Marietta City Schools

2023–2024 District Unit Planner

AP Statistics

Unit title	**Unit 4: Probability, Random Variables, and Probability Distributions**	**Unit duration (hours)**	**10 Class Blocks**

Mastering Content and Skills through INQUIRY (Establishing the purpose of the Unit): *What will students learn?*

Probabilistic reasoning allows statisticians to quantify the likelihood of random events over the long run and to make statistical inferences. Simulations and concrete examples can help students to understand the abstract definitions and calculations of probability. This unit builds on understandings of simulated or empirical data distributions and fundamental principles of probability to represent, interpret, and calculate parameters for theoretical probability distributions for discrete random variables. Interpretations of probability and parameters associated with a probability distribution should use appropriate units and relate to the context of the situation.

GA DoE Standards

Standards

4.1 Introducing Statistics: Random and Non-Random Patterns?
4.2 Estimating Probabilities Using Simulation
4.3 Introduction to Probability
4.4 Mutually Exclusive Events
4.5 Conditional Probability
4.6 Independent Events and Unions of Events
4.7 Introduction to Random Variables and Probability Distributions
4.8 Mean and Standard Deviation of Random Variables
4.9 Combining Random Variables
4.10 Introduction to the Binomial Distribution
4.11 Parameters for a Binomial Distribution
4.12 The Geometric Distribution

Concepts/Skills to support mastery of standards

- Interpret probability as a long-run relative frequency
- Use simulation to model a random process in order to estimate a probability
- Give a probability model for a random process with equally likely outcomes and use it to find the probability of an event.
- Use Basic Probability rules, including the complement rule and the additional rule for mutually exclusive events.

- Use a 2-way table or a Venn Diagram to model a random process and calculate probabilities involving 2 events.
- Apply the general addition rule to calculate probabilities.
- Calculate and interpret conditional probabilities
- Determine whether 2 events are independent
- Use the general multiplication rule to calculate probabilities
- Use a tree diagram to model a chance process involving a sequence of outcomes.
- When appropriate use the multiplication rule for independent events to calculate probabilities.
- Use the probability distribution of a discrete random variable to calculate the probability of an event.
- Make a histogram to display the probability distribution of a discrete random variable and describe its shape.
- Calculate and interpret the mean/expected value of a discrete random variable.
- Calculate and interpret the standard deviation of a discrete random variable.
- Use the probability distribution of a continuous random variable to calculate the probability of an event.
- Calculate the mean and standard deviation of the sum or difference of random variables.
- Determine whether the conditions of a binomial setting are met.
- Calculate and interpret the probability involving binomial distribution.
- Calculate and interpret probability involving geometric random variables.
- Calculate the mean and standard deviation of a geometric distribution.

Vocabulary

Relative Frequency	Law of Large Numbers	Simulation	Complement	Mutually Exclusive	General Addition Rule
Venn Diagram	Independent Events	Probability Model	Conditional Probability	General Multiplication Rule	Tree Diagram
Conditional Probability	Discrete Random Variables	Continuous Random Variables	Expected Value	Probability Distribution	Binomial Setting
10% Condition	Large Counts Condition	Geometric Setting			

Notation

$$P(A \cup B) = P(A) + P(B) - P(A \cap B) \qquad P(A \mid B) = \frac{P(A \cap B)}{P(B)}$$

Probability Distribution	Mean	Standard Deviation
Discrete random variable, X	$\mu_X = E(X) = \sum x_i P(x_i)$	$\sigma_X = \sqrt{\sum (x_i - \mu_X)^2 P(x_i)}$
If X has a **binomial** distribution with parameters n and p, then: $P(X = x) = \binom{n}{x} p^x (1-p)^{n-x}$ where $x = 0, 1, 2, 3, \ldots, n$	$\mu_X = np$	$\sigma_X = \sqrt{np(1-p)}$
If X has a **geometric** distribution with parameter p, then: $P(X = x) = (1-p)^{x-1} p$ where $x = 1, 2, 3, \ldots$	$\mu_X = \frac{1}{p}$	$\sigma_X = \frac{\sqrt{1-p}}{p}$

Essential Questions

How can an event be both random and predictable?
What can we conclude about long run relative frequency?
How does the law of large numbers help us estimate outcomes of events?

What steps are necessary in the simulation process?
What must be true to make a valid probability model?
What are the advantages of using a Venn Diagram to model events?
What does it mean for events to be independent?
What is the relationship between the general multiplication rule and independent events?
Why are the formulas for calculating the standard deviation of adding and subtracting random variables the same?
What conditions must be satisfied for a binomial setting?
What conditions must be satisfied for a geometric setting?

Assessment Tasks

List of common formative and summative assessments.

Formative Assessment(s):

Common Formative Assessment – Ticket out the Door, Homework, Quiz

Summative Assessment(s):

Common Summative Assessment – Unit 4 Summative Test

Learning Experiences

Add additional rows below as needed.

Objective or Content	Learning Experiences	Personalized Learning and Differentiation
Stats Medic Lesson: **Can you get a pair of Aces or a pair of Kings?**	#1 Use the general multiplication rule to calculate probabilities. #2 Use a tree diagram to model a chance process involving a sequence of outcomes and to calculate probabilities. #3 When appropriate use the multiplication rule for independent events to calculate probabilities.	Graphic organizers are provided for each lesson and additional practice as needed. Some students will move through the task independently. Others will need prompts and support for understanding.

Content Resources		
All notes are provided on schoology. The Practice of Statistics Stats Medic AP Statistics Formula Sheet College Board		