distribution. Over time the purchasing agent will undoubtedly revise the distribution as more information is gathered about the company's delivery schedule.

b. The expected value is calculated as follows.

$$\begin{aligned} E(X) &= \Sigma\left[x_i P(x_i)\right] \\ &= (1)\frac{1}{4} + (2)\frac{1}{4} + (3)\frac{1}{4} + (4)\frac{1}{4} \\ &= 0.25 + 0.50 + 0.75 + 1 \\ &= 2.5 \text{ weeks} \end{aligned}$$

The variance is calculated as follows.

$$\begin{aligned} \sigma^2 = V(X) &= \Sigma\left[(x_i - \mu)^2 P(x_i)\right] \\ &= (1-2.5)^2 \frac{1}{4} + (2-2.5)^2 \frac{1}{4} + (3-2.5)^2 \frac{1}{4} + (4-2.5)^2 \frac{1}{4} \\ &= (2.25)\frac{1}{4} + (0.25)\frac{1}{4} + (0.25)\frac{1}{4} + (2.25)\frac{1}{4} \\ &= 1.25 \end{aligned}$$

Therefore, the standard deviation is $\sqrt{1.25} \approx 1.12$ weeks.

Example 6.3.3 illustrates an important principle in the application of the discrete uniform distribution. That is, when there is little or no information concerning the outcome of a random variable, the discrete uniform distribution may be a reasonable initial alternative.

6.3 Exercises

Basic Concepts

1. What is the most significant property of the uniform distribution?
2. What is the discrete uniform probability distribution function?
3. Explain why the uniform distribution is often used when there is little or no information concerning the outcome of a random variable.

Exercises

4. In the casino game of roulette, a wheel is spun and a ball is set in motion, ultimately coming to rest in one of the 38 slots on the wheel. Any slot is as likely as any other to capture the ball. Of the 38 slots, 18 are red, 18 are black, and 2 are green. Suppose the entry fee to play a single game is \$1 and the participant bets on red. If the ball comes to rest in one of the red slots, he wins \$1 in addition to getting back the original \$1 entry fee. If the ball does not end up in a red slot, the \$1 entry fee is lost. Let X denote the monetary gain when betting \$1 on red, in a single game of roulette. Gain is defined as the amount won minus the fee to play.

   a. What are the possible values of X?

   b. Is X a discrete or continuous random variable? Explain.

   c. Construct the probability distribution of X.

   d. Find the expected value of X and interpret this number.

   e. Do you feel that in any casino games you would have a positive expected gain? Why?

5. An experiment consists of tossing two coins and a die simultaneously.

a. List the 24 equally likely outcomes.

b. Define the random variable X as the sum of the number of heads on the two coins and the number of dots on the die. What are the possible values of X?

c. Construct the probability distribution of X in the form of a table.

d. Find the expected value of X.

6. A classmate walks into class and states that he has an extra ticket to a rock concert on Friday night. He asks everyone in the class to put their name on a piece of paper and put it in a basket. He plans to draw from the basket to choose the person who will attend the concert with him. If there are 16 people in class that night, what is your chance of being chosen to attend the concert?

7. Sharlene has just put a down payment on a lot in a small subdivision. There are 10 lots in the subdivision and all are approximately 0.25 acres in size. Five builders have been contracted by the subdivision manager to each build two homes in order to finish the subdivision in 6 months. Sharlene's uncle is one of the builders contracted by the subdivision manager. What is the probability that Sharlene's uncle will be the builder that builds her house?

8. You order some clothing online and get an estimated delivery date of June 6–June 11. You know you will be out of town June 8^{th} and 9^{th} and are a little concerned about the package arriving when you are away. Assuming the delivery date follows a discrete uniform distribution, what is the likelihood your package will be delivered while you are out of town?

9. An experiment consists of tossing a coin and rolling a six-sided die simultaneously.

a. List the sample space for the experiment.

b. What is the probability of getting a head on the coin and the number 3 on the die?

c. What is the probability of getting a tail on the coin and at least a 4 on the die?

10. Given the following discrete uniform probability distribution, find the expected value and standard deviation of the random variable.

x	0	1	2	3	4
$P(X = x)$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$

6.4 The Binomial Distribution

The binomial distribution arises from experiments with repeated two-outcome trials, where only one of the outcomes is counted. Experiments of this kind are rather common in the business world. In market research, a survey respondent (a trial) either will or will not recognize a company's brand. The number that recognize the brand is a count that may be modeled as a **binomial random variable**. When a customer (a trial) enters a bank for service, he or she may have to wait. If we are counting customers who have to wait, then the count may conform to the binomial model. Experiments are required to meet several conditions in order to qualify as a binomial experiment.