Winslow Township School District

Statistics I

Unit 3 – Probability and Distributions

Overview: In this unit, students will be able to independently use probability and statistics to represent real world situations and interpret and communicate results, using technology when needed. Students will use independent and dependent probability rules as well as conditional probability formulas. Students will be able to know what random variables are, what is a distribution and how to find expected value, variance and standard deviation. Students will be able to determine applicability of and use binomial and geometric probability formulas.

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Overview	Standards	Unit Focus	Essential Questions
Unit 3	S.CP.A.1-5 S.CP.B.6-9	• Understand independence and conditional probability and use them to interpret data. Describe events as subsets of a sample space. • 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. • 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. • 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. • Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. • 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. • 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. • 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.	• How are probabilities of independent events compared to their joint probability? • How does conditional probability apply to real-life events? • How are two-way frequency tables used to model real-life data? • How are conditional probabilities and independence interpreted in relation to a situation? • What is the difference between experimental and theoretical probabilities? • What is the study of combinatorics and how is it applied in real-life? • What is the difference between binomial and geometric distribution?

	S.MD.A.1-4 S.MD.B.5-7	• 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. • Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. • Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. For example, find the theoretical probability distribution for the number of correct answers obtained by New Jersey Student Learning Standards for Mathematics 31 guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes. • Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected values. • Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. Find the expected payoff for a game of chance. Evaluate and compare strategies on the basis of expected values. • Use probabilities to make fair. Analyze decisions and strategies using probability concepts.	
Unit 3: Enduring Understandings	Probability has the ability to be both trivially simple and immensely complex. Classical probability rules coupled with multiplication, addition, conditional, and counting rules allow the probability of any event occurring to be calculable. The concept of order mattering and not mattering is fundamental in combinatorics. Differentiating between a permutation and combination and how to use them is essential in larger probability problems. Knowledge of the organization of a probability experiment so that all possible outcomes and the likelihood that each event occurs can be organized and summarized by calculating parameters such as mean and standard deviation. Comprehension of the binomial and geometric distribution and binomial experiments can facilitate expected value and probability of individual events.		

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Curriculum Unit 3	Standards		Pacing	
			Days	Unit Days
Unit 3:	S.CP.A.1-2	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"). 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.	15	
	S.CP.A.3-5	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. 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.		
	S.CP.B.6-7	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.		

	S.CP.B.8-9	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.	5	45
	S.MD.A.1-4	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. Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.. Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.	10	
	S.MD.B.5-7	Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. Find the expected payoff for a game of chance. Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident. Use probabilities to make fair. Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).	10	
	Assessment, Re-teach and Extension		5	

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Unit 1 Statistics1	
District/School Formative Assessment Plan	**District/School Summative Assessment Plan**
Pre-Assessment Quizzes, Tests Projects Exit Tickets Daily Monitoring	Unit Benchmark SAT Testing AP Testing
Resources	**Activities**
Textbooks: **Statistics**, Peck,Short, Olsen, 2019, Cengage Learning, Inc. ➢ TI 84+ ➢ Smartboard Technology ➢ Desmos ➢ https://www.khanacademy.org/math/statistics ➢ **Diversity, Equity & Inclusion Educational Resources** https://www.nj.gov/education/standards/dei/	• Use probability formulas and procedures to be both trivially simple and immensely complex. • Follow classical probability rules coupled with multiplication, addition, conditional, and counting rules allow the probability of any event occurring to be calculable. • The concept of order mattering and not mattering is fundamental in combinatorics. • Differentiate between a permutations and combinations and how to use them is essential in larger probability problems. • Use knowledge of the organization of a probability experiment so that all possible outcomes and the likelihood that each event occurs can be organized and summarized by calculating parameters such as mean and standard deviation. • Comprehend binomial and geometric distribution and binomial and geometric experiments can facilitate expected value and probability of individual events.

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Instructional Best Practices and Exemplars	
1. Identifying similarities and differences 2. Summarizing and note taking 3. Reinforcing effort and providing recognition 4. Homework and practice 5. Nonlinguistic representations	6. Cooperative learning 7. Setting objectives and providing feedback 8. Generating and testing hypotheses 9. Cues, questions, and advance organizers 10. Manage response rates

9.1 Personal Financial Literacy, 9.2 Career Awareness, Exploration, Preparation and Training, 9.3 21st Century Life and Careers & 9.4 Life Literacies and Key Skills

9.3.ST.2: Use technology to acquire, manipulate, analyze and report data.
9.3.ST-ET.5: Apply the knowledge learned in STEM to solve problems.
9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.

The implementation of the 21st Century skills and standards for students of the Winslow Township District is infused in an interdisciplinary format in a variety of curriculum areas that include, English language Arts, Mathematics, School Guidance, Social Studies, Technology, Visual and Performing Arts, Science, Physical Education and Health, and World Language.

Additional opportunities to address 9.1, 9.2 & 9.4:

Philadelphia Mint

https://www.usmint.gov/learn/kids/resources/educational-standards

Different ways to teach Financial Literacy.

https://www.makeuseof.com/tag/10-interactive-financial-websites-teach-kids-money-management-skills/

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Modifications for Special Education/504
Students with special needs: The students' needs will be addressed on an individual and grade level using a variety of modalities. Accommodations will be made for those students who need extra time to complete assignment. Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered. • Small group instruction and demonstration • Electronic, printed and verbal instruction • One-on-one demonstration • Leveled informational texts and videos via online • Modeling and guided practice • Read directions aloud • Repeat, rephrase and clarify directions • Extended time as needed • Break down assignments into smaller units • Provide shortened assignments • Modify testing format • Preferential seating • Graphic organizers • Study guides, study aids and re-teaching as needed

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Modifications for At-Risk Students
Formative and summative data will be used to monitor student success. At first signs of failure, student work will be reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations. More time will be made available with a certified instructor to aid students in reaching the standards. • Contact parents, guidance & child study if students are in danger of failing. • Provide an assignment sheet with step-by-step instructions as well as specifications for each project. • Provide design templates. • Provide study guides. • Provide extended time for written assessments. • Extended time as needed • Read directions aloud • Assist with organization • Use of computer to create, edit and store student work. • Emphasize/highlight key concepts • Recognize success • Provide timelines for work completion • Break down multi-step tasks into smaller chunks • Provide copy of class notes and graphic organizer

English Language Learners	Modifications for Gifted Students
All WIDA Can Do Descriptors can be found at this link: https://wida.wisc.edu/teach/can-do/descriptors ☐ Grades 9-12 WIDA Can Do Descriptors: ☐ Listening ☐ Speaking ☐ Reading ☐ Writing ☐ Oral Language Students will be provided with accommodations and modifications that may include: • Relate to and identify commonalities in Architectural & Engineering studies in student's home country • Use sentence/paragraph frames to assist with writing reports. • Work with a partner to develop and understand written and design projects • Provide extended time for written responses. • Assist with organization • Use of computer for quick translation • Emphasize/highlight key concepts • Teacher Modeling • Peer Modeling • Label Classroom Materials - Word Walls	Students excelling in mastery of standards will be challenged with complex, high level challenges related to the topic. • Raise levels of intellectual demands • Require higher order thinking, communication, and leadership skills • Differentiate content, process, or product according to student's readiness, interests, and/or learning styles • Provide higher level texts • Expand use of open-ended, abstract questions • Critical and creative thinking activities that provide an emphasis on research and in-depth study • Enrichment Activities/Project-Based Learning/ Independent Study Additional Strategies may be located at the links: ❖ Gifted Programming Standards ❖ Webb's Depth of Knowledge Levels and/or Revised Bloom's Taxonomy ❖ REVISED Bloom's Taxonomy Action Verbs

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Interdisciplinary Connections
ELA **NJSLSA.SL1** Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively. **NJSLSA.SL2** Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. **NJSLSA.R7.** Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words. **NJSLSA.R10.** Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed. **NJSLSA.W4.** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience **RI.9-10.1** Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.) and make relevant connections, to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain. **RI.9-10.2** Determine a central idea of a text and analyze how it is developed and refined by specific details; provide an objective summary of the text. **W.9-10.6** Use technology, including the Internet, to produce, share, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. **SL.9-10.5** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest. **SL.9-10.6** Adapt speech to a variety of contexts and tasks, demonstrating command of formal English. **RI.11-12.1** Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain. **RI.11-12.2** Determine two or more central ideas of a text, and analyze their development and how they interact to provide a complex analysis; provide an objective summary of the text.
Integration of Computer Science and Design Thinking NJSLS 8
8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms. **8.1.12.AP.2**: Create generalized computational solutions using collections instead of repeatedly using simple variables. **8.1.12.AP.5**: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects. **8.1.12.AP.8**: Evaluate and refine computational artifacts to make them more usable and accessible. **8.2.12.EC.3**: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience.