distribution, degrees of freedom, proportion, chi-square distribution, statistical hypothesis, null hypothesis, alternative hypothesis, statistical test, test value, Type I error, Type II error, significance level, critical region, one-tailed test, two-tailed test, p-value, power

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Suggested Pacing Guide			
Lesson Name/Topic	Student Learning Objective(s)	Suggested Tasks/Activities:	Day(s) to Complete
Confidence Intervals for the Mean when σ is	-Finding the confidence interval for the mean when σ is known -Determining the minimum sample size	Lesson, Application, Review	3 days

Known	for finding a confidence interval for the mean			
Confidence Intervals for the Mean when σ is Unknown	-Finding the confidence interval for the mean when σ is unknown	Lesson, Application, Review	3 days	
Confidence Intervals and Samples Sizes for Proportions	-Finding the confidence interval for a proportion -Determining the minimum sample size for finding a confidence interval for a proportion	Lesson, Application, Review	3 days	
Confidence Intervals for Variances and Standard Deviations	-Finding a confidence interval for a variance and a standard deviation	Lesson, Application, Review	3 days	
Steps in Hypothesis Testing-Traditional Method	-Understanding the definitions used in hypothesis testing -Stating the null and alternative hypotheses -Finding critical values for the z test -Stating the five steps used in hypothesis testing	Lesson, Application, Review	3 days	
Z Test for a Mean	-Testing means when σ is known, using the z test	Lesson, Application, Review	3 days	
T Test for a Mean	-Testing means when σ is unknown, using the t test	Lesson, Application, Review	3 days	
Z test for a Proportion	-Testing proportion, using the z test	Lesson, Application, Review	3 days	
Chi-Square Test for a Variance or Standard Deviation	-Testing variances or standard deviations, using the chi-square test	Lesson, Application, Review	3 days	
Additional Topics Regarding Hypothesis Testing	-Testing hypotheses, using confidence intervals -Explaining the relationship between type I and type II errors and the power of a test	Lesson, Application, Review	3 days	
Teacher Notes: 33 days including assessment days (quizzes, test)				
Additional Resources:				
Differentiation/Modification Strategies				
Students with Disabilities	English Language Learners	Gifted and Talented Students	Students at Risk	504 Students

<ul style="list-style-type: none"> -Rephrase questions, directions, and explanations -Allow extended time on assessments -Consult with Case Managers and follow IEP modifications/accommodations 	<ul style="list-style-type: none"> -Allow errors in speaking -Rephrase questions, directions, and explanations -Allow extended time on assessments 	<ul style="list-style-type: none"> -Provide extension activities -Build on students' intrinsic motivations 	<ul style="list-style-type: none"> -Consult with Guidance Counselors and follow I&RS procedures and action plans -Consult with classroom teacher(s) for specific behavior interventions -Provide extended time to complete tasks (on need basis) 	<ul style="list-style-type: none"> -Rephrase questions, directions, and explanations -Allow extended time on assessments -Consult with Guidance Counselors and 504 Committees to come up with procedures/504 accommodations
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