Course: Probability and Statistics **Unit 2:** Probability	**Year of Implementation:** 2026-2027

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Stage One - Desired Results

Link(s) to New Jersey Student Learning Standards for this course:
https://www.state.nj.us/education/cccs/2020/

- **Unit Standards:**
  - ***Content Standards***
    - *https://www.nj.gov/education/standards/math/*

NJSLS - Conditional Probability and Rules of Probability [S-CP]

A. Understand independence and conditional probability and use them to interpret data

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").
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.
3. Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.
5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

B. Use the rules of probability to compute probabilities of compound events in a uniform probability model.

6. Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.

NJSLS - Interpreting Categorical and Quantitative Data [S-ID]

A. Summarize, represent, and interpret data on a single count or measurement variable

1. Represent data with plots on the real number line (dot plots, histograms, and box plots).
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.
4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

NJSLS- Making Inferences and Justifying Conclusions [S-IC]

A. Understand and evaluate random processes underlying statistical experiments

1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?

B. Make inferences and justify conclusions from sample surveys, experiments, and observational studies

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

NJSLS- Using Probability To Make Decisions [S-MD]

A. Calculate expected values and use them to solve problems.

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.
2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.

B. Use probability to evaluate outcomes of decisions.

5. (+) Analyze decisions and strategies using probability concepts.

- ***2020 NJSL Standards: Career Readiness, Life Literacies, and Key Skills Introduction***
  https://www.nj.gov/education/standards/clicks/Docs/2020NJSLS-CLKS.pdf

  - 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice
  - 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions
  - 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.
  - 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience.

- ***Interdisciplinary Content Standards***
- 2020 New Jersey Student Learning Standards Science Grade 9 through Grade 12
- *https://www.nj.gov/education/standards/compsci/Docs/2020%20NJSLS-CSDT.pdf*

Computer Science and Design Thinking Introduction

- 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
- HS-LS3-3: Apply concepts of statistics and probability to explain variation and distribution of expressed traits in a population.

- ***NJ Statutes:*** NJ State law mandates the inclusion of the following topics in lesson design and instruction as aligned to elementary and secondary curriculum.

  Amistad Law: N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

  Holocaust Law: N.J.S.A. 18A:35-28 Every board of education shall include instruction on the Holocaust and genocides in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction

shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A.18A:35-4.36) A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

Diversity and Inclusion (N.J.S.A. 18A:35-4.36a) A board of education shall incorporate instruction on diversity and inclusion in an appropriate place in the curriculum of students in grades kindergarten through 12 as part of the district's implementation of the New Jersey Student Learning Standards.

Asian American and Pacific Islanders (AAPI) P.L.2021, c.410 Ensures that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSLS) for Social Studies in kindergarten through Grade 12 (P.L.2021, c.416)

For additional information, see

NJ Amistad Curriculum: ***https://www.nj.gov/education/amistad/about/***

Diversity and Inclusion: ***https://www.nj.gov/education/standards/dei/index.shtml***

- *(Sample Activities/ Lessons):* ***https://www.nj.gov/education/standards/dei/samples/index.shtml***

Asian American and Pacific Islanders:

- ***Asian American and Pacific Islander Heritage and History in the U.S.***
  A Teacher's Guide from EDSITEment offering a collection of lessons and resources for K-12 social studies, literature and arts classrooms that center around the experiences, achievements and perspectives of Asian Americans and Pacific Islanders across U.S. history.

Transfer Goal: Students will be able to independently use their learning to evaluate risk, make informed decisions, and interpret

the likelihood of real-world events based on data.

As aligned with LRHSD Long Term Learning Goal(s): https://www.lrhsd.org/academics/curriculum

The Lenape Regional High School District Math program, in alignment with the New Jersey Student Learning Standards for Mathematics, prepares our students for success in college and their careers. Through completing our coursework, our students will be better able to:

1. Problem-Solving: apply and transfer autonomously and collaboratively mathematical concepts and problem- solving techniques to unfamiliar, varied and real-world situations
2. Reasoning: reason abstractly and quantitatively by applying mathematical representations, symbols and estimation techniques when engaging in problem-solving
3. Critical Thinking: construct and effectively communicate valid conclusions and critique the reasoning of others
4. Modeling: demonstrate mastery of concepts by evaluating models that others have constructed or by creating appropriate models of their own
5. Tools: identify the correct tools to solve problems, if applicable
6. Precision: determine an answer's appropriateness as a means of determining its validity, while using proper mathematical notation and units
7. Structure: use multiple representations, critical thinking skills, and prior knowledge to solve problems in new situations
8. Patterns: analyze data and recognize patterns in a variety of situations
9. Habits of Mind: approach new situations with curiosity, persistence, resourcefulness, and confidence; take risks, monitor their progress, accept and learn from setbacks, make adjustments, and reflect on their performance.

Enduring Understandings	*Essential Questions*
Students will understand that. . . *EU 1* probability models allow us to predict the likelihood of outcomes and make informed decisions in uncertain situations. *EU 2*	• How can we use probability to assess risk and make informed decisions? • How can we use the normal distribution to make sense of data and draw meaningful conclusions about the real world?

the normal distribution is a powerful model for understanding and comparing data.	
Knowledge *Students will know . . .* *EU 1* ● probability can be used to make predictions and evaluate the likelihood of real world outcomes. (S-CP.A.1-3, S-CP.A.5) ● mutually exclusive events cannot happen at the same time, and this distinction affects how probabilities are calculated. (S-CP.A.1-3, S-CP.A.5, S-CP.B.6) ● simple and compound events require different methods for calculating their probabilities. (HS-LS3-3) ● calculating expected value can assess risk and make informed decisions. (S-CP.A.1-5, 9.4.12.CT.1)	*Skills* *Students will be able to. . .* *EU 1* ● define and contextualize probability as a measure of the likelihood of an event occurring, and distinguish between experimental and theoretical approaches. (S-CP.A.1) ● evaluate whether events are independent or dependent by analyzing how the occurrence of one event affects the probability of the other. (S-CP.A.2, S-CP.A.5, HS-LS3-3) ● differentiate between mutually exclusive and non-mutually exclusive events by determining whether two events can occur at the same time, and justify your conclusion with reasoning. (S-CP.A.1, S-CP.A.3) ● use both experimental and theoretical probabilities to make predictions and draw conclusions about real-world or simulated situations. (S-CP.A.1, S-CP.B.6, 9.4.12.IML.4, 8.1.12.DA.5) ● analyze why different results may occur across repeated trials of the same experiment, and explain how variability and sample size affect outcomes. (S-CP.A.1, S-IC.A.2, 9.4.12.CT.1, 8.1.12.DA.5) ● evaluate the limitations of using probability to make short-term predictions by explaining how randomness and small sample sizes can impact expected results. (S-IC.A.1–2) ● determine the appropriate context in which to use a probability distribution by examining the type of data,

EU 2 ● the characteristics of the normal distribution, including its symmetric, bell-shaped curve, mean, median, and mode being equal. (S-ID.A.1-4) ● data can be interpreted within one, two, and three standard deviations of the mean (68-95-99.7%. (S-ID.A.1-4) ● the concept of standard deviation as a measure of variability in a data set. (S-ID.A.1-4, 9.4.12.TL.1) ● z-scores are used to compare data from different normal distributions. (S-ID.A.1-4, S-IC.B.3-4, 9.4.12.IML.3)	expected outcomes, and nature of the event. (S-MD.A.1, S-MD.B.5, 9.4.12.IML.4) ● interpret the measures of central tendency (mean, expected value) and spread (variance, standard deviation) of a probability distribution to summarize and analyze the underlying situation. (S-MD.A.1–2, S-ID.A.4, 8.1.12.DA.5) ● connect probability distributions to real-life applications by reflecting on past experiences involving risk, randomness, or statistical prediction (e.g., games, insurance, weather forecasts). (S-MD.A.1–2, 8.1.12.DA.5) *EU 2* ● classify a distribution of data as symmetric, skewed left, or skewed right by analyzing its shape and spread. (S-ID.A.1) ● interpret and describe the distribution of data using the Empirical Rule to make generalizations about expected values. (S-ID.A.4) ● evaluate whether a distribution is symmetric or skewed by examining graphical displays and summary statistics. (S-ID.A.2) ● identify the key characteristics of a normally distributed curve, including symmetry, center, and spread. (S-ID.A.4) ● construct a sketch of a normal curve that represents a given real-world or simulated data set. (S-ID.A.4, 9.4.12.TL.1) ● apply the standard normal distribution to calculate the probability of a given event using z-scores. (S-ID.A.4) ● calculate z-scores from real-world scenarios and

	interpret their meaning within the context of a standard normal distribution. (S-ID.A.4, 9.4.12.IML.3) ● find a data value that corresponds to a specified probability in an approximately normal distribution. (S-ID.A.4) ● determine the probability of a given region of data values in an approximately normal distribution. (S-ID.A.4) ● find a mean value that corresponds to a specific probability in a sampling distribution of sample means. (S-IC.B.4) ● convert a data value from a normal distribution into its standardized z-score to compare it to other values. (S-ID.A.4) ● determine the probability of a region of mean values in a sampling distribution of sample means. (S-IC.B.4)
Stage Two - Assessment	
Other Evidence: ● Classroom Summarizers ● Independent Practice ● Self Assessments ● Classroom Assessments	
Stage Three - Instruction	

Learning Plan: **Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.** *{place A, M and/or T along with the applicable EU number in parentheses after each statement} All knowledge and skills must be addressed in this section with a corresponding lesson/activity which teaches each concept. The following color codes are used to notate activities that correspond with interdisciplinary connections and 21st Century Life & Career Connections (which involves Technology Literacy): Red = Interdisciplinary Connection; Purple = 21st Century Life & Career Connection*

- Can You Taco Tongue and Evil Eyebrow? Activity - Conditional Probability (A, EU 1)
- Do You Like Green Skittles? Activity - Normal Approximation to Binomial Distribution (T, EU 1)
- Who was the NBA GOAT? Activity - Z-Scores (T, EU 2)
- MLB Marlins Miracle Activity - Probability using a Normal Curve (T, EU 2)

Suggested Sequence of Learning Activities

- Determine the sample space of an event (A, EU 1)
- Find the probability of the occurrence of events using the rules for classical probability and complementary events. (M, EU 1)
- Compare theoretical and experimental probability using the law of large numbers. (T, EU 1)
- Utilize the rules of probability to evaluate risk taking. (T, EU 1)
- Apply the addition rules of probability (mutually exclusive) (M, EU 1)
- Apply the multiplication rules for probability (independence) (M, EU 1)
- Can You Taco Tongue and Evil Eyebrow? Activity - Conditional Probability (A, EU 1)
- Apply the conditional rules for probability. (M, EU 1)
- Find the number of outcomes available in a specific situation using the Fundamental Counting Principle. (T, EU 1)
- Apply the combination and permutation rules to find the number of ways that a number of objects can be selected from a sample size. (M, EU 1)
- Develop probability distributions and use them to determine mathematical expectation. (M, EU 1)
- Identify mean, expected value, standard deviation, and variance of a probability distribution. (M, EU 1)
- Use binomial distribution to determine probability of an event's occurrence. (M, EU 1)
- Do You Like Green Skittles? Activity - Normal Approximation to Binomial Distribution (T, EU 1)
- Use geometric distribution to determine probability of an event's occurrence. (M, EU 1)
- Identify distributions as skewed/symmetric based on visual representations of the data (A, EU 2)
- Build conceptual understanding of the empirical rule and normal distribution. (A, EU 2)
- Apply the empirical rule to estimate population percentages (A, EU 2).

- Explore how changing μ (mean) or σ (standard deviation) affects the shape and interpretation of a normal distribution (A, M, EU 2)
- Build conceptual understanding of what a z-score measures (A, M, EU 2)
- Calculate and interpret z-scores across multiple contexts. (M, EU 2)
- Who was the NBA GOAT? Activity - Z-Scores (T, EU 2)
- Explore how changes in data affect z-scores and relative position. (M, EU 2)
- Apply the properties of the normal distribution to find the probability of a data point falling in a particular region (M, EU 2)
- MLB Marlins Miracle Activity - Probability using a Normal Curve (T, EU 2)
- Find area/probability when given z-scores (M, EU 2)
- Find z-scores when given area/probability (M, EU 2)
- Convert data values to z-scores to utilize the properties of the normal distribution (M, EU 2)
- Find probability when given data values (M, EU 2)
- Find data values when given probability (M, EU 2)
- Apply the Central Limit Theorem to sets of sample data to make inferences regarding the population of interest (T, EU 2)

Pacing Guide

Unit #	***Title of Unit***	***Approximate # of teaching days***
1	Collect, Model, and Analyze Date	48
2	Probability	53
3	One - Sample Inferential Statistics	21
4	Two - Sample Inferential Statistics	13

Instructional Materials

- *TI-Nspire*
- *Desmos*
- *https://www.amstat.org/whats-going-on-in-this-graph*
- *https://slowrevealgraphs.com/*
- *Math Medic*

Accommodations

Special Education: The curriculum will be modified as per the Individualized Education Plan (IEP). Students will be accommodated based on specific accommodations listed in the IEP.

Students with 504 Plans: Students will be accommodated based on specific accommodations listed in the 504 Plan.

English Language Learners: Students will be accommodated based on individual need and in consultation with the ELL teacher.

Students at Risk of School Failure: Students will be accommodated based on individual need and provided various structural supports through their school.

Gifted and Talented Students: Students will be challenged to enhance their knowledge and skills through acceleration and additional independent research on the subject matter.