Standard: - New Jersey Student Learning Standards:S.ID, S.MD, and S.CP
Probability (Chapter 11)

Strand:

S-ID: Interpreting Categorical and Quantitative Data

Summarize, represent, and interpret data on two categorical and quantitative variables

5. *Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.*

S-MD: Using Probability to Make Decisions

Use probability to evaluate outcomes of decisions

7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

S-CP: Conditional Probability and the Rules of Probability

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.*
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.*
5. *Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.*

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.*

7. *Apply the Addition Rule, P(A or B) = P(A) + P(B) - P(A and B), and interpret the answer in terms of the model.*
8. *Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.*

Use permutations and combinations to compute probabilities of compound events and solve problems.

Curriculum aligned with: 2009 New Jersey Core Curriculum Content Standards for 21st Century Skills (9.1 A-F)

21st Century Theme: *Global Awareness ☐,Financial, economic, business and entrepreneurial literacy x Civic literacy ☐,Health literacy ☐Environmental Literacy X*

21st Century Skills: *Critical Thinking & Problem Solving ☐,Creativity and Innovation ☐,Collaboration, Teamwork and Leadership ☐,Cross-Cultural Understanding and Interpersonal Communications X Communication and Media Fluency ☐, Accountability, Productivity and Ethics ☐*

Interdisciplinary Connection: Math=MA, English=ELA, Science=SCI, Social Studies=SS, Physical Education=PE, Art=ART, Music=MU, Technology=TECH, World Language=WL Business = BU

Essential Questions	Enduring Understandings	Activities, Investigation, and Student Experiences
1. How is probability used in everyday life? 2. How does the study of probability integrate itself into the study of statistics? 3. What are conditional probabilities and	*Students will understand….* ● Empirical and Theoretical Probabilities ● Odds ● Expected Value ● Tree diagrams ● OR and AND problems ● Conditional probability	**Task 1 BU** In 100 tosses of a fair coin, 44 landed heads up. Determine the empirical probability of the coin landing heads up. **Answer:** Let E be the event that the coin lands heads up. Then P(E) = 44/100 = 0.44 **Task 2** Numbers 1 – 10 are written on cards and placed in a bag. Find each probability. a) Choosing a number greater than 5 or choosing an odd number. b) Choosing an 8 or choosing a number less than 5.

<table>
<tr>
<td>how do we find them?
4. How do we find the probability of mutually exclusive events?
5. What is the difference between permutations and combinations?</td>
<td>● The counting principal
● Combinations</td>
<td rowspan="2">c) Choosing at least one even number when selecting 2 cards from the bag.

Answer:
a) 4/5
b) 1/2
c) 7/9

Task 3

Suppose you have n items from which you choose r at a time. Explain why you must divide the number of permutations $\frac{n!}{(n-r)!}$ by r! to find the number of combinations $\frac{n!}{(n-r)!r!}$.

<u>Answer:</u>

When counting permutations, order is important so you must count every arrangement of n items taken r at a time. But with combinations, order is not important so you don’t need to count every arrangement of r out of n items (r!). Using $\frac{n!}{(n-r)!}$ over counts the combinations by a factor of r!. Dividing this expression by r! leaves you with the number of combinations of n items taken r at a time.</td>
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<tr>
<td>Content Statements</td>
<td>Cumulative Progress Indicators</td>
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Students will know… ● Empirical probability and theoretical probability ● Odds against an event and odds in favor of an event ● Expected value ● Tree diagrams ● Mutually exclusive and independent events ● Compound probability and conditional probability ● The counting principle, permutations, and combinations.	● Tests ● Quizzes ● Practice problems for homework ● Projects ● Worksheets ● In-class programs	**Modifications and/or Accommodations:** ● **Special Education:** Utilize a multi-sensory (VAKT) approach during instruction, provide alternate presentations of skills by varying the method (repetition, simple explanations, additional examples, modeling, etc.), modify test content and/or format, allow students to retake test for additional credit, provide additional times and preferential seating as needed, review, restate and repeat directions, provide study guides, and/or break assignments into segments of shorter tasks. ● **English Language Learners:** Extend time requirements, preferred seating, positive reinforcement, check often for understanding/review, oral/visual directions/prompts when necessary, supplemental materials including use of online bilingual dictionary, and modified assessment and/or rubric. ● **Students at Risk of School Failure:** Deliver instruction utilizing varied learning styles including audio, visual, and tactile/kinesthetic, provide individual instruction as needed, modify assessments and/or rubrics, repeat
Desired Results		
● Empirical and Theoretical Probabilities ● Odds ● Expected Value ● Tree diagrams		

• OR and AND problems • Conditional probability • The counting principal • Combinations	instructions as needed. **Gifted Students:** Create an enhanced set of introductory activities, integrate active teaching/learning opportunities, incorporate authentic components, propose interest-based extension activities, and connect student to related talent development opportunities. **Spot Light On:** *Seek multiple perspectives and different answers to questions.*
Standards for Mathematical Practices	Teacher Resources
1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Mymathlab.com http://achievethecore.org https://learnzillion.com https://www.khanacademy.org/ https://www.desmos.com/ http://www.ixl.com

LGBT and Disabilities Law: *N.J.S.A. 18A:35-4.35*

Kate Hutton

The mission is to ensure that every student is able to see themselves in our rich and diverse history.

Social and Emotional Learning: ***Competencies***	**Social and Emotional Learning:** ***Sub-Competencies***
Self-Awareness Social Awareness Self-Management Relationship Skills Responsible Decision-Making	• Recognizing the importance of self-confidence in handling daily tasks and challenges. • Demonstrate an awareness of the expectations for social interactions in a variety of ways. • Demonstrate an understanding of the need for mutual respect when viewpoints differ. • Recognize the skills needed to establish and achieve personal and educational goals. • Utilize positive communication and social skills to interact effectively with others. • Develop, implement, and model effective problem solving and critical thinking skills.

New Jersey Legislative Statutes and Administrative Code (place an "X" before each law/statute if/when present within the curriculum map)									
	Amistad Law: *N.J.S.A. 18A 52:16A-88*		Holocaust Law: *N.J.S.A. 18A:35-28*	x	LGBT and Disabilities Law: *N.J.S.A. 18A:35-4.35*	x	Diversity & Inclusion: *N.J.S.A. 18A:35-4.36a*		Standards in Action: *Climate Change*