Unit 3: Probability: Foundations of Inference

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 2**
Length: **9-10 weeks**
Status: **Published**

Brief Summary of Unit

In this unit, students will be able to know what random variables are, what a distribution is and how to find expected value, variance and standard deviation. Students will be able to know what random variables are, what a distribution is and how to find expected value, variance and standard deviation. This unit covers all of the basic calculations for permutations, combinations, compound events, independent events, and conditional probability.

Standards

Analyzing various sets of data will allow students to explore studies about people from different backgrounds. Statistical studies and analysis provides students an opportunity to read about historical statistics about people's cultures. Embracing the diversity within society incorporates the following:

Amistad Commission

This unit also reflects the goals of the Department of Education and the Amistad Commission including the infusion of the history of Africans and African-Americans into the curriculum in order to provide an accurate, complete, and inclusive history regarding the importance of of African-Americans to the growth and development of American society in a global context.

Asian American and Pacific Islander History Law

This unit includes instructional materials that highlight the history and contributions of Asian Americans and Pacific Islanders in accordance with the New Jersey Student Learning Standards in Social Studies.

New Jersey Diversity and Inclusion Law

In accordance with New Jersey’s Chapter 32 Diversity and Inclusion Law, this unit includes instructional materials that highlight and promote diversity, including:

economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance.

Commission on Holocaust Education

This unit further reflects the goals of the Holocaut Education mandate where students are able to identify and analyze applicable theories concerning human nature and behavior; understand that genocide is a consequence of prejudice and discrimination; understand that issues of moral dilemma and conscience have a profound impact on life; and understand the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

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.
MA.S-CP.A	Understand independence and conditional probability and use them to interpret data
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 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.
MA.S-CP.A.3	Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.
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	Use the rules of probability to compute probabilities of compound events in a uniform probability model
MA.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.
MA.S-CP.B.7	Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.
MA.S-CP.B.8	Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = [P(A)] \times [P(B \mid A)] = [P(B)] \times [P(A \mid B)]$, and interpret the answer in terms of the model.
MA.S-CP.B.9	Use permutations and combinations to compute probabilities of compound events and

	solve problems.
LA.K-12.NJSLSA.L4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.
LA.K-12.NJSLSA.L5	Demonstrate understanding of word relationships and nuances in word meanings.
SCI.HS-LS3-2	Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
SCI.HS.LS3.B	Variation of Traits Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.
CS.K-12.3.a	Identify complex, interdisciplinary, real-world problems that can be solved computationally.
CS.K-12.3.b	Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.
TEC.K-12.8.1	All students will use computer applications to gather and organize information and to solve problems.
TEC.K-12.8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual society, and the environment.
WORK.K-12.9.1	All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace.
WORK.K-12.9.2	All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace.

Transfer

- Patterns only appear in the long run.
- Probability is used in many real life situations including games of chance.
- Simulations help predict how an event will play out in the future.
- Experimental and theoretical probabilities are not the same.
- There are benefits of simulating events opposed to gathering real data

Essential Questions

- How is standard deviation determined?
- How important are random variables?
- How are the parameter and statistic defined?
- How is sample data important in sampling?
- How can understanding probability affect our decision making?

Essential Understandings

- Relative frequency of occurrence is probability.
- The Law of Large Numbers allows for accurate estimations when sample size is large enough.
- Tree diagrams are an excellent method of displaying sample space and calculating probability.

Students Will Know

- Students will be able to distinguish between a parameter and a statistic.
- Students will be able to distinguish between population distribution sampling distribution and the distribution of sample data.
- Students will know that probability is a long running mechanism.

Students Will Be Skilled At

- Key concepts/vocabulary - combinations, permutations, sample space, event, simple event, compound event, union, intersection, compliment, disjoint (mutually exclusive), independent events, conditional probability
- Usingprobability to make informed decisions.
- How sampling with replacement and without replacement effect probabilities.

Evidence/Performance Tasks

- Assessments
    - Formative: Daily assessments using examples from class notes, NJSLA test bank problems, and/or Albert/AP Classroom assessments
    - Summative: Teacher-created assessments, NJSLA test bank problems, Big Ideas Math online platform problems, Albert/AP Classroom and/or Big Ideas Math unit assessments
    - Benchmark: IXL or teacher created diagnostic assessments in addition to unit assessments from Big Ideas Math
    - Alternative Assessments: Student-centered activities such as scavenger hunts, various projects involving real world applications, and differentiated learning tasks in Khan Academy, DeltaMath, and IXL
- Answer essential questions
- Class discussion of daily topic

- Teacher Observation
- Tests and quizzes that assess the essential questions
- Classwork and homework that assess the essential questions
- Written assignments that assess the essential questions that involves providing explanations
- Provide alternative means of assessments for certain students
- Know what random variables are, what is a distribution and how to find expected value, variance and standard deviation.
- Create sample spaces for chance events.
- Use Venn Diagrams to represent outcomes.
- Use tree diagrams to map out probabilities.
- Identify mutually exclusive events.
- Distinguish between experimental and theoretical probabilities.
- Calculate probabilities for compound events and conditional events.
- Establish rules for independence of events.

Learning Plan

- Demonstration of how/why/where/when probability is used in real life application.
- Class discussion/notes on key concepts/vocabulary/calculations.
- Class activities/games on probability.

Topics:

- Probability as relative frequency
- Law of Large Numbers" concept
- Complement, addition and multiplication rules, conditional probabilities, independence
- Discrete random variables and their probability distributions
- Geometric and Binomial Probability Distributions
- Simulation of probability distributions including binomial and geometric
- Mean and standard deviation of a random variable
- Combining independent random variables
- Independence vs. dependence
- Mean and standard deviation for sums and differences of independent random variables
- Normal distribution
- Simulating sampling distributions: sample proportion and sample mean
- Central Limit Theorem
- Sampling distribution of a difference between two independent sample proportions and two independent sample means.

Materials

Core Book List including Practice of Statistics

Supplemental materials: AP Classroom, Khan Academy, Edia, and DeltaMath

- District approved textbook
- Khan Academy
- Supplemental Materials – worksheets, guided notes
- Teacher created activiites
- Teacher created notes
- TI-84 Graphing Calculator

Suggested Strategies for Modifications

Possible accommodations/modification for AP Statistics