



Topic B:

Random Variables and Discrete Probability Distributions

S-MD.A.1, S-MD.A.2, S-MD.A.3, S-MD.A.4

Focus Standards:	S-MD.A.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.
	S-MD.A.2	(+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.
	S-MD.A.3	(+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. <i>For example, find the theoretical probability distribution for the number of correct answers obtained by 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.</i>
	S-MD.A.4	(+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. <i>For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?</i>
Instructional Days: 8		
Lesson 5: Discrete Random Variables (P) ¹		
Lesson 6: Probability Distribution of a Discrete Random Variable (P)		
Lesson 7: Expected Value of a Discrete Random Variable (E)		
Lesson 8: Interpreting Expected Value (E)		
Lessons 9–10: Determining Discrete Probability Distributions (P)		
Lessons 11–12: Estimating Probability Distributions Empirically (P,E)		

In this topic, students first distinguish between discrete and continuous random variables and then focus on probability distributions for discrete random variables. In the early lessons of this topic, students develop an

¹ Lesson Structure Key: **P**-Problem Set Lesson, **M**-Modeling Cycle Lesson, **E**-Exploration Lesson, **S**-Socratic Lesson

understanding of the information that a probability distribution provides and interpret probabilities from the probability distribution of a discrete random variable in context (**S-MD.A.1**). Students work with different representations of probability distributions, using both tables and graphs to represent the probability distribution of a discrete random variable. Lessons 7 and 8 introduce the concept of expected value, and students calculate and interpret the expected value of discrete random variables in context. For example, in Lesson 7, students explore the concept of expected value by playing a game called Six Up, where the first player to roll 15 sixes wins. Students play the game, create a probability distribution, and use the data to calculate the mean of the distribution or expected value. In Lesson 8, students are given a probability distribution for the results of a donation drive for a cancer charity and use the distribution to calculate the expected value for the amount of money donated and interpret the value in context (**S-MD.A.2**).

Once students have developed an understanding of what the probability distribution of a discrete random variable is and what information it provides, they see in Lessons 9 and 10 that probabilities associated with a discrete random variable can be calculated given a description of the random variable (**S-MD.A.3**).

In the final lessons of this topic, students also see how empirical data can be used to approximate the probability distribution of a discrete random variable (**S-MD.A.4**). For example, in Lesson 12 students play a game where they toss two dice, find the absolute difference of the numbers on the two faces, and move the same number of places on a number line. The first player to move past 20 wins the game. Students carry out simulations of the game and use the estimated probabilities to create a probability distribution which is then used to determine expected value.