Unit 4: Probabilistic Modeling

Content Area: **Mathematics**
Course(s):
Time Period: **December**
Length: **4 weeks**
Status: **Published**

Unit Overview:

In this unit, students will again consider the modeling process and the role played by variation, reflecting on the data collected from simulations and the ways data can help answer probabilistic questions and leverage this power for decision-making. In the process of creating powerful simulations, students will learn the basics of programming, which will continue to be a powerful tool for data analysis. During this unit students will use Python in Edu-Blocks and Colab.

Essential Questions:

Do the genres you hear played on shuffle represent the genres of the songs in our playlist?

Enduring Understandings:

- Develop a probability model and use it to find probabilities of events. Estimate probabilities using simulation.
- Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring.

Standards/Indicators/Student Learning Objectives (SLOs):

	Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
MATH.9-12.S.IC.A.2	Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.

MATH.9-12.S.IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
MATH.9-12.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”).
MATH.9-12.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.
MATH.9-12.S.CP.A.5	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

Lesson Titles:

- 4.1 Algorithmic Thinking
- 4.2 Basics of programming (Variables, Loops, If-Then Statements)
- 4.3 Variability
- 4.4 Simulation
- 4.5 Probability (Theoretical and Experimental Probability, Conditional Probability)

Career Readiness, Life Literacies, & Key Skills:

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.7	Plan education and career paths aligned to personal goals.
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.

Inter-Disciplinary Connections:

CS.9-12.8.1.12.DA.1	Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
CS.9-12.8.1.12.DA.5	Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
TECH.8.1.12.A.1	Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
TECH.8.1.12.C.CS2	Communicate information and ideas to multiple audiences using a variety of media and formats.
TECH.8.1.12.E.CS4	Process data and report results.
TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.

Equity Considerations

Holocaust Mandate

Topic:

Materials Used:

Addresses the Following Component of the Mandate:

- Bias
- Bigotry
- Bullying
- Holocaust Studies
- Prejudice

LGBTQ and Disabilities Mandate

Topic (Person and Contribution Addresses):

Materials Used:

Addresses the Following Component of the Mandate:

- Economic
- Political
- Social

Climate Change

Asian American Pacific Islander Mandate

Topic (Person and Contribution Addresses):

Sundar Pichai - CEO of Google

Materials Used:

Discussion in our use of Google Colabs.

Addresses the Following Component of the Mandate:

AAPI

- Economic
- Political
- Social

Summative Assessment:

In this assignment, students consider the probability of different genres being played when a playlist is shuffled. They build a class playlist and discuss the theoretical probabilities of each genre, and then in order to calculate experimental probabilities, students program their own simulations using block-based coding in python. In order to prepare students to program their shuffling simulation they build and analyze a series of simpler programs that help them become familiar with the key ideas behind basic programming. They compare their experimental probabilities to the theoretical probabilities of each song having a given genre.

- Build a Portfolio - Unit 4 Song Shuffling Project

Benchmark Assessments

- Project-Based Assessment
- Skills Based Assessment

Alternative Assessment

- Journal Reflections
- Performance tasks
- Portfolios
- Presentations
- Project-based assignments

Formative Assessment:

- Data Talks/ Class Discussions
- Individual. Partner & Group Exploration Activities

- Jigsaw Assignments
- Math Journals

Resources & Materials:

This curriculum will introduce students to the main ideas in data science through free tools such as Google Sheets, Python, Data Commons and Tableau. Students will learn to be data explorers in project-based units, through which they will develop their understanding of data analysis, sampling, correlation/causation, bias and uncertainty, probability, modeling with data, making and evaluating data-based arguments, the power of data in society, and more! At the end of the course students will have a portfolio of their data science work to showcase their newly developed abilities.

- Data Sets & Visuals
- YouCubed High School Data Science Curriculum

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

- Collect and organize data
- Design a simulation using basic programming skills (variables, loops, and if-then statements)
- Generate outlines of basic code using algorithmic thinking
- Interpret the output of a simulation to answer questions related to probability
- Understand theoretical, experimental, and conditional probability and apply concepts within a context

Modifications

ELL Modifications:

- Choice of test format (multiple-choice, essay, true-false)
- Continue practicing vocabulary
- Provide study guides prior to tests
- Read directions to the student
- Read test passages aloud (for comprehension assessment)
- Vary test formats

G&T Modifications:

- Alternate assignments/enrichment assignments

- Enrichment projects
- Extension activities
- Higher-level cooperative learning activities
- Pairing direct instruction with coaching to promote self-directed learning
- Provide higher-order questioning and discussion opportunities
- Provide texts at a higher reading level
- Tiered assignments
- Tiered centers

At Risk Modifications

The possible list of modifications/accommodations identified for Special Education students can be utilized for At-Risk students. Teachers should utilize ongoing methods to provide instruction, assess student needs, and utilize modifications specific to the needs of individual students. In addition, the following may be considered:

- Additional time for assignments
- Adjusted assignment timelines
- Agenda book and checklists
- Answers to be dictated
- Assistance in maintaining uncluttered space
- Books on tape
- Concrete examples
- Extra visual and verbal cues and prompts
- Follow a routine/schedule
- Graphic organizers
- Have students restate information
- No penalty for spelling errors or sloppy handwriting
- Peer or scribe note-taking
- Personalized examples
- Preferential seating
- Provision of notes or outlines
- Reduction of distractions
- Review of directions
- Review sessions
- Space for movement or breaks
- Support auditory presentations with visuals
- Teach time management skills
- Use of a study carrel
- Use of mnemonics
- Varied reinforcement procedures

- Work in progress check

IEP & 504 Modifications:

*All teachers of students with special needs must review each student's IEP. Teachers must then select the appropriate modifications and/or accommodations necessary to enable the student to appropriately progress in the general curriculum.

Possible Modifications/Accommodations: (See listed items below):

- Allow for redos/retakes
- Assign fewer problems at one time (e.g., assign only odds or evens)
- Differentiated center-based small group instruction
- Extra time on assessments
- Highlight key directions
- If a manipulative is used during instruction, allow its use on a test
- Opportunities for cooperative partner work
- Provide reteach pages if necessary
- Provide several ways to solve a problem if possible
- Provide visual aids and anchor charts
- Test in alternative site
- Tiered lessons and assignments
- Use of a graphic organizer
- Use of concrete materials and objects (manipulatives)
- Use of word processor

Technology Materials and Standards

- Chromebooks
- CODAP
- Edublocks
- Google Colab
- Google Jamboard
- Google Sheets
- Google Slides
- Promethean Board
- Tableau

Computer Science and Design Thinking Standards

CS.6-8.DA	Data & Analysis