

E Chapter 5 Exercises

Properties of a Probability Distribution

Answer the question and explain your reasoning.

1. A poster advertising the latest game at a casino lists the probabilities of winning various amounts of money. Can this be a true probability distribution?



2. An insurance company posts the following likelihood for each of the six different types of claims their company covers. Can this be a probability distribution?

Insurance Claims	
X	$P(X)$
Auto physical damage	0.33
Injury claims	0.09
Homeowner's claims	0.21
Health Insurance claims	0.19
Life insurance	0.16
Commercial Claims	0.02

Mean and Standard Deviation for Discrete Probability Distributions

Find each indicated expected value or standard deviation.

3. A nationwide coffee chain is downsizing its branches in six states. It has already told the store managers in five of the six states the amount of downsizing that will occur. The store managers in the sixth state know that the downsizing that has occurred in the other states has the following distribution. If they assume that the probabilities in this distribution represent the likelihood that their stores will be downsized by the given percentages, what percentage of their employees could they expect to be downsized, and with how much variation?

Coffee Chain Downsizing	
Percentage Downsized	Probability
10%	0.25
15%	0.35
20%	0.25
25%	0.10
40%	0.05

4. Suppose that a friend is helping put on a fundraiser for the local animal shelter. One activity is a game using a bowl that contains six green marbles and eight blue marbles. To play the game, each person draws two marbles without replacement (and without looking). If both marbles are green, the player wins \$25. If not, the player must donate \$10 to the animal shelter. The marbles are then replaced for the next player.
 - a. Calculate the expected value of the game for the player.
 - b. Suppose that the marble game is played 350 times. How much money would you expect to be donated to the animal shelter?
5. Begin by creating a probability distribution for the number of heads in five tosses of a coin.
 - a. Explain why this distribution meets the conditions for a binomial distribution.
 - b. Use the discrete probability distribution to calculate the expected value of the random variable.
 - c. The expected value of the random variable is equal to the mean of the distribution. As mentioned in the list of properties of the binomial distribution, the mean of a binomial distribution is given by $\mu = np$. Use this formula to calculate the mean of this probability distribution.
 - d. Does the value you calculated in part b. match the value you calculated in part c.? Explain why or why not.
6. Use the discrete probability distribution you created for Exercise 4.
 - a. Calculate the standard deviation of this distribution. Interpret the standard deviation.
 - b. For a binomial distribution, the formula for standard deviation is $\sigma = \sqrt{np(1-p)}$. Use this formula to calculate the standard deviation for the coin toss distribution. Does this number match the value you calculated in part a.? Explain why or why not.

Discrete Probability Distributions

For each scenario, state the appropriate probability distribution to use, and then find each specified probability.

7. If, in a typical work day, the president of a company is interrupted twice, what is the probability that in a five-day work week she will be interrupted more than 12 times?
8. One day while cleaning out your junk drawer at home, you put all of the loose batteries in a pile. Realizing later that two out of the eight were actually new batteries, you decide that it's necessary to test each battery before throwing it away. What is the probability that the two new batteries are within the first four batteries that you test?
9. Philip is running late for work, and he needs his black socks. Unfortunately, Philip never matches his socks, so there are ten loose white and two loose black socks in his drawer. If he reaches in and randomly grabs two socks at once, what is the probability that he gets the two black socks he needs?
10. Every time Vera goes to the mall, she has a 0.6 chance of forgetting where she parked her car. If she goes to the mall five times this month, what is the probability that she will forget where she has parked fewer than two times?
11. Your boss has ordered lunch for everyone at the office. There are twelve chicken salad plates and six tuna salad plates to choose from. If you randomly select three plates for yourself and two coworkers, what is the probability that they all contain chicken salad?
12. You forgot to study for your statistics quiz, and you don't know the answers to any of the ten questions on the page. If each question has four multiple-choice options (one of which is correct), what is the probability that you will guess the right answer on at least one question?
13. One southern city experiences an ice storm on average once every eight years. Calculate the probability that there is an ice storm in the city twice in the next three years.
14. It is more common in southern states for high school students to take the ACT than the SAT. Assume that the probability that a southern high school student takes the ACT is 0.93 and the probability that a southern high school student takes the SAT is 0.35. Suppose that a group of 24 southern high school students is randomly selected.
 - a. What is the probability that all 24 students have taken the ACT?
 - b. What is the probability that half have taken the SAT?