Unit 1: Exploring One-Variable Data

Content Area: **Math**
Course(s): **Generic Course, MATH ANALYSIS**
Time Period: **Marking Period 1**
Length: **7 weeks**
Status: **Published**

Standards

Math Standards

MA.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
MA.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.
MA.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).
MA.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.

Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Transfer Goals and Career Ready Practices

Transfer Goals

Concepts

Essential Questions

- How is the normal model used?
- What are categorical variables?
- What are quantitative variables?
- What are z-scores and how are they used?
- What is Statistics?

Understandings

- We treat variables in two basic ways: as categorical or quantitative
- We've learned that data are information in context
- We've seen that histograms or stem and leaf plots can compare two distributions well, if drawn on the same scale. Boxplots are more effective for comparing several groups
- When we want to see how two categorical variables are related, we put the counts in a contingency table

Critical Knowledge and Skills

Knowledge

Students will know:

- Given sets of data find the measures of center, shape, and spread and be able to determine the impact potential outliers have on these measures
- Students will be able to display and describe categorical and quantitative variables
- Students will become comfortable working with the Normal model

Skills

Students will be able to:

- Be able to use the Normal model and the 68-95-99.7 rule to estimate the percentage that fall within 1,2, and 3 standard deviations of the mean
- Define z-scores; Calculate z-scores using the formula; Use z-scores to compare data across different distributions; Use z-scores to determine if a data point is "unusual"
- Determine what happens to measures of center and spread when data is shifted and scaled
- Identify categorical variables and create appropriate displays
- Identify quantitative variables and create appropriate displays
- Solve word problems using knowledge of z-scores and percentages

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

Homework through Pearson online component - Ch 1,2,3,4,5

Sample free response and multiple choice questions from previous AP exams

Class examples

School Summative Assessment Plan

Tests and quizzes through Pearson online component - Ch 1,2,3,4,5

Primary Resources

- AP Statistics: Stats Modeling the World, 4th Edition, Bock, Velleman, DeVeaux

Supplementary Resources

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- AP Classroom

- Skew the Script
- Stats Medic

Technology Integration and Differentiated Instruction

Technology Integration

● **Google Products**

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● **One to One Student's laptop**

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● **Additional Support Videos**

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

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❑ Within each lesson, the English Language Learners are given choice of topic and resources so that their materials are within their ability to grasp the language.

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Learning Plan / Pacing Guide

7 Weeks

Week 1 - Categorical and Quantitative Variables

Week 2 - Shape, center and spread of date

Week 3 - z-scores

Week 4 - Normal Model

Week 5 - Normal Model

Week 6 - z-scores with technology

Week 7 - Review and Unit Assessment

Unit 2 : Exploring Two-Variable Data

Content Area:	**Math**
Course(s):	**Generic Course, MATH ANALYSIS**
Time Period:	**Marking Period 1**
Length:	**4 weeks**
Status:	**Published**

Standards

Math Standards

MA.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.
MA.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
MA.S-ID.B.6a	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.
MA.S-ID.B.6b	Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.
MA.S-ID.B.6c	Fit a linear function for a scatter plot that suggests a linear association.
MA.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.
MA.S-ID.C.8	Compute (using technology) and interpret the correlation coefficient of a linear fit.
MA.S-ID.C.9	Distinguish between correlation and causation.

Mathematical Practices

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Transfer Goals and Career Ready Practices

Transfer Goals

Concepts

Essential Questions

- Does correlation mean causation?
- What are explanatory and response variables?
- What is a residual and how it it helpful?
- What is the correlation coefficient and what is it used for?

Understandings

- Scatterplots display patterns, trends, and relationships between two quantitative variables
- Correlation is a measure of direction and strength of the linear association between two quantitative variables
- Correlation does not mean causation
- Through technology, the equation of the least squares regression line (LSRL) can be created and used to interpolate and extrapolate

Critical Knowledge and Skills

Knowledge

Students will know:

- Given the averages, standard deviations, and correlation coefficient for two quantitative variables, write the equation of the LSRL
- Know facts about the correlation coefficient
- Students will be able to explore the relationships between two quantitative variables

Skills

Students will be able to:

- Create a scatter plot and determine the equation of the LSRL using technology
- Define correlation coefficient
- Define explanatory and response variables
- Define residual and use the formula to calculate residuals

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

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Learning Plan / Pacing Guide

4 Weeks

Week 1: Explanatory and Response Variables

Week 2: Scatter plots

Week 3: Residuals and Correlation Coefficient

Week 4: **Linear Regression Project**

Unit 3: Collecting Data

Content Area:	**Math**
Course(s):	**Generic Course, MATH ANALYSIS**
Time Period:	**Marking Period 2**
Length:	**5 weeks**
Status:	**Published**

Standards

Math Standards

MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
MA.S-IC.A.2	Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.
MA.S-IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
MA.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.
MA.S-IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
MA.S-IC.B.6	Evaluate reports based on data.

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Transfer Goals and Career Ready Practices

Transfer Goals

Concepts

Essential Questions

- How can you tell if a survey is biased?
- How is blocking used in a experiment?
- What are the components of a well designed experiment?
- What are the different observational studies?
- What are the different survey models?
- What does it mean to be random?
- What is a control group?
- What is a placebo treatment?

Understandings

- Given that variation may be random or not, conclusions are uncertain
- The way we collect data influences what we can and cannot say about a population.
- Well-designed experiments can establish evidence of causal relationships.

Critical Knowledge and Skills

Knowledge

Students will know:

- A census selects all items/subjects in a population.
- A cluster sample involves the division of a population into smaller groups, called clusters. Ideally, there is heterogeneity within each cluster, and clusters are similar to one another in their composition. A simple random sample of clusters is selected from the population to form the sample of clusters. Data are collected from all observations in the selected clusters.
- A confounding variable in an experiment is a variable that is related to the explanatory variable and

influences the response variable and may create a false perception of association between the two

- A control group is a collection of experimental units either not given a treatment of interest or given a treatment with an inactive substance (placebo) in order to determine if the treatment of interest has an effect.

- A matched pairs design is a special case of a randomized block design. Using a blocking variable, subjects (whether they are people or not) are arranged in pairs matched on relevant factors. Matched pairs may be formed naturally or by the experimenter. Every pair receives both treatments by randomly assigning one treatment to one member of the pair and subsequently assigning the remaining treatment to the second member of the pair. Alternately, each subject may get both treatments.

- A population consists of all items or subjects of interest.

- A response variable in an experiment is an outcome from the experimental units that is measured after the treatments have been administered.

- A sample is only generalizable to the population from which the sample was selected.

- A simple random sample (SRS) is a sample in which every group of a given size has an equal chance of being chosen. This method is the basis for many types of sampling mechanisms. A few examples of mechanisms used to obtain SRSs include numbering individuals and using a random number generator to select which ones to include in the sample, ignoring repeats, using a table of random numbers, or drawing a card from a deck without replacement.

- A stratified random sample involves the division of a population into separate groups, called strata, based on shared attributes or characteristics (homogeneous grouping). Within each stratum a simple random sample is selected, and the selected units are combined to form the sample.

- A systematic random sample is a method in which sample members from a population are selected according to a random starting point and a fixed, periodic interval.

- A well-designed experiment should include the following: a. Comparisons of at least two treatment groups, one of which could be a control group. b. Random assignment/allocation of treatments to experimental units. c. Replication (more than one experimental unit in each treatment group). d. Control of potential confounding variables where appropriate.

- An explanatory variable (or factor) in an experiment is a variable whose levels are manipulated intentionally. The levels or combination of levels of the explanatory variable(s) are called treatments

- Bias occurs when certain responses are systematically favored over others.

- Blocking ensures that at the beginning of the experiment the units within each block are similar to each other with respect to at least one blocking variable. A randomized block design helps to separate natural variability from differences due to the blocking variable.

- For randomized complete block designs, treatments are assigned completely at random within each block.

- In a completely randomized design, treatments are assigned to experimental units completely at random. Random assignment tends to balance the effects of uncontrolled (confounding) variables so that differences in responses can be attributed to the treatments

- In a double-blind experiment neither the subjects nor the members of the research team who interact with them know which treatment a subject is receiving.

- In a single-blind experiment, subjects do not know which treatment they are receiving, but members of the research team do, or vice versa.

- In an experiment, different conditions (treatments) are assigned to experimental units (participants or subjects).

- In an observational study, treatments are not imposed. Investigators examine data for a sample of individuals (retrospective) or follow a sample of individuals into the future collecting data (prospective) in order to investigate a topic of interest about the population. A sample survey is a type of observational study that collects data from a sample in an attempt to learn about the population from which the sample was taken.

- Individuals chosen for the sample for whom data cannot be obtained (or who refuse to respond) may differ from those for whom data can be obtained (nonresponse bias).
- It is not possible to determine causal relationships between variables using data collected in an observational study
- It is only appropriate to make generalizations about a population based on samples that are randomly selected or otherwise representative of that population.
- Methods for data collection that do not rely on chance result in untrustworthy conclusions
- Methods for randomly assigning treatments to experimental units in a completely randomized design include using a random number generator, a table of random values, drawing chips without replacement, etc.
- Non-random sampling methods (for example, samples chosen by convenience or voluntary response) introduce potential for bias because they do not use chance to select the individuals
- Problems in the data gathering instrument or process result in response bias. Examples include questions that are confusing or leading (question wording bias) and self-reported responses.
- The experimental units are the individuals (which may be people or other objects of study) that are assigned treatments. When experimental units consist of people, they are sometimes referred to as participants or subjects.
- The placebo effect occurs when experimental units have a response to a placebo.
- When a sample is comprised entirely of volunteers or people who choose to participate, the sample will typically not be representative of the population (voluntary response bias).
- When an item from a population can be selected only once, this is called sampling without replacement. When an item from the population can be selected more than once, this is called sampling with replacement.
- When part of the population has a reduced chance of being included in the sample, the sample will typically not be representative of the population (undercoverage bias).

Skills

Students will be able to:

- Compare experimental designs and methods.
- Describe elements of a well-designed experiment
- Explain why a particular experimental design is appropriate. [
- Explain why a particular sampling method is or is not appropriate for a given situation.
- Identify a sampling method, given a description of a study.
- Identify appropriate generalizations and determinations based on observational studies.
- Identify potential sources of bias in sampling methods.
- Identify questions to be answered about data collection methods.
- Identify the components of an experiment.
- Identify the type of a study.
- Interpret the results of a well-designed experiment.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

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Learning Plan / Pacing Guide

Week 1: Survey Methods

Week 2: Experiments

Week 3: Experimental Design

Week 4: Random Selection

Week 5: Control Group and Blocking

Unit 4: Probability, Random Variables, and Probability Distributions

Content Area: **Math**
Course(s): **MATH ANALYSIS**
Time Period: **Marking Period 2**
Length: **4 weeks**
Status: **Published**

Standards

Math Standards

MA.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”).
MA.S-CP.A.2	Understand that two events ▯ and ▯ are independent if the probability of ▯ and ▯ occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
MA.S-CP.A.3	Understand the conditional probability of ▯ given ▯ as ▯(▯ ▯▯▯ ▯)/▯(▯), and interpret independence of ▯ and ▯ as saying that the conditional probability of ▯ given ▯ is the same as the probability of ▯, and the conditional probability of ▯ given ▯ is the same as the probability of ▯.
MA.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.
MA.S-CP.A.5	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.
MA.S-CP.B.6	Find the conditional probability of ▯ given ▯ as the fraction of ▯’s outcomes that also belong to ▯, and interpret the answer in terms of the model.
MA.S-CP.B.7	Apply the Addition Rule, ▯(▯ ▯▯ ▯) = ▯(▯) + ▯(▯) – ▯(▯ ▯▯▯ ▯), and interpret the answer in terms of the model.
MA.S-CP.B.8	Apply the general Multiplication Rule in a uniform probability model, ▯(▯ ▯▯▯ ▯) = [▯(▯)] × [▯(▯|▯)] = [▯(▯)] × [▯(▯|▯)], and interpret the answer in terms of the model.
MA.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.
MA.S-MD.A.2	Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.
MA.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.
MA.S-MD.A.4	Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.

Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
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MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Transfer Goals and Career Ready Practices

Transfer Goals

Concepts

Essential Questions

- What are mutually exclusive events?
- What is Binomial probability?
- What is Geometric probability?
- What is a probability tree?
- What is a simulation?
- What is the difference between Binomial and Geometric probability?

Understandings

- Given that variation may be random or not, conclusions are uncertain
- Simulation allows us to anticipate patterns in data.
- The likelihood of a random event can be quantified.
- Probability distributions may be used to model variation in populations.
- Probabilistic reasoning allows us to anticipate patterns in data.

Critical Knowledge and Skills

Knowledge

Students will know:

- Patterns in data do not necessarily mean that variation is not random.
- A random process generates results that are determined by chance.
- An outcome is the result of a trial of a random process.
- An event is a collection of outcomes.
- Simulation is a way to model random events, such that simulated outcomes closely match real-world outcomes. All possible outcomes are associated with a value to be determined by chance. Record the counts of simulated outcomes and the count total.
- The relative frequency of an outcome or event in simulated or empirical data can be used to estimate the probability of that outcome or event.
- The law of large numbers states that simulated (empirical) probabilities tend to get closer to the true probability as the number of trials increases.
- The sample space of a random process is the set of all possible non-overlapping outcomes.
- The probability of an event is a number between 0 and 1, inclusive.
- The probability of the complement of an event E, E' or C E , (i.e., not E) is equal to 1 () − P E .
- Probabilities of events in repeatable situations can be interpreted as the relative frequency with which the event will occur in the long run.
- The probability that events A and B both will occur, sometimes called the joint probability, is the probability of the intersection of A and B, denoted PA B ( ) ∩ .
- The values of a random variable are the numerical outcomes of random behavior.
- The addition rule states that the probability that event A or event B or both will occur is equal to the probability that event A will occur plus the probability that event B will occur minus the probability that both events A and B will occur
- The multiplication rule states that the probability that events A and B both will occur is equal to the probability that event A will occur multiplied by the probability that event B will occur, given that A has occurred. This is denoted PA B PA PB A ( )
- Events A and B are independent if, and only if, knowing whether event A has occurred (or will occur) does not change the probability that event B will occur.
- If, and only if, events A and B are independent, then PAB PA (|) () = , PB A PB (|) () = , and PA B PA PB ( ) () () ∩= ⋅ .
- A probability distribution can be represented as a graph, table, or function showing the probabilities associated with values of a random variable.
- A numerical value measuring a characteristic of a population or the distribution of a random variable is known as a parameter, which is a single, fixed value.
- For random variables X and Y and real numbers a and b, the mean of aX bY + is x y a b μ μ + .

- A binomial random variable, X, counts the number of successes in n repeated independent trials, each trial having two possible outcomes (success or failure), with the probability of success p and the probability of failure 1 – p
- If a random variable is binomial, its mean, µx, is np and its standard deviation, σ x, is np p (1) − .
- Probabilities and parameters for a binomial distribution should be interpreted using appropriate units and within the context of a specific population or situation.
- For a sequence of independent trials, a geometric random variable, X, gives the number of the trial on which the first success occurs. Each trial has two possible outcomes (success or failure) with the probability of success p and the probability of failure 1 – p
- The probability that the first success for repeated independent trials with probability of success p occurs on trial x is calculated as 1 ( ) (1) , 1,2,3,... x PX x p px − = =− = . This is the geometric probability function.
- Probabilities and parameters for a geometric distribution should be interpreted using appropriate units and within the context of a specific population or situation.

Skills

Students will be able to:

- Identify questions suggested by patterns in data.
- Estimate probabilities using simulation
- Calculate probabilities for events and their complements
- Interpret probabilities for events. [
- Explain why two events are (or are not) mutually exclusive.
- Calculate conditional probabilities.
- Calculate probabilities for independent events and for the union of two events.
- Represent the probability distribution for a discrete random variable. [
- Interpret a probability distribution. [
- Calculate parameters for a discrete random variable
- Interpret parameters for a discrete random variable.
- Calculate parameters for linear combinations of random variables.
- Describe the effects of linear transformations of parameters of random variables. [
- Estimate probabilities of binomial random variables using data from a simulation.
- Calculate probabilities for a binomial distribution.
- Calculate parameters for a binomial distribution.
- Interpret probabilities and parameters for a binomial distribution. [
- Calculate probabilities for geometric random variables.
- Calculate parameters of a geometric distribution.
- Interpret probabilities and parameters for a geometric distribution

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

Homework through Pearson online component - Ch 13,14,15,16

Sample free response and multiple choice questions from previous AP exams

Class examples

School Summative Assessment Plan

Tests and quizzes through Pearson online component - Ch 13-16

Primary Resources

AP statistics: Stats Modeling the world, 5th edition, Bock, Velleman, DeVeaux

Supplementary Resources

Khan Academy

IXL

AP Classroom

Skew the Script

Technology Integration and Differentiated Instruction

Technology Integration

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Learning Plan / Pacing Guide

Week 1: Probability

Week 2: Independent Events

Week 3: Random Variables

Week 4: Binomial and Geometric Probability

Unit 5: Sampling Distributions

Content Area:	**Math**
Course(s):	**Generic Course, MATH ANALYSIS**
Time Period:	**Marking Period 2**
Length:	**3 weeks**
Status:	**Published**

Standards

Math Standards

MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
MA.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.
MA.S-IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

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MA.K-12.8	Look for and express regularity in repeated reasoning.

Transfer Goals and Career Ready Practices

Transfer Goals

Concepts

Essential Questions

- What is a Probability Distribution?
- What is the Central Limit Theorem?
- When do you use a Probability Distribution for sample means?
- When do you use a Probability Distribution for sample proportions?

Understandings

- Given that variation may be random or not, conclusions are uncertain.
- The normal distribution may be used to model variation.
- Probabilistic reasoning allows us to anticipate patterns in data.

Critical Knowledge and Skills

Knowledge

Students will know:

- A continuous random variable is a variable that can take on any value within a specified domain. Every interval within the domain has a probability associated with it.
- A continuous random variable with a normal distribution is commonly used to describe populations. The distribution of a normal random variable can be described by a normal, or "bell-shaped," curve.
- A randomization distribution is a collection of statistics generated by simulation assuming known values for the parameters. For a randomized experiment, this means repeatedly randomly reallocating/reassigning the response values to treatment groups.
- A sample statistic is a point estimator of the corresponding population parameter.
- A sampling distribution of a statistic is the distribution of values for the statistic for all possible samples of a given size from a given population.
- For a categorical variable, the sampling distribution of the sample proportion, pˆ, will have an approximate normal distribution, provided the sample size is large enough: np ≥10 and n p (1) 10
- For a numerical variable, if the population distribution cannot be modeled with a normal distribution, the sampling distribution of the sample mean, x, can be modeled approximately by a normal distribution, provided the sample size is large enough, e.g., greater than or equal to 30.
- For a numerical variable, when random sampling with replacement from a population with mean μ and standard deviation, σ pˆ , the sampling distribution of the sample mean has mean μ μ x = and standard deviation x n σ σ = .

- If sampling without replacement, the standard deviation of the difference in sample means is smaller than what is given by the formula above. If the sample sizes are less than 10% of the population sizes, the difference is negligible.
- If sampling without replacement, the standard deviation of the difference in sample proportions is smaller than what is given by the formula above. If the sample sizes are less than 10% of the population sizes, the difference is negligible.
- If sampling without replacement, the standard deviation of the sample proportion is smaller than what is given by the formula above. If the sample size is less than 10% of the population size, the difference is negligible
- Normal distributions are symmetrical and "bell-shaped." As a result, normal distributions can be used to approximate distributions with similar characteristics
- Parameters for a sampling distribution for a difference of proportions should be interpreted using appropriate units and within the context of a specific populations.
- Probabilities and parameters for a sampling distribution for a difference of sample means should be interpreted using appropriate units and within the context of a specific populations
- Probabilities and parameters for a sampling distribution for a sample proportion should be interpreted using appropriate units and within the context of a specific population.
- The area under a normal curve over a given interval represents the probability that a particular value lies in that interval.
- The boundaries of an interval associated with a given area in a normal distribution can be determined using z-scores or technology, such as a calculator, a standard normal table, or computer-generated output.
- The central limit theorem (CLT) states that when the sample size is sufficiently large, a sampling distribution of the mean of a random variable will be approximately normally distributed.
- The central limit theorem requires that the sample values are independent of each other and that n is sufficiently large.
- The sampling distribution of a statistic can be simulated by generating repeated random samples from a population.
- The sampling distribution of the difference in sample means 1 2 x − x can be modeled with a normal distribution if the two population distributions can be modeled with a normal distribution.
- The sampling distribution of the difference in sample means x 1 2 − x can be modeled approximately by a normal distribution if the two population distributions cannot be modeled with a normal distribution but both sample sizes are greater than or equal to 30.
- Variation in statistics for samples taken from the same population may be random or not.
- When estimating a population parameter, an estimator is unbiased if, on average, the value of the estimator is equal to the population parameter.

Skills

Students will be able to:

- Identify questions suggested by variation in statistics for samples collected from the same population.
- Calculate the probability that a particular value lies in a given interval of a normal distribution
- Determine the interval associated with a given area in a normal distribution.
- Determine the appropriateness of using the normal distribution to approximate probabilities for

unknown distributions.

- Estimate sampling distributions using simulation.
- Explain why an estimator is or is not unbiased.
- Calculate estimates for a population parameter.
- Determine parameters of a sampling distribution for sample proportions.
- Determine whether a sampling distribution for a sample proportion can be described as approximately normal.
- Interpret probabilities and parameters for a sampling distribution for a sample proportion. [
- Determine parameters of a sampling distribution for a difference in sample proportions. [
- Determine whether a sampling distribution for a difference of sample proportions can be described as approximately normal.
- Interpret probabilities and parameters for a sampling distribution for a difference in proportions
- Determine parameters for a sampling distribution for sample means.
- Determine whether a sampling distribution of a sample mean can be described as approximately normal.
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- Determine whether a sampling distribution of a difference in sample means can be described as approximately normal.
- Interpret probabilities and parameters for a sampling distribution for a difference in sample means

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

Homework through Pearson online component - Ch 17

Sample free response and multiple choice questions from previous AP exams

Class examples

School Summative Assessment Plan

Tests and quizzes through Pearson online component - Ch 17

Primary Resources

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Learning Plan / Pacing Guide

Week 1: Central Limit Theorem

Week 2: **Probability Distribution for Sample Proportions**

Week 3: **Probability Distribution for Sample Means**

Unit 6: Inference for Categorical Data: Proportions

Content Area: **Math**
Course(s): **Generic Course, MATH ANALYSIS**
Time Period: **Marking Period 1**
Length: **4 weeks**
Status: **Published**

Standards

Math Standards

MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
MA.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.
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Transfer Goals and Career Ready Practices

Transfer Goals

Concepts

Essential Questions

- What are the conditions for a two sample z-test?
- What is a null hypothesis?
- What is a p-value?
- What is the difference between Type I and Type II errors?
- Which Type of error is more dangerous?

Understandings

- Given that variation may be random or not, conclusions are uncertain.
- An interval of values should be used to estimate parameters, in order to account for uncertainty
- The normal distribution may be used to model variation.
- Significance testing allows us to make decisions about hypotheses within a particular context
- Probabilities of Type I and Type II errors influence inference.

Critical Knowledge and Skills

Knowledge

Students will know:

- A Type I error occurs when the null hypothesis is true and is rejected (false positive).
- A Type II error occurs when the null hypothesis is false and is not rejected (false negative).
- A confidence interval for a population proportion either contains the population proportion or it does not, because each interval is based on random sample data, which varies from sample to sample.
- A confidence interval for a population proportion provides an interval of values that may provide sufficient evidence to support a particular claim in context.
- A p-value is the probability of obtaining a test statistic as extreme or more extreme than the observed test statistic when the null hypothesis and probability model are assumed to be true. The significance level may be given or determined by the researcher
- Confidence intervals for population proportions can be used to calculate interval estimates with specified units.
- Critical values represent the boundaries encompassing the middle C% of the standard normal distribution, where C% is an approximate confidence level for a proportion

- For a given sample, the width of the confidence interval for a population proportion increases as the confidence level increases.
- For a one-sample z-test for a population proportion, the null hypothesis specifies a value for the population proportion, usually one indicating no difference or effect.
- In order to calculate a confidence interval to estimate a population proportion, p, we must check for independence and that the sampling distribution is approximately normal. a. To check for independence: i. Data should be collected using a random sample or a randomized experiment. ii. When sampling without replacement, check that n N ≤10% , where N is the size of the population. b. To check that the sampling distribution of pˆ is approximately normal (shape): i. For categorical variables, check that both the number of successes, npˆ, and the number of failures, n p (1) − ˆ are at least 10 so that the sample size is large enough to support an assumption of normality.
- In order to make assumptions necessary for inference on population proportions, means, and slopes, we must check for independence in data collection methods and for selection of the appropriate sampling distribution.
- In repeated random sampling with the same sample size, approximately C% of confidence intervals created will capture the population proportion.
- The appropriate confidence interval procedure for a one-sample proportion for one categorical variable is a one sample z-interval for a proportion.
- The distribution of the test statistic assuming the null hypothesis is true (null distribution) can be either a randomization distribution or when a probability model is assumed to be true, a theoretical distribution (z).
- The formula for margin of error can be rearranged to solve for n, the minimum sample size needed to achieve a given margin of error. For this purpose, use a guess for pˆ or use pˆ = 0.5 in order to find an upper bound for the sample size that will result in a given margin of error.
- The null hypothesis is the situation that is assumed to be correct unless evidence suggests otherwise, and the alternative hypothesis is the situation for which evidence is being collected.
- The p-value is the proportion of values for the null distribution that are as extreme or more extreme than the observed value of the test statistic. This is: a. The proportion at or above the observed value of the test statistic, if the alternative is >. b. The proportion at or below the observed value of the test statistic, if the alternative is <. c. The proportion less than or equal to the negative of the absolute value of the test statistic plus the proportion greater than or equal to the absolute value of the test statistic, if the alternative is ≠.
- The significance level, ?, is the predetermined probability of rejecting the null hypothesis given that it is true.
- Variation in shapes of data distributions may be random or not
- We are C% confident that the confidence interval for a population proportion captures the population proportion.

Skills

Students will be able to:

- Calculate an appropriate confidence interval for a comparison of population proportions.
- Calculate an appropriate confidence interval for a population proportion.
- Calculate an appropriate test statistic and p-value for a population proportion
- Calculate an appropriate test statistic for the difference of two population proportions.

- Calculate the probability of a Type I and Type II errors.
- Determine the margin of error for a given sample size and an estimate for the sample size that will result in a given margin of error for a population proportion.
- Identify Type I and Type II errors. [
- Identify an appropriate confidence interval procedure for a comparison of population proportions.
- Identify an appropriate confidence interval procedure for a population proportion.
- Identify the null and alternative hypotheses for a difference of two population proportions.
- Identify the null and alternative hypotheses for a population proportion.
- Identify the relationships between sample size, width of a confidence interval, confidence level, and margin of error for a population proportion
- Interpret Type I and Type II errors
- Interpret a confidence interval for a difference of proportions
- Interpret a confidence interval for a population proportion
- Interpret the p-value of a significance test for a population proportion
- Justify a claim about the population based on the results of a significance test for a population proportion.
- Verify the conditions for calculating confidence intervals for a population proportion.
- Verify the conditions for making statistical inferences when testing a difference of two population proportions.
- Verify the conditions for making statistical inferences when testing a population proportion.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

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Class examples

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❑ Within each lesson, the English Language Learners are given choice of topic and resources so that their materials are within their ability to grasp the language.

❑ All assignments have been created in the student's native language.

❑ Work with ELL Teacher to allow for all assignments to be completed with extra time.

At-Risk Students (N.J.A.C.6A:8-4.3c)

❑ Within each lesson, the at-risk students are given choice of topic and resources so that their materials are within their ability level and high-interest.

Special Education Students (N.J.A.C.6A:8-3.1)

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2. Economics: Statistics is essential for analyzing economic data and making informed decisions. You can explore concepts such as regression analysis, correlation, hypothesis testing in economic studies, and understanding economic indicators like GDP, inflation rates, and unemployment rates.
3. Social Sciences: Statistics is widely used in social science research. You can explore survey design, sampling methods, data analysis techniques, and statistical inference in disciplines such as sociology, psychology, political science, and anthropology. Topics may include opinion polls, social surveys, correlation studies, and statistical modeling in social sciences.
4. Medicine and Public Health: Statistics is fundamental in medical research, clinical trials, and public health studies. You can explore concepts such as epidemiology, biostatistics, medical experiments, diagnostic testing, and interpreting medical data. Topics may include analyzing disease patterns, evaluating treatment effectiveness, and understanding risk factors.
5. Environmental Science: Statistics is used to analyze and interpret environmental data. You can explore statistical techniques applied in environmental studies, such as analyzing climate data, assessing pollution levels, studying biodiversity, and conducting environmental impact assessments.
6. Business and Marketing: Statistics is essential for making data-driven business decisions and understanding consumer behavior. You can explore statistical concepts applied in market research, data analysis for marketing campaigns, A/B testing, regression analysis in business forecasting, and analyzing financial data.
7. Political Science: Statistics is used in political science to analyze survey data, election results, and public opinion. You can explore topics such as polling methodologies, sampling techniques, analyzing voting patterns, and understanding statistical models used in political forecasting.
8. Sports Analytics: Statistics plays a significant role in sports analytics, helping teams make informed decisions and analyze player performance. You can explore concepts such as sports statistics, regression analysis in sports performance evaluation, and using data to optimize strategies and game outcomes.
9. Data Journalism: Statistics is vital in data-driven journalism, where journalists use data analysis to uncover trends, investigate stories, and communicate information effectively. You can explore data visualization techniques, statistical analysis in journalism, and interpreting and presenting data in news articles.
10. Education: Statistics is used in educational research to analyze student performance, evaluate teaching methods, and assess educational policies. You can explore topics such as designing educational studies, analyzing test scores, understanding educational data sets, and interpreting research findings in education.

Learning Plan / Pacing Guide

Week 1: One proportion test and confidence intervals

Week 2: **Interpreting p value**

Week 3: **Types of errors**

Week 4: **Difference of two proportions**

Unit 7: Inference for Quantitative Data: Means

Content Area:	**Math**
Course(s):	**Generic Course, MATH ANALYSIS**
Time Period:	**Marking Period 2**
Length:	**4 weeks**
Status:	**Published**

Standards

Math Standards

MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
MA.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.
MA.S-IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Transfer Goals and Career Ready Practices

Transfer Goals

Concepts

Essential Questions

- What are Degrees of Freedom?
- What is a t-table?
- When do you use a Matched Pairs Test?
- When do you use a t-test?

Understandings

- Given that variation may be random or not, conclusions are uncertain.
- The t-distribution may be used to model variation
- An interval of values should be used to estimate parameters, in order to account for uncertainty
- Significance testing allows us to make decisions about hypotheses within a particular context.

Critical Knowledge and Skills

Knowledge

Students will know:

- A confidence interval for a difference of population means provides an interval of values that may provide sufficient evidence to support a particular claim in context
- A confidence interval for a population mean either contains the population mean or it does not, because each interval is based on data from a random sample, which varies from sample to sample
- An interpretation of the p-value of a significance test for a population mean should recognize that the p-value is computed by assuming that the null hypothesis is true, i.e., by assuming that the true population mean is equal to the particular value stated in the null hypothesis.
- An interpretation of the p-value of a significance test for a two-sample difference of population means should recognize that the p-value is computed by assuming that the null hypothesis is true, i.e., by assuming that the true population means are equal to each other.
- As the degrees of freedom increase, the area in the tails of a t-distribution decreases.
- Because ⍰ is typically not known for distributions of quantitative variables, the appropriate confidence interval procedure for estimating the population mean of one quantitative variable for one sample is a one-sample t-interval for a mean.
- For a quantitative variable, the appropriate test for a difference of two population means is a two-sample t-test for a difference of two population means.

- In order to calculate confidence intervals to estimate a population mean, we must check for independence and that the sampling distribution is approximately normal: a. To check for independence: i. Data should be collected using a random sample or a randomized experiment. ii. When sampling without replacement, check that n N ≤10% , where N is the size of the population. b. To check that the sampling distribution of x is approximately normal (shape): i. If the observed distribution is skewed, n should be greater than 30. ii. If the sample size is less than 30, the distribution of the sample data should be free from strong skewness and outliers.
- In repeated random sampling with the same sample size, approximately C% of confidence intervals created will capture the difference of population means.
- Matched pairs can be thought of as one sample of pairs. Once differences between pairs of values are found, inference for confidence intervals proceeds as for a population mean.
- The appropriate confidence interval procedure for one quantitative variable for two independent samples is a two-sample t-interval for a difference between population means.
- The appropriate test for a population mean with unknown ⍰ is a one-sample t-test for a population mean.
- The critical value * t with n −1 degrees of freedom can be found using a table or computer-generated output.
- The point estimate for a population mean is the sample mean, x .
- The results of a significance test for a two-sample test for a difference between two population means can serve as the statistical reasoning to support the answer to a research question about the populations that were sampled.
- We are C% confident that the confidence interval for a population mean captures the population mean.
- When finding the mean difference, µd , between values in a matched pair, it is important to define the order of subtraction.
- When s is used instead of ⍰ to calculate a test statistic, the corresponding distribution, known as the t-distribution, varies from the normal distribution in shape, in that more of the area is allocated to the tails of the density curve than in a normal distribution.

Skills

Students will be able to:

- Describe t-distributions.
- Identify an appropriate confidence interval procedure for a population mean, including the mean difference between values in matched pairs
- Verify the conditions for calculating confidence intervals for a population mean, including the mean difference between values in matched pairs
- Determine the margin of error for a given sample size for a one-sample t-interval.
- Calculate an appropriate confidence interval for a population mean, including the mean difference between values in matched pairs.
- identify the relationships between sample size, width of a confidence interval, confidence level, and margin of error for a population mean.
- Identify an appropriate testing method for a population mean with unknown σ , including the mean difference between values in matched pairs.
- Identify the null and alternative hypotheses for a population mean with unknown σ , including the

mean difference between values in matched pairs.

- Interpret the p-value of a significance test for a population mean, including the mean difference between values in matched pairs.
- Justify a claim about the population based on the results of a significance test for a population mean.
- Identify an appropriate confidence interval procedure for a difference of two population means.
- Determine the margin of error for the difference of two population means.
- Calculate an appropriate confidence interval for a difference of two population means.
- Interpret a confidence interval for a difference of population means.
- Identify the effects of sample size on the width of a confidence interval for the difference of two means.
- Identify the null and alternative hypotheses for a difference of two population means.
- Identify an appropriate selection of a testing method for a difference of two population means.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

Homework through Pearson online component - Ch 22,23,24

Sample free response and multiple choice questions from previous AP exams

Class examples

School Summative Assessment Plan

Tests and quizzes through Pearson online component - Ch 22-24

Primary Resources

AP Statistics: - Stats Modeling the World 5th edition, Bock, Velleman, DeVeaux

Supplementary Resources

Khan Academy

IXL

AP Classroom

Skew the Script

Technology Integration and Differentiated Instruction

Technology Integration

- **Google Products**

  - Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
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- **Additional Support Videos**

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Learning Plan / Pacing Guide

Week 1: One sample t-test/confidence interval

Week 2: Two sample t-test/confidence interval

Week 3: Matched Pairs

Week 4: Review of all techniques

Unit 8: Inference for Categorical Data: Chi-Square

Content Area: **Math**
Course(s): **Generic Course, MATH ANALYSIS**
Time Period: **Marking Period 3**
Length: **2 weeks**
Status: **Published**

Standards

Math Standards

MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
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Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
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MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Transfer Goals and Career Ready Practices

Transfer Goals

Concepts

Essential Questions

- When do you use Chi Square Goodness of Fit test?
- When do you use Chi Square Test for Homogeneity?

Understandings

- Given that variation may be random or not, conclusions are uncertain.
- The chi-square distribution may be used to model variation.

Critical Knowledge and Skills

Knowledge

Students will know:

- An interpretation of the p-value for the chi-square test for goodness of fit is the probability, given the null hypothesis and probability model are true, of obtaining a test statistic as, or more, extreme than the observed value.
- Chi-square distributions have positive values and are skewed right. Within a family of density curves, the skew becomes less pronounced with increasing degrees of freedom.
- Expected counts of categorical data are counts consistent with the null hypothesis. In general, an expected count is a sample size times a probability
- For a chi-square goodness-of-fit test, the null hypothesis specifies null proportions for each category, and the alternative hypothesis is that at least one of these proportions is not as specified in the null hypothesis.
- In order to make statistical inferences for a chi-square test for goodness of fit we must check the following: a. To check for independence: i. Data should be collected using a random sample or randomized experiment. ii. When sampling without replacement, check that n N ≤10% . b. The chi-square test for goodness of fit becomes more accurate with more observations, so large counts should be used (shape). i. A conservative check for large counts is that all expected counts should be greater than 5.
- The appropriate hypotheses for a chi-square test for homogeneity are: H0: There is no difference in distributions of a categorical variable across populations or treatments. Ha : There is a difference in distributions of a categorical variable across populations or treatments.
- The chi-square statistic measures the distance between observed and expected counts relative to expected counts.
- The p-value for a chi-square test for goodness of fit for a number of degrees of freedom is found using the appropriate table or computer generated output.

- The p-value for a chi-square test for independence or homogeneity for a number of degrees of freedom is found using the appropriate table or technology
- The results of a chi-square test for homogeneity or independence can serve as the statistical reasoning to support the answer to a research question about the population that was sampled (independence) or the populations that were sampled (homogeneity).
- When considering a distribution of proportions for one categorical variable, the appropriate test is the chi-square test for goodness of fit

Skills

Students will be able to:

- Calculate expected counts for the chi-square test for goodness of fit
- Calculate expected counts for two-way tables of categorical data
- Calculate the appropriate statistic for the chi-square test for goodness of fit.
- Determine the p-value for a chi-square significance test for independence or homogeneity
- Determine the p-value for chi-square test for goodness of fit significance test.
- Identify an appropriate testing method for a distribution of proportions in a set of categorical data.
- Identify the null and alternative hypotheses for a chi-square test for homogeneity or independence.
- Identify the null and alternative hypotheses in a test for a distribution of proportions in a set of categorical data
- Justify a claim about the population based on the results of a chi-square test for homogeneity or independence.
- Verify the conditions for making statistical inferences when testing a chi-square distribution for independence or homogeneity

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

Homework through Pearson online component - Ch 25

Sample free response and multiple choice questions from previous AP exams

Class examples

School Summative Assessment Plan

Tests and quizzes through Pearson online component - Ch 25

Primary Resources

AP Statistics - AP Stats - Modeling the world 5th edition, Bock, Velleman, Deveaux

Supplementary Resources

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IXL

AP Classroom

Skew the Script

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Learning Plan / Pacing Guide

Week 1: Chi Square Goodness of Fit

Week 2: Chi Square Test for Homogeneity

Unit 9: Inference for Quantitative Data: Slopes

Content Area:	**Math**
Course(s):	**Generic Course, MATH ANALYSIS**
Time Period:	**Marking Period 3**
Length:	**2 weeks**
Status:	**Published**

Standards

Math Standards

MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
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Transfer Goals and Career Ready Practices

Transfer Goals

Concepts

Essential Questions

- When is it appropriate to perform inference about the slope of a population regression line based on sample data?
- Why do we not conclude that there is no correlation between two variables based on the results of a statistical inference for slopes?
- § How can there be variability in slope if the slope statistic is uniquely determined for a line of best fit?

Understandings

- An interval of values should be used to estimate parameters, in order to account for uncertainty.
- Given that variation may be random or not, conclusions are uncertain.
- The t-distribution may be used to model variation.

Critical Knowledge and Skills

Knowledge

Students will know:

- A confidence interval for the slope of a regression model provides an interval of values that may provide sufficient evidence to support a particular claim in context.
- An interpretation for a confidence interval for the slope of a regression line should include a reference to the sample taken and details about the population it represents.
- An interpretation of the p-value of a significance test for the slope of a regression model should recognize that the p-value is computed by assuming that the null hypothesis is true, i.e., by assuming that the true population slope is equal to the particular value stated in the null hypothesis.
- For the slope of a regression line, the margin of error is the critical value (* t) times the standard error (SE) of the slope.
- In order to calculate a confidence interval to estimate the slope of a regression line, we must check the following: a. The true relationship between x and y is linear. Analysis of residuals may be used to verify linearity. b. The standard deviation for y, □ y , does not vary with x. Analysis of residuals may be used to check for approximately equal standard deviations for all x. c. To check for independence: i. Data should be collected using a random sample or a randomized experiment. ii. When sampling without replacement, check that n N ≤10% . d. For a particular value of x, the responses (y-values) are approximately normally distributed. Analysis of graphical representations of residuals may be used to check for normality. i. If the observed distribution is skewed, n should be greater than 30.
- In repeated random sampling with the same sample size, approximately C% of confidence intervals

created will capture the slope of the regression model, i.e., the true slope of the population regression model.

- The appropriate confidence interval for the slope of a regression model is a t-interval for the slope.
- The appropriate test for the slope of a regression model is a t-test for a slope.
- The distribution of the slope of a regression model assuming all conditions are satisfied and the null hypothesis is true (null distribution) is a t-distribution.
- The results of a significance test for the slope of a regression model can serve as the statistical reasoning to support the answer to a research question about that sample
- Variation in points' positions relative to a theoretical line may be random or non-random.

Skills

Students will be able to:

- Identify an appropriate confidence interval procedure for a slope of a regression model.
- Verify the conditions to calculate confidence intervals for the slope of a regression model.
- Determine the given margin of error for the slope of a regression model.
- Calculate an appropriate confidence interval for the slope of a regression model
- Interpret a confidence interval for the slope of a regression model.
- Justify a claim based on a confidence interval for the slope of a regression model.
- Identify the effects of sample size on the width of a confidence interval for the slope of a regression model.
- Identify the appropriate selection of a testing method for a slope of a regression mode
- Identify appropriate null and alternative hypotheses for a slope of a regression model. [
- Verify the conditions for the significance test for the slope of a regression model.
- Calculate an appropriate test statistic for the slope of a regression model.
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- Justify a claim about the population based on the results of a significance test for the slope of a regression model.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

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Class examples

School Summative Assessment Plan

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Special Education Students (N.J.A.C.6A:8-3.1)

❑ Within each lesson, special education students are given choice of topic and resources so that their materials are within their ability level and high-interest.

❑ All content will be modeled with examples and all essays are built on a step-by-step basis so modifications for assignments in small chunks are met.

All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)

Interdisciplinary Connections

1. Science: Statistics plays a crucial role in scientific research. You can explore how statistical methods are used in various scientific disciplines such as biology, physics, chemistry, environmental science, and psychology. Topics may include experimental design, hypothesis testing, data analysis, and interpreting scientific findings.
2. Economics: Statistics is essential for analyzing economic data and making informed decisions. You can explore concepts such as regression analysis, correlation, hypothesis testing in economic studies, and understanding economic indicators like GDP, inflation rates, and unemployment rates.
3. Social Sciences: Statistics is widely used in social science research. You can explore survey design, sampling methods, data analysis techniques, and statistical inference in disciplines such as sociology, psychology, political science, and anthropology. Topics may include opinion polls, social surveys, correlation studies, and statistical modeling in social sciences.
4. Medicine and Public Health: Statistics is fundamental in medical research, clinical trials, and public health studies. You can explore concepts such as epidemiology, biostatistics, medical experiments, diagnostic testing, and interpreting medical data. Topics may include analyzing disease patterns, evaluating treatment effectiveness, and understanding risk factors.
5. Environmental Science: Statistics is used to analyze and interpret environmental data. You can explore statistical techniques applied in environmental studies, such as analyzing climate data, assessing pollution levels, studying biodiversity, and conducting environmental impact assessments.
6. Business and Marketing: Statistics is essential for making data-driven business decisions and understanding consumer behavior. You can explore statistical concepts applied in market research, data analysis for marketing campaigns, A/B testing, regression analysis in business forecasting, and analyzing financial data.
7. Political Science: Statistics is used in political science to analyze survey data, election results, and public opinion. You can explore topics such as polling methodologies, sampling techniques, analyzing voting patterns, and understanding statistical models used in political forecasting.
8. Sports Analytics: Statistics plays a significant role in sports analytics, helping teams make informed decisions and analyze player performance. You can explore concepts such as sports statistics, regression analysis in sports performance evaluation, and using data to optimize strategies and game outcomes.
9. Data Journalism: Statistics is vital in data-driven journalism, where journalists use data analysis to uncover trends, investigate stories, and communicate information effectively. You can explore data visualization techniques, statistical analysis in journalism, and interpreting and presenting data in news articles.
10. Education: Statistics is used in educational research to analyze student performance, evaluate

teaching methods, and assess educational policies. You can explore topics such as designing educational studies, analyzing test scores, understanding educational data sets, and interpreting research findings in education.

Learning Plan / Pacing Guide

Week 1: Confidence intervals for the slope of a regression model

Week 2: Test for the slope of a regression model