Unit 5 Statistics and Probability

Content Area: **Mathematics**
Course(s): **Honors Pre-Algebra 7, CCSS Math 7**
Time Period: **May**
Length: **1 Marking Period**
Status: **Published**

Unit Overview

In this unit students will build on their previous work with single data distributions to compare two data distributions and address questions about differences between populations. They begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences. Permutations, combinations, and probability will be learned to help solve problems. The fundamental counting principal will also be utilized throughout the unit.

Enduring Understandings

- Communicating information is critical in real-life situations.
- Experimental results tend to approach theoretical probabilities after a large number of trials.
- Grouping by attributes can be used to answer mathematical questions.
- Predictions can often be expressed and justified through the use of data.
- The results of a statistical investigation can be used to support or refute an argument.

Career Readiness, Life Literacies & Key Skills

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Essential Questions

- How can experimental and theoretical probabilities be used to make predictions or draw conclusions?
- How do data and statistics help us make predictions?
- How do people use data and statistics to influence others?
- Why would we want to know how likely it is that an event might occur?

Student Learning Objectives (SLOs)

- Conduct experimental probability events that are both uniform and non-uniform to collect and analyze data to make predictions for the approximate relative frequency of chance events.
- Design a simulation of a compound probability event and determine the sample space using organized lists, tables, and tree diagrams, calculate the fractional probabilities for each outcome in the sample space, and conduct the simulation using the data collected to determine the frequencies of the outcomes in the sample space.
- Develop uniform and non-uniform theoretical probability models by listing the probabilities of all possible outcomes in an event, for instance, the probability of the number cube landing on each number being 1/6. Then, conduct an experiment of the event using frequencies to determine the probabilities of each outcome and use the results to explain possible sources of discrepancies in theoretical and experimental probabilities.
- Distinguish between valid and invalid samples from a population by determining if the sample is representative of the subgroups within the population.
- Interpret and express the likelihood of a chance event as a number between 0 and 1, relating that the probability of an unlikely event happening is near 0, a likely event is near 1, and 1/2 is neither likely nor unlikely.
- Use random sampling to produce a represenative sample, develop valid inferences about a population with an unknown characteristic of interest, and compare the variation in estimates using multiple samples of the same and different size.
- Visually and numerically compare the means and variations of two distinct populations to draw informal comparative inferences about measures of center and variability using graphical representations and statistical calculations.

Standards/Indicators

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.7.SP	Statistics and Probability
MA.7.SP.A	Use random sampling to draw inferences about a population.
MA.7.SP.A.1	Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
MA.7.SP.A.2	Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.
MA.7.SP.B	Draw informal comparative inferences about two populations.

MA.7.SP.B.3	Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability.
MA.8.SP.A.1	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
MA.7.SP.B.4	Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.
MA.7.SP.C	Investigate chance processes and develop, use, and evaluate probability models.
MA.7.SP.C.5	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
MA.7.SP.C.6	Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability.
MA.7.SP.C.7	Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.
MA.7.SP.C.7a	Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events.
MA.7.SP.C.7b	Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.
MA.7.SP.C.8	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
MA.7.SP.C.8a	Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
MA.7.SP.C.8b	Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event.
MA.7.SP.C.8c	Design and use a simulation to generate frequencies for compound events.

Lesson Titles

- Experimental Probability
- Making Statistical inferences
- Probability Models
- Probability of Compound Events
- Understanding Probability Concepts
- Understanding Random Samples
- Using Mean and Mean Absolute Deviation to Compare Data
- Using Measures of Center and Variability to Compare Data

Equity Considerations

Climate Change

Students will make connections between math and STEM processes.

Students analyze the melting of the polar ice caps and its effects on the Earth and humanity

How fast are the polar ice caps melting, and why is this rate important to human life on Earth?

https://www.oercommons.org/authoring/7876-climate-change-cross-curricular-math-english-scien/view

https://jancovici.com/en/climate-change/risks/will-oceans-submerge-everything/

- Social

SCI.MS-ESS3-5	Ask questions to clarify evidence of the factors that have caused climate change over the past century.

Asian American and Pacific Islander Mandate

https://ideas.ted.com/8-asian-americans-and-pacific-islanders-whose-innovations-have-changed-your-life-really/
https://www.ngpf.org/blog/math/math-monday-celebrating-aapi-mathematicians/

Diana Ma is a statistician who has built a career out of her two passions: basketball and math. As a Data Scientist for the Lakers, she works in basketball operations and does analysis involving player evaluation, roster construction, and in-game strategy.

Shakuntala Devi is known as “The Human Computer”, Shakuntala Devi was a famous mathematician who holds the Guinness World Record for the “Fastest Human Computation.” In addition to her computational prowess, Devi was also an outspoken LGBTQ+ advocate, novelist, and political hopeful. Her life story was adapted into the biopic Shakuntala Devi in 2020.

Dr. Kamuela Yong is an associate professor of mathematics at the University of Hawai‘i–West O‘ahu. He is the first Native Hawaiian to earn a Ph.D. in applied mathematics and is the co-founder of the organization Indigenous Mathematicians.

- Social

LGBTQ and Disabilities Mandate

Students will engage in discussion centered around mathematicians of the LBGTQ and Disabilities population.

STEM

LGBTQ:

Sir Francis Bacon (1561–1626)

Florence NightingaleFrancis Bacon | Philosophy, Scientific Method, & Facts | Britannica(1820-1910)

George Washington Carver (1861-1943)

Sara Josephine Baker (1873-1945)

Alan Turing (1912-1954)

Allan Cox (1926-1987)

Sally Ride (1951-2012)

Ben Barres (1954-2017)

Ruth Gates (1962-2018)

Tim Cook (1960)

Disabilities:

Leonardo da Vinci (1452-1519)- Dyslexia

Isaac Newton (1664-1727)- Epilepsy

Thomas Edison (1847-1931)- Hearing

Charles Darwin (1809-1882)- Stutter, Dyslexia

Alexander Graham Bell (1847-1922)- Deaf

Albert Einstein (1879-1955)- Aspergers

Florence B. Seibert (1897-1991)- Mobility

Stephen Hawking (1942-2019)- ALS

John Forbes Nash (1928-2015)- Schizophrenia

Temple Grandin (1947)- Autism

- Social

Inter-Disciplinary Connections

- Art - Graphing
- History - Current Events
- History - Math History
- LAL - Key Terms
- LAL - Vocabulary
- LAL - Word Wall
- Note Taking
- Sci - Making Predictions
- Tech -Web

LA.RL.7.4	Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meanings; analyze the impact of rhymes and other repetitions of sounds (e.g., alliteration) on a specific verse or stanza of a poem or section of a story or drama.
SCI.7-8.5.1.8.B.2	Gather, evaluate, and represent evidence using scientific tools, technologies, and computational strategies.
SCI.7-8.5.1.8.B.b	Mathematics and technology are used to gather, analyze, and communicate results.
SCI.7-8.5.1.8.B.c	Carefully collected evidence is used to construct and defend arguments.
SCI.7-8.5.1.8.D.1	Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences.

Anticipatory Set

- Current Events
- Display
- Mathematics History
- Relate to prior knowledge
- Videos

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK

- Apply and justify the properties to simplify algebraic expressions with a partner.
- Blooms # 6 Evaluation - Make and defend judgements based on internal evidence or external criteria
- Blooms #1 Knowledge - Remember Previously learned information.
- Blooms #2 Comprehension - Demonstrate an understanding of facts.
- Blooms #3- Application - Apply knowledge to actual situations
- Blooms #4 Analysis - Break down objects or ideas into simpler parts and find evidence to support generalizations.
- Blooms #5 Synthesis - Compile component ideas into a new whole or propose alternative solutions.
- Complete worksheets on using order of operations to evaluate expressions.
- Examples of translating phrase into expressions and vice versa

- Graphing ordered pairs on a coordinate plane.
- Introduction, notes and examples on converting fractions to decimals and vice versa.
- Introduction, notes, examples on adding, subtracting, multiplying and dividing integers.
- Introduction, notes, examples on adding, subtracting, multiplying and dividing rational numbers.
- Introduction, notes, examples on using order of operations
- Note cards on converting fractions & decimals
- Note cards on Integer Rules
- Review homework - student work on board
- Students will work as a group or with a partner.
- Students will work independently.
- Tutoring during Academic Enrichment
- Using number lines to compare and order integers
- Using Number lines to compare and order rational numbers
- Using number lines to find absolute value
- Worksheet on compare and order rational numbers.

Modifications

ELL Modifications

Content specific vocabulary important for ELL students to understand include:

Statistics and Probability

- Calculate the probability of simple and compound events
- Make predictions of the probability of random events
- Calculate experimental and theoretical probability
- Determine the type of probability to use in a situation
- Conduct simulations to determine an experimental probability

- Anticipate where needs will be
- Assign a peer to help keep student on task
- Break tests down in smaller increments
- Collaboration with ELL Teacher
- Graphic organizers
- Increase one-to-one time
- Modification plan
- Modifications & accommodations as listed in the student's IEP
- Modified or reduced assignments
- Position student near helping peer or have quick access to teacher
- Prioritize tasks
- Provide guided notes and step-by-step instructions on solving equations
- Provide manipulative, such as unified cubes or counting chips, for students to use when calculating probability
- Provide students with a calculator to help with calculations
- Provide worked out examples on classwork and homework that students can use as a guide when working independently
- Reduce length of assignment for different mode of delivery
- Strategy groups
- Teacher conferences
- Think in concrete terms and provide hands-on-tasks
- Tutoring during Academic Enrichment
- Use patterns that are easily discernible in function tables
- Working contract between you and student at risk

IEP & 504 Modifications

- Anticipate where needs will be
- Assign a peer to help keep student on task
- Break tests down in smaller increments
- Graphic organizer for remembering integer rules.
- Increase one-to-one time
- Modifications & accommodations as listed in the student's IEP
- Modified or reduced assignments
- Personal handout for remembering integer rules (can be taped to desk)

- Position student near helping peer or have quick access to teacher
- Prioritize tasks
- Provide example list of rational and irrational numbers
- Provide guided notes and step-by-step instructions on solving equations
- Provide manipulative such as Uniflex cubes or counting chips, for students to use when calculating probability
- Provide personal handout for integer rules
- Provide worked out examples on classwork and homework that students can use as a guide when working independently
- Reduce length of assignment for different mode of delivery
- Think in concrete terms and provide hands-on-tasks
- Tutoring during Academic Enrichment
- Working contract between you and student at risk

G & T Modifications

- Calculate experimental and theoretical probability
- Calculate the probability of simple and compound events
- Conduct simulations to determine an experimental probability
- Conduct simulations to determine an experimental probability
- Determine the type of probability to use in a situation
- Make predictions of the probability of random events
- Tutoring during Academic Enrichment

Formative Assessment

- Choral Responses
- Collaborative work
- Constructed Responses
- Crossmatics
- Exit Card
- Guided Practice
- Hand Signals
- Independent Practice
- PARCC Questions - Counting Outcomes
- PARCC Questions - Measures of Central Tendency
- PARCC Questions - Probability of Compound Events
- PARCC Questions - Sampling to Predict

- PARCC Vocabulary
- Quick Quizzes
- Quiz - Box and Whisker plots
- Quiz - Experimental and Theoretical Probability
- Quiz - Measures of Central Tendency
- Quiz - Stem and Leaf Plots
- Rubrics
- Self Assessments
- Senteo Response
- Teacher Observation
- Think Pair Share
- Turn to your partner

Summative Assessment

- Marking Period Assessment
- Mid Chapter Test on Comparing and ordering Fractions, decimals, adding and subtracting rational numbers
- Mid Chapter Tests Comparing and ordering integers, adding and subtracting integers
- Project - Coordinate graph
- Test on Integers
- Test on Order of Operations
- Test on Rational Numbers
- Unit Tests

Benchmark Assessment

- MPA 1
- MPA 2
- MPA 3
- MPA 4
- Skills-based assessment- math practice

Alternative assessments:

- Performance tasks
- Presentations
- Problem-based assignments
- Project-based assignments

Resources & Materials

- Calculators
- Chromebooks
- PMI practice questions online
- Senteo Response Questions
- Smartboard

Technology

- Answer Garden
- Calculator
- Chromebooks
- GoGaurdian
- Google Classroom
- Kahoot
- Khan Academy - order of operations, integers, rational numbers
- PARCC Online Practice Assessment
- PMI - Senteo Response
- Quizlet - Volcabulary
- Smartboard

TECH.8.1.8.A.CS1	Understand and use technology systems.
TECH.8.1.8.A.CS2	Select and use applications effectively and productively.
TECH.8.1.8.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.
TECH.8.1.8.D.CS1	Advocate and practice safe, legal, and responsible use of information and technology.
TECH.8.1.8.D.CS2	Demonstrate personal responsibility for lifelong learning.
TECH.8.1.8.D.CS3	Exhibit leadership for digital citizenship.
TECH.8.1.8.E.CS3	Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.