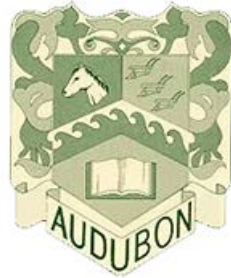# Audubon Public School District

Statistics

Curriculum Guide

Developed by:

Ms. Erica Wenzel

Mr. Adam Cramer

August 18, 2021

Table of Contents

Course Description

This course is designed to strengthen algebra skills while exploring practical applications of mathematics through the use of statistics and probability. The focus of this course will be topics such as algebra, statistics, data analysis, and probability, but will also use examples in research, everyday news, sports, demographics, and other areas of study in order to solve and analyze applications of mathematics. The four major topics of study in this course will be exploring data, collecting and sampling data, probability, and statistical inference (using hypothesis testing). This course is designed for students with strong algebra skills and who may be pursuing a college major in the field of nursing, business, exercise and sports science, psychology, criminal justice, or economics.

Overview / Progressions

Overview	Standards for Mathematical Content	Unit Focus	Standards for Mathematical Practice
Unit 1 **What is Statistics?**	● S.IC.A-1 ● S.IC.A-2 ● S.IC.B-3 ● S.IC.B-6	● Defining statistics as a science that collects, organizes, and analyzes data. Applications in the real world are endless as statistics are used in nearly any work environment in plain site or behind the scenes. ● Consistency on classifying data into different disjoint groups is essential for accuracy and progression in this course. ● How data is sampled, determines how much we trust the information: bias is sometimes inevitable but it can be reduced. ● Understanding the difference between factual raw data, and inference which is aided by the raw data is essential.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments & critique the reasoning. of others.
Unit 2 **Organization and Description of Data**		● As sample sizes increase the concept of putting a data set in order becomes necessary but nearly impossible to extract any information. The creation of a frequency distribution and graph following strict, consistent rules allows all parties to display and understand the	MP.4 Model with mathematics.

		same information in a condensed and organized manner. ● Simple internet searches, template creations, or intuitive thought allows students to create or use different ways of organizing data. ● As organized data can be misleading, and a picture can tell a thousand words… Those words are not always correct. By calculating means, standard deviations, and z-scores the data can be summarized and described more specifically. ● Calculations in this unit can be long and cumbersome. Though students must learn the method by hand it is important to show pre-loaded operations into spreadsheet programs and graphing calculators allow for easier and quick access to these values.	MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

| Unit 3 Probability and Counting | • S.CP.A.1-4
• S.CP.B.6-9
• S. MD.A.1-5
• S.MD.B.6-9 | • Probability has the ability to be both trivially simple and immensely complex. Classical probability rules coupled with multiplication, addition, conditional, and counting rules allow the probability of any event occurring to be calculable.
• The concept of order mattering and not mattering is fundamental in combinatorics. Differentiating between a permutation and combination and how to use them is essential in larger probability problems.
• Knowledge of the organization of a probability experiment so that all possible outcomes and the likelihood that each event occurs can be organized and summarized by calculating parameters such as mean and standard deviation.
• Comprehension of the binomial distribution and binomial experiments can facilitate expected value and probability of individual events. | |

Unit 4 **The Normal Distribution**	• S.ID.A.2 • S.ID.A.3 • S.ID.A.4	• Identify a normal distribution analytically, graphically, and numerically. Students will know the properties and features of a normal distribution. • Understand that the normal curve is a tool that allows us to extract probabilities of events occurring at above or below a specific z-score. Those probabilities represent a percent of the data which can then be used to find out how much of a population falls above, below, or within a certain data value(s)	
Unit 5 **Inferential Statistics**	S.IC.A.1-2 S.IC.B.3-6	• Confidence intervals allow for a specific range of values around a sample statistic that we expect to show up a specific percent of the time. These intervals allow students to identify whether a study collected an acceptable sample, or if a sample may have been biased or poorly selected. • In many fields of study and in the media people make bold statements without evidence. Hypothesis testing gives students the tools to determine whether data they are being presented has statistical support or not. • When dealing with any scatterplot of data it will be beneficial to have the tools to fit a curve to represent the	

Statistics Curriculum Guide

		average values along that scatter plot. Regression lines/curves allow us to fit the most appropriate match to these plots. ● The difference between causality and correlation is essential for students who want to consider themselves college ready. Students must recognize that not all correlating variables are actually causing changes in each other.	

Subject: Statistics	Grade: 12	Unit: 1 What is Statistics?	1st Marking Period
Content Standards	**Suggested Standards for Mathematical Practice**	**Critical Knowledge & Skills**	
● S.IC.A-1: Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	Concept(s): ● Demonstrate knowledge of statistical terms ● Differentiate between the two branches of statistics. ● Identify and organize types of data Students are able to: ● Describe the difference between the two major fields of statistics: descriptive and inferential ● Define common terms that appear in statistics. Learning Goal 1: Understand the difference between the two major fields of statistics and how they can be linked.	
● S.IC.A-2: Decide if a specified model is consistent with results from a given data-generating process,	MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically.	Concept(s): ● Identify the basic sampling techniques. ● Explain the difference between an observational and experimental study	

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*? ● S.IC.B.3: Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	Students are able to: ● Determine the best sampling technique for a study. ● State the difference between an observational and experimental study ● Explain how data can be ordered, counted or measured. ● State if a specified model is consistent with the results. Learning Goal 2: Organize sampling techniques and questioning options into different types of studies. Understand how data can be ordered, counted, or measured by understanding the different levels of measurement: nominal, ordinal, interval, ratio. Learn methods of collecting data properly by selecting samples when a population is very large.
● S.IC.B.6: Evaluate reports based on data.	MP.2 Reason abstractly and quantitatively. MP.7 Look for and make use of structure.	Concept(s): ● Explain how statistics can be used and misused ● Understand that there are tools to help evaluate data Students are able to: ● State how statistics can be used and misused.

		● List some of the tools that can be used to help evaluate data (graphing calculators, google sheets, Microsoft excel, and other internet/tech tools)
		Learning Goal 3: Awareness of the misuses of statistics that appear in the media, textbooks, and everyday conversations. Understand that graphing calculators, google sheets, Microsoft excel, and other internet/tech tools can aid and simplify tedious calculations in the course.

Formative Assessments	Summative Assessments
● Quick Writing ● Whiteboard work ● Mathematical Discourse Questions ● Exit tickets ● Checks for Understanding ● Quizzes ● Small group activities ● Desmos ● Homework ● Teacher's Observation	● Test ● Midterm ● Paper ● Project ● Common Assessment ● Post Unit Assessment ● Benchmark ● Standardized Testing
Suggested Primary Resources	**Suggested Supplemental Resources**
Exemplar tasks or illustrative models could be provided.	*District/school resources and supplementary resources that are texts as well as digital resources used to support the instruction.*

Statistics Curriculum Guide

Camden County College Statistics 1 and Introductory Statistics Curriculum Guide Bluman. Elementary Statistics: A Step by Step Approach 7th Ed. New York, NY: McGraw-Hill, 2009. Print.	AP Statistics from a Bag of M&M's: StatsMonkey, http://apstatsmonkey.com/StatsMonkey/m&m_Activities_files/Statmnms.pdf

Cross-Curricular Connections & 21st Century Skills

- Open ended math problems using language from ELA
- The math of physical science
- Surveys connected to science, history, and english to analyze and create problems

Essential Questions	Enduring Understanding
- What are some common terms used in the subject of statistics? - What are different types and classifications of data? - What is the difference between the two major branches of statistics? - What is a level of measurement for a variable? - What are the different ways that we can sample data and are any of these sampling techniques better or worse than others? - What are the major differences between observational, experimental, and quasi-experimental studies? - In what ways can statistics be misused? - How can technology such as spreadsheets, calculators, and the internet be helpful in statistics?	- Common terms that appear in statistics need to be defined early for consistency and understanding during everyday communication in statistics. - Establish differences between quantitative and qualitative variables and the difference between discrete and continuous variables. - Understand a difference between the two major fields of statistics: descriptive and inferential. - Understand how data can be ordered, counted, or measured by understanding the different levels of measurement: nominal, ordinal, interval, ratio. - Learn methods of collecting data properly by selecting samples when a population is very large. - Organize sampling techniques and questioning options into different types of studies based on variable manipulation or no variable manipulation.

	• Awareness of different misuses of statistics appear in the media, textbooks, everyday conversation is an important concept. Do not be a skeptic of everything but be aware. • Understand that graphing calculators, google sheets, Microsoft excel, and other internet/tech tools can aid and simplify tedious calculations in the course.

Differentiation & Real World Connections		
504	● preferential seating ● extended time on tests and assignments ● reduced homework or classwork ● verbal, visual, or technology aids	● modified textbooks or audio-video materials ● behavior management support ● adjusted class schedules or grading ● verbal testing
Enrichment	● Utilize collaborative media tools ● Provide differentiated feedback ● Opportunities for reflection ● Opportunities for self-evaluation	● Encourage student voice and input ● Model close reading ● Distinguish long term and short term goals
IEP	● Utilize "skeleton notes" where some required information is already filled in for the student ● Provide access to a variety of tools for responses ● Provide opportunities to build familiarity and to practice with multiple media tools ● Graphic organizers	● Leveled text and activities that adapt as students build skills ● Provide multiple means of action and expression ● Consider learning styles and interests ● Provide differentiated mentors

Statistics Curriculum Guide

ELLs	- Pre-teach new vocabulary and meaning of symbols - Embed glossaries or definitions - Provide translations - Connect new vocabulary to background knowledge	- Provide flash cards - Incorporate as many learning senses as possible - Portray structure, relationships, and associations through concept webs - Graphic organizers
At-risk	- Purposeful seating - Counselor involvement - Parent involvement	- Contracts - Alternate assessments - Hands-on learning

21st Century Skills

- Creativity - Innovation - Critical Thinking	- Problem Solving - Communication - Collaboration

Integrating Technology

- Chromebooks - Internet research - Online programs	- Virtual collaboration and projects - Presentations using presentation hardware and software

Career education

● Weekly Discussions: The value of mastering multiple languages in the workforce.	● Equity Discussions: People who benefit from knowing multiple languages.

Subject: Statistics	Grade: 12	Unit: 2 Organization and Description of Data	1st Marking Period
Content Standards	**Suggested Standards for Mathematical Practice**	**Critical Knowledge & Skills**	
● 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. ● S.IC.B.6: Evaluate reports based on data. ● S.IC.A.1: Understand statistics as a process for making inferences about population parameters based on a random	MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning	Concept(s): ● Calculate measure of central tendency, standard deviation, and variance ● Summarize and describe the data set based on calculations Students are able to: ● Calculate the measures of central tendency for a data set ● Calculate the standard deviation, variance, and range of a data set. ● Use the measure of central tendency to draw conclusions about the data. ● Use the standard deviation, variance, and range to describe the variation in the data set Learning Goal 1: Summarizing data using central tendency includes understanding of the mean, median, mode, and midrange. Describing a quality of variation in a data set	

		includes understanding measures of Variance, Standard Deviation, and Range
● 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.ID.A.2: Use statistics appropriate to the shape of data distribution to compare center and spread of two or more different data sets.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): ● A frequency distribution is the organization of raw data in table form, using classes and frequencies. ● Raw data can be placed in a class (a quantitative or qualitative category) Students are able to: ● Organize data using a frequency distribution. ● Draw conclusions about the data based on the frequency distribution. Learning Goal 2: Organizing data in order and contained groups allows for easier estimates, quicker calculations, and a more aesthetically pleasing presentation of raw data.

Formative Assessments	Summative Assessments
● Quick Writing ● Whiteboard work ● Mathematical Discourse Questions	● Test ● Midterm ● Paper

● Exit tickets ● Checks for Understanding ● Quizzes ● Small group activities ● Desmos ● Homework ● Teacher's Observation	● Project ● Common Assessment ● Post Unit Assessment ● Benchmark ● Standardized Testing
Suggested Primary Resources	**Suggested Supplemental Resources**
Exemplar tasks or illustrative models could be provided. Camden County College Statistics 1 and Introductory Statistics Curriculum Guide Bluman. Elementary Statistics: A Step by Step Approach 7th Ed. New York, NY: McGraw-Hill, 2009. Print.	*District/school resources and supplementary resources that are texts as well as digital resources used to support the instruction.* AP Statistics from a Bag of M&M's: StatsMonkey, http://apstatsmonkey.com/StatsMonkey/m&m_Activities_files/Statmnms.pdf

Cross-Curricular Connections & 21st Century Skills

- Open ended math problems using language from ELA
- The math of physical science
- Surveys connected to science, history, and english to analyze and create problems

Essential Questions	Enduring Understanding
● How is a frequency distribution the best, most organized, and most consistent form of data organizing when dealing with large sample sizes? ● Once a distribution is obtained what are beneficial and consistent ways to visually represent these data sets? ● What are some out of the box and data specific ways to organize and display data?	● Organizing data in order and contained groups allows for easier estimates, quicker calculations, and a more aesthetically pleasing presentation of raw data. ● For even more aesthetics for common application a chart or graph that is accurate and not misleading is more desired for presentation purposes. ● Students will recognize the different between normal data (symmetric) and skewed data types.

• Once data is organized, how can we use measures of central tendency, variation, and position to summarize our data set? • How can technology assist us in organizing data, creating charts/graphs and completing tedious calculations? • After a data set is summarized, what are the best ways we can then analyze our data sets?	• Other chart types include pie graphs, time-series charts, Pareto charts, and bar graphs. • Stem and leaf organization must also be consistent and accurate. Side by side data can be analyzed easily based on distribution shape of the plot. • Summarizing data using central tendency includes understanding of the mean, median, mode, and midrange. • Describing a quality of variation in a data set includes understanding measures of Variance, Standard Deviation, and Range • Location and position will be represented with values of Z-score, percentiles, deciles, and quartiles. • Data can be analyzed only by bring all summarizing and descriptive values together. Formation of boxplots displays the general idea of center, variation, and position all in one place. Educated conclusions can then be established.

Differentiation & Real World Connections

504	• preferential seating • extended time on tests and assignments • reduced homework or classwork • verbal, visual, or technology aids	• modified textbooks or audio-video materials • behavior management support • adjusted class schedules or grading • verbal testing
Enrichment	• Utilize collaborative media tools • Provide differentiated feedback • Opportunities for reflection • Opportunities for self-evaluation	• Encourage student voice and input • Model close reading • Distinguish long term and short term goals

Statistics Curriculum Guide

IEP	- Utilize "skeleton notes" where some required information is already filled in for the student - Provide access to a variety of tools for responses - Provide opportunities to build familiarity and to practice with multiple media tools - Graphic organizers	- Leveled text and activities that adapt as students build skills - Provide multiple means of action and expression - Consider learning styles and interests - Provide differentiated mentors
ELLs	- Pre-teach new vocabulary and meaning of symbols - Embed glossaries or definitions - Provide translations - Connect new vocabulary to background knowledge	- Provide flash cards - Incorporate as many learning senses as possible - Portray structure, relationships, and associations through concept webs - Graphic organizers
At-risk	- Purposeful seating - Counselor involvement - Parent involvement	- Contracts - Alternate assessments - Hands-on learning

21st Century Skills

- Creativity - Innovation - Critical Thinking	- Problem Solving - Communication - Collaboration

Integrating Technology

• Chromebooks • Internet research • Online programs	• Virtual collaboration and projects • Presentations using presentation hardware and software
Career education	
• Weekly Discussions: The value of mastering multiple languages in the workforce.	• Equity Discussions: People who benefit from knowing multiple languages.

Subject: Statistics	**Grade: 12**	**Unit: 3** Probability and Counting	**2nd Marking Period**
Content Standards	**Suggested Standards for Mathematical Practice**	**Critical Knowledge & Skills**	
• 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").	MP.1 Make sense of problems and persevere in solving them MP.2 Reason abstractly and quantitatively. MP.4 Model with	Concept(s): • Find subsets using unions, intersections and and/or statements • Fundamental counting rule is used to determine how many possible outcomes an event has • Independent events	

● 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. ● 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.*	mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	Students are able to: ● Apply different rules for and/or statements. ● Use the fundamental counting rule to determine how many possible outcomes an event has. ● Determine if two events are independent. Learning Goal 1: Understanding that typical methods in probability rules that all go back to the basic concept of desired events divided by total amount of possible events. Use different rules for and/or statements with addition and multiplication rules depending on independent and dependent events. Use the fundamental counting rule to determine how many possible outcomes an event has. Understand the difference between permutation and combination rules in order to choose how many different ways selected items can be arranged.

● 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*. ● 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. ● 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. ● 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.B.9:(+) Use permutations and combinations to compute probabilities of compound events and solve problems.	MP.1 Make sense of problems and persevere in solving them MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	Concept(s): ● Conditional Probability ● Apply the addition rule and multiplication rule to scenarios and interpret the results ● Evaluate permutations and combinations and identify when to use each one. Students are able to: ● Find the conditional probability of an event. ● Use the addition rule and interpret the answer in the context of the problem. ● Use the multiplication rule and interpret the answer in the context of the problem. ● Calculate permutations and combinations ● Explain the difference between permutations and combinations and when each would be used. Learning Goal 2: Understand the difference between permutation and combination rules in order to choose how many different ways selected items can be arranged. Classical probability rules coupled with multiplication, addition, conditional, and counting rules allow the probability of any event occurring to be calculable.

● 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. ● 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.A.4: (+) Develop a probability distribution for a	MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning	Concept(s): ● Expected value can be used to interpret the mean of a distribution ● Create probability distributions Students are able to: ● Define random variables ● Calculate the expected value ● Create a probability distribution for a given scenario where theoretical probabilities can be calculated or using empirical probability Learning Goal 3: Organizing probability experiments into distributions show how likely each event in an experiment occurs. Finding mean, standard deviations, and expected values of different probability experiments and binomial experiments.

Statistics Curriculum Guide

random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. *For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?*		
● S.MD.B.6:(+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). ● 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).	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): ● An experiment is considered fair if all outcomes are equally likely ● Use probabilities to make fair decisions Students are able to: ● Use probabilities to make fair decisions ● Determine if an experiment is fair or not ● Analyze decisions using probability Learning Goal 4: Determine if a situation is fair. Use probability concepts to analyze

Statistics Curriculum Guide

	decisions made.

Formative Assessments	Summative Assessments
- Quick Writing - Whiteboard work - Mathematical Discourse Questions - Exit tickets - Checks for Understanding - Quizzes - Small group activities - Desmos - Homework - Teacher's Observation	- Test - Midterm - Paper - Project - Common Assessment - Post Unit Assessment - Benchmark - Standardized Testing
Suggested Primary Resources	**Suggested Supplemental Resources**
Exemplar tasks or illustrative models could be provided. Camden County College Statistics 1 and Introductory Statistics Curriculum Guide Bluman. Elementary Statistics: A Step by Step Approach 7th Ed. New York, NY: McGraw-Hill, 2009. Print.	*District/school resources and supplementary resources that are texts as well as digital resources used to support the instruction.* AP Statistics from a Bag of M&M's: StatsMonkey, http://apstatsmonkey.com/StatsMonkey/m&m_Activities_files/Statmnms.pdf

Cross-Curricular Connections & 21st Century Skills
- Open ended math problems using language from ELA   - The math of physical science   - Surveys connected to science, history, and english to analyze and create problems

Essential Questions	Enduring Understanding
• How can classical probability be used to calculate the probability of an event occurring? • What are the addition and multiplication rules for compound probability? • What is conditional probability? • How can the fundamental counting rule determine the total number of outcomes in a sequence of events? • What is the difference between a permutation and a combination? • How can counting rules and probabilities rules be combined to find the probability of an event occurring? • What is a random variable and how can we create a probability distribution for a random variable? • Can we calculate parameters from Unit 2 for discrete random variables? • What is a Binomial experiment? • How can we calculate parameters of binomial distributions? • What are the other distribution types besides probability and binomial distributions?	• Understanding that typical methods in probability rules all go back to the basic concept of desired events divided by the total amount of possible events. • Use different rules for and/or statements with addition and multiplication rules depending on independent and dependent events. • Use the fundamental counting rule to determine how many possible outcomes an event has. • Understand the difference between permutation and combination rules in order to choose how many different ways selected items can be arranged. • Organizing probability experiments into distributions show how likely each event in an experiment occurs. • Finding mean, standard deviations, and expected values of different probability experiments and binomial experiments. • Determine other situations where non-standard, poisson, and hypergeometric distributions for probability events.

Differentiation & Real World Connections		
504	• preferential seating • extended time on tests and assignments • reduced homework or classwork • verbal, visual, or technology aids	• modified textbooks or audio-video materials • behavior management support • adjusted class schedules or grading • verbal testing

Enrichment	- Utilize collaborative media tools - Provide differentiated feedback - Opportunities for reflection - Opportunities for self-evaluation	- Encourage student voice and input - Model close reading - Distinguish long term and short term goals
IEP	- Utilize "skeleton notes" where some required information is already filled in for the student - Provide access to a variety of tools for responses - Provide opportunities to build familiarity and to practice with multiple media tools - Graphic organizers	- Leveled text and activities that adapt as students build skills - Provide multiple means of action and expression - Consider learning styles and interests - Provide differentiated mentors
ELLs	- Pre-teach new vocabulary and meaning of symbols - Embed glossaries or definitions - Provide translations - Connect new vocabulary to background knowledge	- Provide flash cards - Incorporate as many learning senses as possible - Portray structure, relationships, and associations through concept webs - Graphic organizers
At-risk	- Purposeful seating - Counselor involvement - Parent involvement	- Contracts - Alternate assessments - Hands-on learning
21st Century Skills		

● Creativity ● Innovation ● Critical Thinking	● Problem Solving ● Communication ● Collaboration
Integrating Technology	
● Chromebooks ● Internet research ● Online programs	● Virtual collaboration and projects ● Presentations using presentation hardware and software
Career education	
● Weekly Discussions: The value of mastering multiple languages in the workforce.	● Equity Discussions: People who benefit from knowing multiple languages.

| Subject: Statistics | Grade: 12 | Unit: 4

Normal Distribution | 3nd Marking Period |
|---|---|---|---|
| **Content Standards** | **Suggested Standards for Mathematical Practice** | **Critical Knowledge & Skills** | |
| ● 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). | MP.1 Make sense of problems and persevere in solving them

MP.2 Reason abstractly and quantitatively.

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning. | Concept(s):

● Understand that a normal distribution is a bell curve
● Visually see if a data set is skewed
● Analyze the data to see if it is skewed
Students are able to:

● Identify normal distributions.
● Classify data sets as skewed or normal based on the graph.
● Classify data sets as skewed or normal after analyzind the data.

Learning Goal 2: Understand that a normal distribution is a bell curve centered about the mean, symmetric, and unimodal. Understand how to visually see whether a data set is skewed, analyze the values to see whether they appear skewed and ultimately testing with a predictive index for skewness. | |

● 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.	MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning	Concept(s): ● Central limit theorem ● z-scores Students are able to: ● Use the central limit theorem to estimate population means ● Calculate the z-score of a normal curve ● Calculate the area/probability under a curve based on a specific z-score Learning Goal 3: Organizing probability experiments into distributions show how likely each event in an experiment occurs. Finding mean, standard deviations, and expected values of different probability experiments and binomial experiments.

Formative Assessments	**Summative Assessments**
● Quick Writing ● Whiteboard work	● Test ● Midterm

Statistics Curriculum Guide

- Mathematical Discourse Questions - Exit tickets - Checks for Understanding - Quizzes - Small group activities - Desmos - Homework - Teacher's Observation	- Paper - Project - Common Assessment - Post Unit Assessment - Benchmark - Standardized Testing
Suggested Primary Resources	**Suggested Supplemental Resources**
Exemplar tasks or illustrative models could be provided. Camden County College Statistics 1 and Introductory Statistics Curriculum Guide Bluman. Elementary Statistics: A Step by Step Approach 7th Ed. New York, NY: McGraw-Hill, 2009. Print.	*District/school resources and supplementary resources that are texts as well as digital resources used to support the instruction.* AP Statistics from a Bag of M&M's: StatsMonkey, http://apstatsmonkey.com/StatsMonkey/m&m_Activities_files/Statmnms.pdf

Cross-Curricular Connections & 21st Century Skills

- Open ended math problems using language from ELA
- The math of physical science
- Surveys connected to science, history, and english to analyze and create problems

Essential Questions	**Enduring Understanding**
- How can we determine whether a distribution is symmetric or skewed? - What are some properties of the normal distribution? - What is the area under a normal distribution? - How can we use the area under s normal distribution to find probability?	- Students will understand how to visually see whether a data set is skewed, analyze the values to see whether they appear skewed and ultimately testing with a predictive index for skewness. - Understand that a normal distribution is a bell curve centered about the mean, symmetric, and unimodal.

• How can we find specific data values based on percentages of derived from a standard normal distribution? • What is the central limit theorem? • How can we calculate continuous probabilities for a binomial variable?	• Students will also understand that the standard normal curve will be centered about a z-score of 0, and have an area under the curve equal to 1 or 100% • Using a table of values, calculated via integration, students can determine area/probability under a curve based on a specific z-score. • Students will use the central limit theorem in order to estimate population means based on collected sample means. (The mean of means)

Differentiation & Real World Connections		
504	• preferential seating • extended time on tests and assignments • reduced homework or classwork • verbal, visual, or technology aids	• modified textbooks or audio-video materials • behavior management support • adjusted class schedules or grading • verbal testing
Enrichment	• Utilize collaborative media tools • Provide differentiated feedback • Opportunities for reflection • Opportunities for self-evaluation	• Encourage student voice and input • Model close reading • Distinguish long term and short term goals
IEP	• Utilize "skeleton notes" where some required information is already filled in for the student • Provide access to a variety of tools for responses • Provide opportunities to build familiarity and to practice with multiple media tools • Graphic organizers	• Leveled text and activities that adapt as students build skills • Provide multiple means of action and expression • Consider learning styles and interests • Provide differentiated mentors

Statistics Curriculum Guide

ELLs	- Pre-teach new vocabulary and meaning of symbols - Embed glossaries or definitions - Provide translations - Connect new vocabulary to background knowledge	- Provide flash cards - Incorporate as many learning senses as possible - Portray structure, relationships, and associations through concept webs - Graphic organizers
At-risk	- Purposeful seating - Counselor involvement - Parent involvement	- Contracts - Alternate assessments - Hands-on learning

21st Century Skills

- Creativity - Innovation - Critical Thinking	- Problem Solving - Communication - Collaboration

Integrating Technology

- Chromebooks - Internet research - Online programs	- Virtual collaboration and projects - Presentations using presentation hardware and software

Career education

● Weekly Discussions: The value of mastering multiple languages in the workforce.	● Equity Discussions: People who benefit from knowing multiple languages.

Subject: Statistics	Grade: 12	Unit: 5 Inferential Statistics	4nd Marking Period
Content Standards	**Suggested Standards for Mathematical Practice**	**Critical Knowledge & Skills**	
- S.IC.A.1: Understand statistics as a process for making inferences about population parameters based on a random sample from that population. - 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?*	MP.1 Make sense of problems and persevere in solving them MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	Concept(s): - Use confidence intervals to accept or reject the null hypothesis - Correlation does not always imply causation Students are able to: - Accept or reject the hypothesis using confidence intervals. - Identify when correlation leads to causation and when it does not Learning Goal 1: Use confidence intervals in order to determine if our hypothesis falls within an acceptable range to reject or fail to reject (accept) our null hypothesis. Understand that the relationship of two variables (correlation) does not necessarily imply that one variable causes changes in the other (causation.) Identify a process for	

		properly identifying what a null and alternative hypothesis then use those values to test and throw away the null hypothesis.
● S.IC.B.3: Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. ● 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. ● S.IC.B.5: Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. ● S.IC.B.6: Evaluate reports based on data.	MP.1 Make sense of problems and persevere in solving them MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	Concept(s): ● Confidence intervals ● False negatives and false positives ● Understand when to use a Chi-Squared test ● Use correlation coefficients to fit a least squares regression line to a scatter plot. Students are able to: ● Identify a confidence interval, what it means, and how to read it. ● Define false negatives and false positives (Type I and Type II errors) and identify them in a given scenario. ● Use a chi-squared test and identify when a chi-squared test should be used ● Fit a least square regression line to a scatter plot using correlation coefficients. Learning Goal 2: Identify a confidence interval, what it means, and how to read it. Calculate the confidence interval for many different statistics in which some parameters are given and in other situations parameters

are not given. Calculate how large a sample must be in order to have a certain level of confidence. Understand the difference between false negatives and false positives (Type I and Type II errors).

Use hypothesis testing in order to compare the statistics of different data sets to compare means to means, proportions to proportions, Sdevs to Sdevs, etc.
Use correlation coefficients in order to fit a least squares regression line to a scatter plot. When necessary a regression curve such as a quadratic or cubic regression can be applied.

Formative Assessments	Summative Assessments
- Quick Writing - Whiteboard work - Mathematical Discourse Questions - Exit tickets - Checks for Understanding - Quizzes - Small group activities - Desmos - Homework - Teacher's Observation	- Test - Midterm - Paper - Project - Common Assessment - Post Unit Assessment - Benchmark - Standardized Testing
Suggested Primary Resources	**Suggested Supplemental Resources**

Exemplar tasks or illustrative models could be provided. Camden County College Statistics 1 and Introductory Statistics Curriculum Guide Bluman. Elementary Statistics: A Step by Step Approach 7th Ed. New York, NY: McGraw-Hill, 2009. Print.	*District/school resources and supplementary resources that are texts as well as digital resources used to support the instruction.* AP Statistics from a Bag of M&M's: StatsMonkey, http://apstatsmonkey.com/StatsMonkey/m&m_Activities_files/Statmnms.pdf

Cross-Curricular Connections & 21st Century Skills
- Open ended math problems using language from ELA   - The math of physical science   - Surveys connected to science, history, and english to analyze and create problems

Essential Questions	Enduring Understanding
- What is a confidence interval? - How can you find a confidence interval for mean, variance, standard deviation, and proportions? - What is the minimum sample size needed to have a certain confidence? - What is a hypothesis test? - Knowing the difference between using a z and t test? - Identify the null hypothesis, alternative hypothesis, and the critical values in a z test. - How can we use confidence intervals to test a hypothesis? - When will a chi-squared test be used to test a standard deviation? - What is the difference between a type I and type II error? - How can we test for differences in two parameters? - How can we create a scatter plot? - What is a correlation coefficient and how can we compute it?	- Identify a confidence interval, what it means, and how to read it. - Calculate the confidence interval for many different statistics in which some parameters are given and in other situations parameters are not given. - Calculate how large a sample must be in order to have a certain level of confidence. - Identify a process for properly identifying what a null and alternative hypothesis are and then use those values to test and throw away the null hypothesis. - Use confidence intervals in order to determine if our hypothesis falls within an acceptable range to reject or fail to reject(accept) our null hypothesis. - Understand that testing for variance or standard deviation requires us to use a Chi-Squared test on confidence. - Understand the difference between false negatives and false positives (Type I and Type II errors)

• How can we compute an equation for a regression line or curve? • What is the difference between correlation and causation?	• Use hypothesis testing in order to compare the statistics of different data sets to compare means to means, proportions to proportions, Sdevs to Sdevs, etc. • Use correlation coefficients in order to fit a least squares regression line to a scatter plot. When necessary a regression curve such as a quadratic or cubic regression can be applied. • Understand that the relationship of two variables (correlation) does not necessarily imply that one variable causes changes in the other (causation.)

Differentiation & Real World Connections		
504	• preferential seating • extended time on tests and assignments • reduced homework or classwork • verbal, visual, or technology aids	• modified textbooks or audio-video materials • behavior management support • adjusted class schedules or grading • verbal testing
Enrichment	• Utilize collaborative media tools • Provide differentiated feedback • Opportunities for reflection • Opportunities for self-evaluation	• Encourage student voice and input • Model close reading • Distinguish long term and short term goals

IEP	- Utilize "skeleton notes" where some required information is already filled in for the student - Provide access to a variety of tools for responses - Provide opportunities to build familiarity and to practice with multiple media tools - Graphic organizers	- Leveled text and activities that adapt as students build skills - Provide multiple means of action and expression - Consider learning styles and interests - Provide differentiated mentors
ELLs	- Pre-teach new vocabulary and meaning of symbols - Embed glossaries or definitions - Provide translations - Connect new vocabulary to background knowledge	- Provide flash cards - Incorporate as many learning senses as possible - Portray structure, relationships, and associations through concept webs - Graphic organizers
At-risk	- Purposeful seating - Counselor involvement - Parent involvement	- Contracts - Alternate assessments - Hands-on learning

21st Century Skills

- Creativity - Innovation - Critical Thinking	- Problem Solving - Communication - Collaboration

Integrating Technology

● Chromebooks ● Internet research ● Online programs	● Virtual collaboration and projects ● Presentations using presentation hardware and software
Career education	
● Weekly Discussions: The value of mastering multiple languages in the workforce.	● Equity Discussions: People who benefit from knowing multiple languages.

Appendix A

Course Title: Statistics   **Unit Name:** What is Statistics?   **Grade Level:** 12

Content Statements	NJSLS
Unit overview includes keeping students consistent and aware of what and how statistics can be used in everyday life. The concept of descriptive and inferential branches of statistics will show up a lot throughout the year. Though the unit is short, it is necessary for students to get in the correct mindset early in a school year on understand key terms and how statistics are used/misused. Recommended to begin course with this unit.	S.IC.A-1 S.IC.A-2 S.IC.B-3 S.IC.B-6
Overarching Essential Questions What is the definition of statistics and where is it used in the real world? How can we organize and collect data in a consistent and acceptable way? What are the proper ways of collecting samples of data and organizing the data into studies that have meaning in the real world? How can we link the two branches of statistics? How can raw data (Descriptive statistics) be understood and interpreted so that we can make educated conclusions and	**Overarching Enduring Understandings** Defining statistics as a science that collects, organizes, and analyzes data. Applications in the real endless as statistics are used in nearly and work environment in plain site or behind the scenes. Consistency on classifying data into different disjoint groups is essential for accuracy and progression in this course. How data is sampled, determines how much we trust the information: bias is sometimes inevitable but it can be reduced. Understanding the difference between factual raw data, and inference which is aided by the raw data is essential.

recommendations (Inferential Statistics) about what the data means?	
Unit Essential Questions What are some common terms used in the subject of statistics? What are different types and classifications of data? What is the difference between to the two major branches of statistics? What is a level of measurement for a variable? What are the different ways that we can sample data and are any of these sampling techniques better or worse than others? What are the major differences between observational, experimental, and quasi-experimental studies? In what ways can statistics be misused? How can technology such as spreadsheets, calculators, and the internet be helpful in statistics?	**Unit Enduring Understandings** Common terms that appear in statistics need to be defined early for consistency and understanding during everyday communication in statistics. Establish differences between quantitative and qualitative variables and the difference between discrete and continuous variables. Understand a difference between the two major fields of statistics: descriptive and inferential. Understand how data can be ordered, counted, or measured by understanding the different levels of measurement: nominal, ordinal, interval, ratio. Learn methods of collecting data properly by selecting samples when a population is very large. Organize sampling techniques and questioning options into different types of studies based on variable manipulation or no variable manipulation. Awareness of different misuses of statistics appear in the media, textbooks, everyday conversation is an important concept. Do not be a skeptic of everything but be aware. Understand that graphing calculators, google sheets, Microsoft excel, and other internet/tech tools can aid and simplify tedious calculations in the course.
Unit Rationale Statistics are found and used in every branch of every job, market, subject, and application in the real world. Understanding and collecting data is a necessity that can further our understanding of human behavior, hidden trends, correlation that relates two variables, and much more. The ability to collect, organize, and understand what the data is trying to tell us is the focus of a statistics class. This unit takes those fundamental principles and gives us a consistent framework that allows us to use the same terminology, understand best practices, and give us a road to	**Unit Overview** What is Statistics? Quantitative or Qualitative? Branches of Statistics Level of Measurement and Variable Type Sampling Methods Studies in Statistics Misuses of Statistics

| build on the more technical aspects of the course in future units.
Focus will entail classification of statistics, data, and ways of collecting that data. | |

Resources
Camden County College Statistics 1 and Introductory Statistics Curriculum Guide
AP Statistics from a Bag of M&M's: StatsMonkey, http://apstatsmonkey.com/StatsMonkey/m&m_Activities_files/Statmnms.pdf
TI Calculator and Software
Bluman. Elementary Statistics: A Step by Step Approach 7th Ed. New York, NY: McGraw-Hill, 2009. Print.
Google Sheets and/or Microsoft Excel
College Board AP Statistics Course Description

Key Terms
Statistics – the science of collecting, organizing, summarizing, analyzing, and drawing conclusions from data
Variable – A value or property that can assume different values
Descriptive Statistics – Collecting, organizing, and summarizing the data
Inferential Statistics – Making generalizations about a sample or population by making estimates, performing hypothesis tests, predicting, and implying relationships between one or more variables
Population – All the subjects that are being studied
Sample – A subgroup selected from a population
Qualitative – A variable that can be placed into a category based on a quality or attribute
Quantitative – A variable that assumes a numerical value and can be ordered or ranked
Discrete – Values that can be counted
Continuous – Can be an infinite number of values between any two specific values. Often obtained by measuring
Nominal – Level of measurement in which data is classified into non-overlapping groups that have no order or ranking
Ordinal – Level of measurement in which data is classified into categories that can be ordered or ranked
Interval – Level of measurement in which data is classified into ranks but no meaningful zero exists
Ratio – Level of measurement in which all the features of interval exists but a meaningful zero exists
Random – Sampling technique where subjects are chosen by random number assignment
Systematic – Sampling where subjects are chosen by every kth subject

Stratified – Sampling where subjects are divided into groups then subjects are evenly chosen at random from each group

Cluster – Sampling where subjects are divided into groups and all of one or more groups is selected.

Convenience – Sampling in which subjects are selected from a pre-existing group

Bias - prejudice in favor of or against one thing, person, or group compared with another, usually in a way considered to be unfair.

Observational – Study in which researcher observes what is or has happened to draw conclusions

Experimental – Study in which researcher intervention allows for manipulation of one variable to observe effects on the other variable

Quasi-Experimental – Experimental study where convenience sampling took place

Confounding Variable – Any influence of a dependent variable that has not been separated from an independent variable.

Non-Essential terminology: Hawthorn Effect, Placebo Effect, Control group, Treatment group, Detached statistics, Ambiguous averages, Independent variable, Explanatory variable, Dependent variable, Outcome variable, Survey, Hypothesis testing, Probability, Data, Random variables

Audubon Public Schools

Engaging Students ~ Fostering Achievement ~ Cultivating 21st Century Global Skills
Written By: Adam Cramer

Course Title: Statistics   **Unit Name:** Organization and Description of Data   **Grade Level:** 12

Content Statements	NJSLS
In this unit, students will be taught organize data in consistent matter. They will create charts, graphs, and tables in order to extract important information to summarize data sets. The organized students will use measures of center, spread, and location to determine more out about a data set, or a single value relative to the entire data set.	S.ID.A.1 S.ID.A.2 S.ID.A.3 S.ID.A.4 S.ID.B.5 S.ID.B.6

Overarching Essential Questions	Overarching Enduring Understandings
How is a frequency distribution the best, most organized, and most consistent form of data organizing when dealing with large sample sizes? Once a distribution is obtained what are beneficial and consistent ways to visually represent these data sets? What are some out of the box and data specific ways to organize and display data? Once data is organized, how can we use measures of central tendency, variation, and position to summarize our data set? How can technology assist us in organizing data, creating charts/graphs and completing tedious calculations? After a data set is summarized, what are the best ways we can then analyze our data sets?	As sample sizes increase the concept of putting a data set in order becomes necessary but nearly impossible to extract any information. The creation of a frequency distribution and graph follow strict, consistent rules allows all parties to display and understand the same information in a condensed and organized manner. Simple internet searches, template creations, or intuitive thought allows students to create or use different ways of organizing data. As organized data can be misleading, and a picture can tell a thousand words… those words are not always correct. By calculating means, standard deviations, and z-scores the data can be summarized and described more specifically. Calculations in this unit can be long and cumbersome. Though student must learn the method by hand it is important to show pre-loaded operations into spreadsheet programs and graphing calculators allow for easier and quick access to these values.

Statistics Curriculum Guide

Unit Essential Questions	Unit Enduring Understandings
How can data be organized into a frequency distribution?	Organizing data in order and contained groups allows for easier estimates, quicker calculations, and a more aesthetically pleasing presentation of raw data.
How can frequency distributions be organized into histograms, polygons, and ogives?	For even more aesthetics for common application a chart or graph that is accurate and not misleading is more desired for presentation purposes.
What are the most common distribution shapes?	Students will recognize the different between normal data (symmetric) and skewed data types.
What are other forms of graphs that can be used to represent data not in a frequency distribution?	Other chart types include pie graphs, time-series charts, Pareto charts, and bar graphs.
What is a Stem-and-Leaf plot and how is it used to organize data?	Stem and leaf organization must also be consistent and accurate. Side by side data can be analyzed easily based on distribution shape of the plot.
How can data be summarized using measures of central tendency?	Summarizing data using central tendency includes understanding of the mean, median, mode, and midrange.
How can data be described by using measures of variation?	Describing a quality of variation in a data set includes understanding measures of Variance, Standard Deviation, and Range
How can data be represented by its measure of position relative to the data set?	Location and position will be represented with values of Z-score, percentiles, deciles, and quartiles.
How can a box-plot help summarize and generalize a data set?	Data can be analyzed only by bring all summarizing and descriptive values together.
What are some techniques for exploratory data analysis?	Formation of boxplots displays the general idea of center, variation, and position all in one place. Educated conclusions can then be established.

Unit Rationale	Unit Overview
As data can be found everywhere, it is important for students to understand that they can never look directly into one data value. They need to see the big picture or what the data of time is telling us, or how can I select a single parameter that best represents an entire data set. There are two major topics in study, Organization of data sets and Description of data sets. I recommend separating into two separate chapters in order for students to first appreciate the consistency necessary in collecting, organizing, and understanding charts/graphs,	Frequency Distributions Graphs of Frequency Distributions Pareto Charts, Pie Graphs, and Time-Series Charts Distribution Shapes Technology to Create Graphs Summarizing Data (Central Tendency) Describing Data (Variation) Locating Data (Position) Exploring/Analyzing Data

and a second chapter on calculating the values of central tendency, variation, and position in order to describe the data set. Students must also see, with each addition of a new parameter they are given to the ability to compare multiple data sets that do not seem to be comparable in the first place.	

Resources
Camden County College Statistics 1 and Introductory Statistics Curriculum Guide
AP Statistics from a Bag of M&M's: StatsMonkey, http://apstatsmonkey.com/StatsMonkey/m&m_Activities_files/Statmnms.pdf
TI Calculator and Software
Bluman. Elementary Statistics: A Step by Step Approach 7th Ed. New York, NY: McGraw-Hill, 2009. Print.
Google Sheets and/or Microsoft Excel
College Board AP Statistics Course Description

Key Terms
Frequency Distribution – Organization of raw data into a table form
Frequency – Number of data values within a class
Class – A category that a data value is assigned
Categorical – Frequency distribution in which data is nominal or ordinal
Grouped – Continuous frequency distribution where classes have distinct boundaries
Class Midpoint – Middle of a class
Cumulative Frequency – A frequency that totals up to and including that value
Histogram – A vertical bar graph that plots frequency on against a continuous independent variable
Frequency Polygon – A line graph that plots frequency against class midpoints
Ogive – A line graph that plots cumulative frequency against class midpoints (cumulative frequency polygon)
Pareto Chart – Bar graph that represents data in order from highest to lowest
Time-Series – Line graph that plots one or more dependent variable against time
Statistic(singular) – A characteristic or measurement taken from a sample
Parameter – A characteristic or measurement taken from an entire population
Mean – Average value
Median – Middle value

Mode – Most often occurring value
Midrange – Middle of the highest and lowest values
Normal Curve – distribution shape that peaks in the middle, is unimodal, and symmetric. (Bell)
Skewed Curve – Distribution shape that peaks to left or right of the middle and often contains an outlier
Variance – The average distance squared each value is from the mean
Standard Deviation – SQRT of variance, the average distance each value is from the means
Coefficient of Variation – Method of comparing standard deviations when units are different
Chebyshev's Theorem – Crude estimate for the amount of data with-in a specified range of the mean
Empirical Rule – More accurate estimate of Chebyshev's Theorem, but only for normal distributions
Z-Score – Number of standard deviations a value is from the mean
Quart/Deci/Percent(iles) – Divides the data set into 4/10/100 groups
Outlier – Data value that is extremely high or low when compared with the rest of the data
Non-Essential terminology: Raw data, Class boundaries, Class limit, Class width, Bar Graph, Pie Chart, Stem-and-Leaf chart, Relative frequency, Bimodal, Multimodal, Modal class, Weighted mean, Boxplot

Engaging Students ~ Fostering Achievement ~ Cultivating 21st Century Global Skills
Written By: Adam Cramer

Course Title: Statistics   **Unit Name:** Probability and Counting   **Grade Level:** 12

Content Statements	NJSLS
In this unit students will learn rules and tools that allow them to count how many possible situations exist as well as what the probability of specific events occurring is. Students will have the ability to then create probability experiments in which they can calculate the probability of all individual events occurring. The unit culminates in us being able to generalize specific probability experiments that follow definitive rules to calculate the most common probability events.	S.CP.A.1-4 S.CP.B.6-9 S. MD.A.1-5 S.MD.B.6-9

Overarching Essential Questions	Overarching Enduring Understandings
How can the probability of any event occurring in any sample space be calculated? What are the different types of rules and situations for probability and how do we determine which rules apply to each situation? How can counting rules be applied to determine the size of sample spaces and ultimately help calculate probabilities? When dealing with a changing variable, what are ways that we can organize and summarize the properties of specific probability events? How can we determine all possible outcomes in a probability experiment and the likelihood that they occur?	Probability has the ability to be both trivially simple and immensely complex. Classical probability rules coupled with multiplication, addition, conditional, and counting rules allow the probability of any event occurring to be calculable. The concept of order mattering and not mattering is fundamental in combinatorics. Differentiating between a permutation and combination and how to use them is essential in larger probability problems. Knowledge of the organization of a probability experiment so that all possible outcomes and the likelihood that each event occurs can be organized and summarized by calculating parameters such as mean and standard deviation. Comprehension of the binomial distribution and binomial experiments can facilitate expected value and probability of individual events.

In experiments in which each individual trial has only two possible outcomes how can we determine the likelihood that an event occurs? All probability situations do not behave with only two possible outcomes, so what are our other distribution options for these situations?	
Unit Essential Questions How can classical probability be used to calculate the probability of an event occurring? What are the addition and multiplication rules for compound probability? What is conditional probability? How can the fundamental counting rule determine the total number of outcomes in a sequence of events? What is the difference between a permutation and a combination? How can counting rules and probabilities rules be combined to find the probability of an event occurring? What is a random variable and how can we create a probability distribution for a random variable? Can we calculate parameters from Unit 2 for discrete random variables? What is a Binomial experiment? How can we calculate parameters of binomial distributions? What are the other distribution types besides probability and binomial distributions?	**Unit Enduring Understandings** Understanding that typical methods in probability rules that all go back to the basic concept of desired events divided by total amount of possible events. Use different rules for and/or statements with addition and multiplication rules depending on independent and dependent events. Use the fundamental counting rule to determine how many possible outcomes an event has. Understand the difference between permutation and combination rules in order to choose how many different ways selected items can be arranged. Organizing probability experiments into distributions show how likely each event in an experiment occurs. Finding mean, standard deviations, and expected values of different probability experiments and binomial experiments. Determine other situations where non-standard, poisson, and hypergeometric distributions for probability events.
Unit Rationale In order to understand the most important continuous probability distribution (the normal distribution) students should delve into the discrete. This unit allows students to learn basic probability, followed by more complicated probability, and finally organizing discrete probability distributions	**Unit Overview** Sample Spaces and Classical Probability Addition and Multiplication rules of Probability Conditional Probability Combinatorics and Counting Rules Complex Probability Probability Distributions

to represent all outcomes. Once students work with the discrete and can organize finite solution with countable solutions they can jump into the next unit that focuses on continuous distributions.	Parameters of Probability Distributions Binomial Distributions Special Probability Distributions

Resources
Camden County College Statistics 1 and Introductory Statistics Curriculum Guide
AP Statistics from a Bag of M&M's: StatsMonkey, http://apstatsmonkey.com/StatsMonkey/m&m_Activities_files/Statmnms.pdf
TI Calculator and Software
Bluman. Elementary Statistics: A Step by Step Approach 7th Ed. New York, NY: McGraw-Hill, 2009. Print.
Google Sheets and/or Microsoft Excel
College Board AP Statistics Course Description

Key Terms
Probability Experiment - The likelihood of well-defined outcomes occurring during a specific event
Sample Space - The set of all possible outcomes in a probability experiment
Event - Set of outcomes of a probability experiment
Complement - The set of outcomes that are not included in a well defined event
Law of Large Numbers - Experimental probability will approach a theoretical probability as more trials are completed
Mutual Exclusivity - If two events cannot occur at the same time
Independent Events - If one event does not affect the probability of the second event occurring
Dependent Events - If a first event causes the the probability of the second event to change
Fundamental Counting Rule - Mathematically defined as multiplication of individual events
Permutation - An arrangement of 'n' objects in a specific order
Combination - A selection of distinct objects in which order does not matter
Random Variable - A variable whose values change based on chance
Discrete Probability Distribution - Theoretical or experiment display of random variables and the probability that each variable occurs
Expected Value - The theoretical average value for a random variable
Binomial Distribution - Specific distributions for a probability experiment in which each event has only two possible outcomes.
Poisson Distribution - Specific distribution for a probability experiment in which there are a lot of trials the likely of a success is small and the experiment occurred over time.
Hypergeometric Distribution - Specific distribution in which two outcomes exists but the probability is conditional because the sample is created without replacement

Non-Essential Terminology - Outcome, Tree diagram, Compound event, Venn Diagram, Factorial, Multinomial distribution

Audubon Public Schools

Engaging Students ~ Fostering Achievement ~ Cultivating 21st Century Global Skills
Written By: Adam Cramer

Course Title: Statistics   **Unit Name: The Normal Distribution**   **Grade Level:** 12

Content Statements	NJSLS
This is the shortest and most important unit in this course. Students will look into the most common continuous distribution in real world applications. Most large samples of collected data turns out to have unimodal and symmetric properties (bell curve) or can be standardized into a normal distribution. Behind the scenes Integrating a standard normal curve creates a table of z-score and probabilities that are directly related to events occurring within a certain amount of standard deviations of the mean.	S.ID.A.2 S.ID.A.3 S.ID.A.4
Overarching Essential Questions Students will be able to identify any data set as normal or not normal and understand the properties of this normal curve. How can we use the standard normal curve to calculate general probabilities for any normal data set? How can we use the normal curve to determine specific data values that are above or below or within a certain percentage of the data?	**Overarching Enduring Understandings** Identify a normal distribution analytically, graphically, and numerically. Students will know the properties and features of a normal distribution. Understand that the normal curve is a tool that allows us to extract probabilities of events occurring at above or below a specific z-score. Those probabilities represent a percent of the data which can then be used to find out how much of a population falls above, below, or within a certain data value(s).

Statistics Curriculum Guide

Unit Essential Questions	Unit Enduring Understandings
How can we determine whether a distribution is symmetric or skewed?	Students will understand how to visually see whether a data set is skewed, analyze the values to see whether they appear skewed and ultimately testing with a predictive index for skewness.
What are some properties of the normal distribution?	Understand that a normal distribution is a bell curve centered about the mean, symmetric, and unimodal.
What is the area under a normal distribution?	Students will also understand that the standard normal curve will be centered about a z-score of 0, and have an area under the curve equal to 1 or 100%
How can we use the area under s normal distribution to find probability?	Using a table of values, calculated via integration, students can determine area/probability under a curve based on a specific z-score.
How can we find specific data values based on percentages of derived from a standard normal distribution?	Students will use the central limit theorem in order to estimate population means based on collected sample means. (The mean of means)
What is the central limit theorem?	
How can we calculate continuous probabilities for a binomial variable?	

Unit Rationale	Unit Overview
The unit allows students to get a taste of what a college statistics class will entail. Notes, formulas, definitions, and then get hit with a large table of values. The z-score to probability table for the standard normal curve is overwhelming at first, but easy and straight forward to read and extract data. The table will be used for the duration of the year along with the introduction to other key distributions as the course continues. It is also important that students understand the features of a normal curve, as most data can be standardized to fit that curve.	The Normal Distribution Applications of the Normal Distribution The Central Limit Theorem Using the Normal Distribution to Approximate in a Binomial Distribution

Resources
Camden County College Statistics 1 and Introductory Statistics Curriculum Guide
AP Statistics from a Bag of M&M's: StatsMonkey, http://apstatsmonkey.com/StatsMonkey/m&m_Activities_files/Statmnms.pdf
TI Calculator and Software

Bluman. Elementary Statistics: A Step by Step Approach 7th Ed. New York, NY: McGraw-Hill, 2009. Print.
Google Sheets and/or Microsoft Excel
College Board AP Statistics Course Description

Key Terms
Normal Distribution - A continuous, symmetric, bell-shaped distribution of a variable.
Standard Normal Distribution - A normal distribution whose mean is 0 and each standard deviation is 1
Unusual - Value that is more than 2 standard deviations away from the mean
Predictive Index - Numerical value comparing the mean and median in order to determine skewness
Sampling Error - The percent difference found between a sample mean and the known population mean
Central Limit Theorem
Mean of Means - Process used to find a population mean by finding the average of sample means

Engaging Students ~ Fostering Achievement ~ Cultivating 21st Century Global Skills
Written By: Adam Cramer

Course Title: Statistics   **Unit Name:** Inferential Statistics   **Grade Level:** 12

Content Statements	NJSLS
This unit will focus on how we can use descriptive statistics and parameters in order to make educated and informed statements conclusions regarding the sata. Students will use confidence intervals, 't' and chi square tests, and hypothesis testing to make inferences in order to dismiss or accept data.	S.IC.A.1-2 S.IC.B.3-6

Overarching Essential Questions	Overarching Enduring Understandings
What are confidence intervals and how can we use them to find an acceptable range of data values? What is a hypothesis and how can we use it to make an inference to support and argument regarding real world data? How can statistical tests allow for the comparison of multiple measurements within different data sets? How can statistical tests allow for the fitting of a curve or line on a scatter plot of data? What evidence can we find to determine whether two variables correlate with each and whether a change in one variable is <u>causing</u> a change in another variable.	Confidence intervals allow for a specific range of values around a sample statistic that we expect to show up a specific percent of the time. These intervals allow students to identify whether a study collected an acceptable sample, or if a sample may have been biased or poorly selected. In many fields of study and in the media people make bold statements without evidence. Hypothesis testing gives students the tools to determine whether data they are being presented has statistical support or not. When dealing with any scatterplot of data it will be beneficial to have the tools to fit a curve to represent the average values along that scatter plot. Regression lines/curves allow us to fit the most appropriate match to these plots. The difference between causality and correlation is essential for students who want to consider themselves college ready. Students must recognize that not all correlating variables are actually causing changes in each other.

Statistics Curriculum Guide

Unit Essential Questions	Unit Enduring Understandings
What is a confidence interval?	Identify a confidence interval, what it means, and how to read it.
How can you find a confidence interval for mean, variance, standard deviation, and proportions?	Calculate the confidence interval for many different statistics in which some parameters are given and in other situations parameters are not given.
What is the minimum sample size needed to have a certain confidence?	Calculate how large a sample must be in order to have certain level of confidence.
What is a hypothesis test?	Identify a process for properly identifying what a null and alternative hypothesis then use those values to test and throw away the null hypothesis.
Knowing the difference between using a z and t test?	Use confidence intervals in order to determine if our hypothesis falls within an acceptable range to reject or fail to reject(accept) our null hypothesis.
Identify the null hypothesis, alternative hypothesis, and the critical values in a z test.	Understand that testing for variance or standard deviation requires us to use a Chi-Squared test on confidence.
How can we use confidence intervals to test a hypothesis?	Understand the difference between false negatives and false positives (Type I and Type II errors)
When will a chi-squared test be used to test a standard deviation?	Use hypothesis testing in order to compare the statistics of different data sets to compare means to means, proportions to proportions, Sdevs to Sdevs, etc.
What is the difference between a type I and type II error?	Use correlation coefficients in order to fit a least squares regression line to a scatter plot.
How can we test for differences in two parameters?	When necessary a regression curve such as a quadratic or cubic regression can be applied.
How can we create a scatter plot?	Understand that the relationship of two variables (correlation) does not necessarily imply that one variable causes changes in the other (causation.)
What is a correlation coefficient and how can we compute it?	
How can we compute an equation for a regression line or curve?	
What is the difference between correlation and causation?	

Statistics Curriculum Guide

Unit Rationale	Unit Overview
This unit is the first step back away from raw mathematical calculations since the start of the class. Though the numbers that we calculate in this section give us concrete answers, those answers are still subject to interpretation, explanation, and argument. The inferential statistics units take opinions and allows us to provide concrete statistical evidence. This unit will use many different numbers to allow students to argue their points of few and find whether statistical evidence exists to support their claims.	Confidence Intervals when Parameters are Known. Confidence Intervals when Parameters are Unknown Confidence Intervals of Sample Size Confidence Intervals for Standard Deviations Traditional Hypothesis Testing Z and T Tests for a Mean Chi-Squared Tests Testing between Multiple Statistics Standard Error Scatter Plots and Correlation Regression

Resources
Camden County College Statistics 1 and Introductory Statistics Curriculum Guide
AP Statistics from a Bag of M&M's: StatsMonkey, http://apstatsmonkey.com/StatsMonkey/m&m_Activities_files/Statmnms.pdf
TI Calculator and Software
Bluman. Elementary Statistics: A Step by Step Approach 7th Ed. New York, NY: McGraw-Hill, 2009. Print.
Google Sheets and/or Microsoft Excel
College Board AP Statistics Course Description

Key Terms
Point Estimate - Any numerical value estimate of a parameter, typically a sample statistic
Confidence Level - The probability that the interval estimate will contain the actual population parameter
Confidence Interval - A specific interval estimate of a parameter based on a selected confidence level
t-distribution - A distribution used to identify a corrected z-score based on not knowing a population standard deviation.
Degree of Freedom - The number of values that a free to vary after a sample statistic has been selected
Chi-Squared Distribution - Used to determine estimates of variance and standard deviation parameters
Hypothesis - A conjecture about a population parameter regardless of its truth
Null Hypothesis - Typically will state that there is no difference between a value and the actual parameter
Alternative Hypothesis - Typically will state that there is a difference between a value and the actual parameter
Test Value - Numerical value that is obtained from a statistical test
Type I Error - When the null hypothesis is rejected even when it was true

Type II Error - When you do not reject a false null hypothesis
Significance Level - Maximum probability of committing a type 1 error
Critical Value - Value that separates the rejection region from the non-rejection region
z-test - Statistical test to determine the mean of a population
t-test - Statistical test to determine the mean of a population when the standard deviation is unknown
Correlation - Used to determine whether a relationship between two variables exists
Regression - Determines the nature of the relationship between two variables

Appendix

Differentiation	
Enrichment	- Utilize collaborative media tools - Provide differentiated feedback - Opportunities for reflection - Encourage student voice and input - Model close reading - Distinguish long term and short term goals

Intervention & Modification	- Utilize "skeleton notes" where some required information is already filled in for the student - Provide access to a variety of tools for responses - Provide opportunities to build familiarity and to practice with multiple media tools - Leveled text and activities that adapt as students build skills - Provide multiple means of action and expression - Consider learning styles and interests - Provide differentiated mentors - Graphic organizers
ELLs	- Pre-teach new vocabulary and meaning of symbols - Embed glossaries or definitions - Provide translations - Connect new vocabulary to background knowledge - Provide flash cards - Incorporate as many learning senses as possible - Portray structure, relationships, and associations through concept webs - Graphic organizers

21st Century Skills

- Creativity
- Innovation
- Critical Thinking
- Problem Solving
- Communication
- Collaboration

Integrating Technology
- Chromebooks   - Internet research   - Online programs   - Virtual collaboration and projects   - Presentations using presentation hardware and software