Ch. 4  Discrete Probability Distributions

4.1 Probability Distributions

1  Decide if a Random Variable is Discrete or Continuous

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) State whether the variable is discrete or continuous.
   The number of cups of coffee sold in a cafeteria during lunch
   A) discrete  B) continuous

2) State whether the variable is discrete or continuous.
   The height of a player on a basketball team
   A) continuous  B) discrete

3) State whether the variable is discrete or continuous.
   The cost of a Statistics textbook
   A) discrete  B) continuous

4) State whether the variable is discrete or continuous.
   The blood pressures of a group of students the day before their final exam
   A) continuous  B) discrete

5) State whether the variable is discrete or continuous.
   The temperature in degrees Fahrenheit on July 4th in Juneau, Alaska
   A) continuous  B) discrete

6) State whether the variable is discrete or continuous.
   The number of goals scored in a soccer game
   A) discrete  B) continuous

7) State whether the variable is discrete or continuous.
   The speed of a car on a Los Angeles freeway during rush hour traffic
   A) continuous  B) discrete

8) State whether the variable is discrete or continuous.
   The number of phone calls to the attendance office of a high school on any given school day
   A) discrete  B) continuous

9) State whether the variable is discrete or continuous.
   The age of the oldest student in a statistics class
   A) continuous  B) discrete
10) State whether the variable is discrete or continuous.
   The number of pills in a container of vitamins
   A) discrete B) continuous

2 Find Probabilities

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) The random variable \( x \) represents the number of cars per household in a town of 1000 households. Find the probability of randomly selecting a household that has less than two cars.

\[
\begin{array}{c|c}
\text{Cars} & \text{Households} \\
0 & 125 \\
1 & 428 \\
2 & 256 \\
3 & 108 \\
4 & 83 \\
\end{array}
\]

A) 0.553 B) 0.809 C) 0.428 D) 0.125

2) The random variable \( x \) represents the number of cars per household in a town of 1000 households. Find the probability of randomly selecting a household that has at least one car.

\[
\begin{array}{c|c}
\text{Cars} & \text{Households} \\
0 & 125 \\
1 & 428 \\
2 & 256 \\
3 & 108 \\
4 & 83 \\
\end{array}
\]

A) 0.875 B) 0.125 C) 0.500 D) 0.083

3) The random variable \( x \) represents the number of cars per household in a town of 1000 households. Find the probability of randomly selecting a household that has between one and three cars, inclusive.

\[
\begin{array}{c|c}
\text{Cars} & \text{Households} \\
0 & 125 \\
1 & 428 \\
2 & 256 \\
3 & 108 \\
4 & 83 \\
\end{array}
\]

A) 0.792 B) 0.125 C) 0.208 D) 0.256

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

4) A student has five motor vehicle accidents in one year and claims that having five accidents is not unusual. Use the frequency distribution below to determine if the student is correct.

\[
\begin{array}{c|c|c|c|c|c}
\text{Accidents} & 0 & 1 & 2 & 3 & 4 & 5 \\
\text{Students} & 260 & 500 & 425 & 305 & 175 & 45 \\
\end{array}
\]

Page 80
5) A baseball player gets four hits during the World Series and a sports announcer claims that getting four or more hits is not unusual. Use the frequency distribution below to determine if the sports announcer is correct.

<table>
<thead>
<tr>
<th>Hits</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Players</td>
<td>7</td>
<td>9</td>
<td>7</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

### 3 Construct Probability Distributions

**SHORT ANSWER.** Write the word or phrase that best completes each statement or answers the question.

**Provide an appropriate response.**

1) A sports analyst records the winners of NASCAR Winston Cup races for a recent season. The random variable \( x \) represents the races won by a driver in one season. Use the frequency distribution to construct a probability distribution.

<table>
<thead>
<tr>
<th>Wins</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drivers</td>
<td>12</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

2) An insurance actuary asked a sample of senior citizens the cause of their automobile accidents over a two-year period. The random variable \( x \) represents the number of accidents caused by their failure to yield the right of way. Use the frequency distribution to construct a probability distribution.

<table>
<thead>
<tr>
<th>Accidents</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Citizens</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

3) A sports announcer researched the performance of baseball players in the World Series. The random variable \( x \) represents the number of hits a player had in the series. Use the frequency distribution to construct a probability distribution.

<table>
<thead>
<tr>
<th>Hits</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Players</td>
<td>7</td>
<td>9</td>
<td>7</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**MULTIPLE CHOICE.** Choose the one alternative that best completes the statement or answers the question.

4) Determine the probability distribution's missing value.

The probability that a tutor will see 0, 1, 2, 3, or 4 students

<table>
<thead>
<tr>
<th>( x )</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( P(x) )</td>
<td>( \frac{4}{27} )</td>
<td>( \frac{1}{27} )</td>
<td>( \frac{5}{9} )</td>
<td>?</td>
<td>( \frac{5}{27} )</td>
</tr>
</tbody>
</table>

A) \( \frac{2}{27} \)  B) \( \frac{1}{9} \)  C) \( \frac{25}{27} \)  D) \( \frac{10}{27} \)
5) Determine the probability distribution's missing value.
The probability that a tutor will see 0, 1, 2, 3, or 4 students

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>P(x)</td>
<td>0.01</td>
<td>0.04</td>
<td>0.37</td>
<td></td>
<td>?</td>
</tr>
</tbody>
</table>

A) 0.24  B) 0.95  C) 0.76  D) -0.29

6) Determine the probability distributions's missing value.
The probability that a tutor sees 0, 1, 2, 3, or 4 students on a given day.

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>P(x)</td>
<td>?</td>
<td>0.15</td>
<td>0.20</td>
<td>0.20</td>
<td>0.25</td>
</tr>
</tbody>
</table>

A) 0.20  B) 0.50  C) 0.80  D) 1.0

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

7) The random variable $x$ represents the number of boys in a family of three children. Assuming that boys and girls are equally likely, (a) construct a probability distribution, and (b) graph the distribution.

8) The random variable $x$ represents the number of tests that a patient entering a hospital will have along with the corresponding probabilities. Graph the probability distribution.

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>P(x)</td>
<td>3/17</td>
<td>5/17</td>
<td>6/17</td>
<td>2/17</td>
<td>1/17</td>
</tr>
</tbody>
</table>

9) The random variable $x$ represents the number of credit cards that adults have along with the corresponding probabilities. Graph the probability distribution.

<table>
<thead>
<tr>
<th>x</th>
<th>P(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.07</td>
</tr>
<tr>
<td>1</td>
<td>0.68</td>
</tr>
<tr>
<td>2</td>
<td>0.21</td>
</tr>
<tr>
<td>3</td>
<td>0.03</td>
</tr>
<tr>
<td>4</td>
<td>0.01</td>
</tr>
</tbody>
</table>

10) In a pizza takeout restaurant, the following probability distribution was obtained. The random variable $x$ represents the number of toppings for a large pizza. Graph the probability distribution.

<table>
<thead>
<tr>
<th>x</th>
<th>P(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.30</td>
</tr>
<tr>
<td>1</td>
<td>0.40</td>
</tr>
<tr>
<td>2</td>
<td>0.20</td>
</tr>
<tr>
<td>3</td>
<td>0.06</td>
</tr>
<tr>
<td>4</td>
<td>0.04</td>
</tr>
</tbody>
</table>
11) Use the frequency distribution to (a) construct a probability distribution for the random variable $x$ represents the number of cars per household in a town of 1000 households, and (b) graph the distribution.

<table>
<thead>
<tr>
<th>Cars</th>
<th>Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>125</td>
</tr>
<tr>
<td>1</td>
<td>428</td>
</tr>
<tr>
<td>2</td>
<td>256</td>
</tr>
<tr>
<td>3</td>
<td>108</td>
</tr>
<tr>
<td>4</td>
<td>83</td>
</tr>
</tbody>
</table>

4 Determine if a Distribution is a Probability Distribution

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

1) Determine whether the distribution represents a probability distribution. If not, identify any requirements that are not satisfied.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$P(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>2</td>
<td>0.2</td>
</tr>
<tr>
<td>3</td>
<td>0.2</td>
</tr>
<tr>
<td>4</td>
<td>0.2</td>
</tr>
<tr>
<td>5</td>
<td>0.2</td>
</tr>
</tbody>
</table>

2) Determine whether the distribution represents a probability distribution. If not, identify any requirements that are not satisfied.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$P(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>-0.3</td>
</tr>
<tr>
<td>6</td>
<td>0.5</td>
</tr>
<tr>
<td>9</td>
<td>0.1</td>
</tr>
<tr>
<td>12</td>
<td>0.3</td>
</tr>
<tr>
<td>15</td>
<td>0.4</td>
</tr>
</tbody>
</table>

3) Determine whether the distribution represents a probability distribution. If not, identify any requirements that are not satisfied. Also, the sum of the probabilities does not equal one.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$P(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.2</td>
</tr>
<tr>
<td>2</td>
<td>1.2</td>
</tr>
<tr>
<td>3</td>
<td>1.4</td>
</tr>
<tr>
<td>4</td>
<td>1.1</td>
</tr>
<tr>
<td>5</td>
<td>1.1</td>
</tr>
</tbody>
</table>
4) Determine whether the distribution represents a probability distribution. If not, any requirements that are not satisfied. Also, the sum of the probabilities does not equal one.

<table>
<thead>
<tr>
<th>x</th>
<th>P(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.49</td>
</tr>
<tr>
<td>2</td>
<td>0.05</td>
</tr>
<tr>
<td>3</td>
<td>0.32</td>
</tr>
<tr>
<td>4</td>
<td>0.07</td>
</tr>
<tr>
<td>5</td>
<td>0.07</td>
</tr>
</tbody>
</table>

5) Determine whether the distribution represents a probability distribution. If not, identify any requirements that are not satisfied. Also, the sum of the probabilities does not equal one.

<table>
<thead>
<tr>
<th>x</th>
<th>P(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-0.2</td>
</tr>
<tr>
<td>2</td>
<td>-0.2</td>
</tr>
<tr>
<td>3</td>
<td>-0.2</td>
</tr>
<tr>
<td>4</td>
<td>-0.2</td>
</tr>
<tr>
<td>5</td>
<td>-0.2</td>
</tr>
</tbody>
</table>

5 Find the Expected Value of the Probability Distribution

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) The random variable x represents the number of boys in a family of three children. Assuming that boys and girls are equally likely, find the mean and standard deviation for the random variable x.

A) mean: 1.50; standard deviation: 0.87  
B) mean: 2.25; standard deviation: 0.87  
C) mean: 1.50; standard deviation: 0.76  
D) mean: 2.25; standard deviation: 0.76

2) The random variable x represents the number of tests that a patient entering a hospital will have along with the corresponding probabilities. Find the mean and standard deviation.

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>P(x)</td>
<td>3/17</td>
<td>5/17</td>
<td>6/17</td>
<td>2/17</td>
<td>1/17</td>
</tr>
</tbody>
</table>

A) mean: 1.59; standard deviation: 1.09  
B) mean: 1.59; standard deviation: 3.71  
C) mean: 2.52; standard deviation: 1.93  
D) mean: 3.72; standard deviation: 2.52
3) The random variable \( x \) represents the number of credit cards that adults have along with the corresponding probabilities. Find the mean and standard deviation.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( P(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.07</td>
</tr>
<tr>
<td>1</td>
<td>0.68</td>
</tr>
<tr>
<td>2</td>
<td>0.21</td>
</tr>
<tr>
<td>3</td>
<td>0.03</td>
</tr>
<tr>
<td>4</td>
<td>0.01</td>
</tr>
</tbody>
</table>

A) mean: 1.23; standard deviation: 0.66  
B) mean: 1.30; standard deviation: 0.32  
C) mean: 1.30; standard deviation: 0.44  
D) mean: 1.23; standard deviation: 0.44

4) In a pizza takeout restaurant, the following probability distribution was obtained. The random variable \( x \) represents the number of toppings for a large pizza. Find the mean and standard deviation.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( P(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.30</td>
</tr>
<tr>
<td>1</td>
<td>0.40</td>
</tr>
<tr>
<td>2</td>
<td>0.20</td>
</tr>
<tr>
<td>3</td>
<td>0.06</td>
</tr>
<tr>
<td>4</td>
<td>0.04</td>
</tr>
</tbody>
</table>

A) mean: 1.14; standard deviation: 1.04  
B) mean: 1.54; standard deviation: 1.30  
C) mean: 1.30; standard deviation: 2.38  
D) mean: 1.30; standard deviation: 1.54

5) One thousand tickets are sold at $1 each. One ticket will be randomly selected and the winner will receive a color television valued at $398. What is the expected value for a person that buys one ticket?

A) $-0.60  
B) $0.60  
C) $1.00  
D) $-1.00

6) If a person rolls doubles when tossing two dice, the roller profits $90. If the game is fair, how much should the person pay to play the game?

A) $18  
B) $90  
C) $89  
D) $87

7) At a raffle, 10,000 tickets are sold at $5 each for three prizes valued at $4,800, $1,200, and $400. What is the expected value of one ticket?

A) $-4.36  
B) $4.36  
C) $0.64  
D) $-0.64

8) At a raffle, 10,000 tickets are sold at $10 each for three prizes valued at $4,800, $1,200, and $400. What is the expected value of one ticket?

A) $-9.36  
B) $9.36  
C) $-0.64  
D) $0.64

9) In a raffle, 1,000 tickets are sold for $2 each. One ticket will be randomly selected and the winner will receive a laptop computer valued at $1200. What is the expected value for a person that buys one ticket?

A) $-0.80  
B) $0.8  
C) $1.20  
D) $-1.20
SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

10) From the probability distribution, find the mean and standard deviation for the random variable $x$, which represents the number of cars per household in a town of 1000 households.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$P(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.125</td>
</tr>
<tr>
<td>1</td>
<td>0.428</td>
</tr>
<tr>
<td>2</td>
<td>0.256</td>
</tr>
<tr>
<td>3</td>
<td>0.108</td>
</tr>
<tr>
<td>4</td>
<td>0.083</td>
</tr>
</tbody>
</table>

4.2 Binomial Distributions

1 Determine if an Experiment is a Binomial Experiment

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

1) Decide whether the experiment is a binomial experiment. If it is not, explain why. You observe the gender of the next 150 babies born at a local hospital. The random variable represents the number of girls.

2) Decide whether the experiment is a binomial experiment. If it is not, explain why. You roll a die 750 times. The random variable represents the number that appears on each roll of the die.

3) Decide whether the experiment is a binomial experiment. If it is not, explain why. You spin a number wheel that has 19 numbers 950 times. The random variable represents the winning numbers on each spin of the wheel.

4) Decide whether the experiment is a binomial experiment. If it is not, explain why. You test four pain relievers. The random variable represents the pain reliever that is most effective.

5) Decide whether the experiment is a binomial experiment. If it is not, explain why. Testing a pain reliever using 40 people to determine if it is effective. The random variable represents the number of people who find the pain reliever to be effective.

6) Decide whether the experiment is a binomial experiment. If it is not, explain why. Surveying 100 prisoners to see how many crimes in which they were convicted. The random variable represents the number of crimes in which each prisoner was convicted.

7) Decide whether the experiment is a binomial experiment. If it is not, explain why. Surveying 1000 prisoners to see whether they are serving time for their first offense. The random variable represents the number of prisoners serving time for their first offense.

8) Decide whether the experiment is a binomial experiment. If it is not, explain why. Each week, a man plays a game in which he has a 36% chance of winning. The random variable is the number of times he wins in 78 weeks.

9) Decide whether the experiment is a binomial experiment. If it is not, explain why. Selecting five cards, one at a time without replacement, from a standard deck of cards. The random variable is the number of red cards obtained.
2. Find the Mean, Variance, and Standard Deviation of a Binomial Distribution

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

1) Assume that male and female births are equally likely and that the birth of any child does not affect the probability of the gender of any other children. Suppose that 650 couples each have a baby; find the mean and standard deviation for the number of girls in the 650 babies.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

2) A test consists of 330 true or false questions. If the student guesses on each question, what is the mean number of correct answers?
   A) 165
   B) 0
   C) 330
   D) 66

3) A test consists of 810 true or false questions. If the student guesses on each question, what is the standard deviation of the number of correct answers?
   A) 14.23
   B) 0
   C) 2
   D) 20.12

4) A test consists of 90 multiple choice questions, each with five possible answers, only one of which is correct. Find the mean and the standard deviation of the number of correct answers.
   A) mean: 18; standard deviation: 3.79
   B) mean: 18; standard deviation: 4.24
   C) mean: 45; standard deviation: 3.79
   D) mean: 45; standard deviation: 6.71

5) In a recent survey, 80% of the community favored building a police substation in their neighborhood. If 15 citizens are chosen, what is the mean number favoring the substation?
   A) 12
   B) 15
   C) 8
   D) 10

6) In a recent survey, 80% of the community favored building a police substation in their neighborhood. If 15 citizens are chosen, what is the standard deviation of the number favoring the substation?
   A) 1.55
   B) 2.40
   C) 0.98
   D) 0.55

7) The probability that an individual is left-handed is 0.15. In a class of 70 students, what is the mean and standard deviation of the number of left-handers in the class?
   A) mean: 10.5; standard deviation: 2.99
   B) mean: 70; standard deviation: 2.99
   C) mean: 10.5; standard deviation: 3.24
   D) mean: 70; standard deviation: 3.24

8) A recent survey found that 60% of all adults over 50 wear glasses for driving. In a random sample of 90 adults over 50, what is the mean and standard deviation of those that wear glasses?
   A) mean: 54; standard deviation: 4.65
   B) mean: 54; standard deviation: 7.35
   C) mean: 36; standard deviation: 4.65
   D) mean: 36; standard deviation: 7.35
9) According to government data, the probability that a woman between the ages of 25 and 29 was never married is 40%. In a random survey of 10 women in this age group, what is the mean and standard deviation of the number that never married?

A) mean: 4; standard deviation: 1.55  
B) mean: 6; standard deviation: 1.55  
C) mean: 6; standard deviation: 155  
D) mean: 4; standard deviation: 2.4

10) According to police sources, a car with a certain protection system will be recovered 92% of the time. If 900 stolen cars are randomly selected, what is the mean and standard deviation of the number of cars recovered after being stolen?

A) mean: 828; standard deviation: 8.14  
B) mean: 828; standard deviation: 66.24  
C) mean: -7272; standard deviation: 8.14  
D) mean: -7272; standard deviation: 66.24

11) The probability that a tennis set will go to a tiebreaker is 18%. In 60 randomly selected tennis sets, what is the mean and the standard deviation of the number of tiebreakers?

A) mean: 10.8; standard deviation: 2.98  
B) mean: 10.8; standard deviation: 3.29  
C) mean: 10.2; standard deviation: 2.98  
D) mean: 10.2; standard deviation: 3.29

12) The probability that a house in an urban area will be burglarized is 5%. If 20 houses are randomly selected, what is the mean of the number of houses burglarized?

A) 1  
B) 10  
C) 0.5  
D) 1.5

3 Find Binomial Probabilities

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) Assume that male and female births are equally likely and that the birth of any child does not affect the probability of the gender of any other children. Find the probability of exactly eight boys in ten births.

A) 0.044  
B) 0.8  
C) 0.176  
D) 0.08

2) Assume that male and female births are equally likely and that the birth of any child does not affect the probability of the gender of any other children. Find the probability of at most three boys in ten births.

A) 0.172  
B) 0.300  
C) 0.003  
D) 0.333

3) A test consists of 10 true or false questions. To pass the test a student must answer at least eight questions correctly. If the student guesses on each question, what is the probability that the student will pass the test?

A) 0.055  
B) 0.8  
C) 0.20  
D) 0.08

4) A test consists of 10 multiple choice questions, each with five possible answers, one of which is correct. To pass the test a student must get 60% or better on the test. If a student randomly guesses, what is the probability that the student will pass the test?

A) 0.006  
B) 0.060  
C) 0.377  
D) 0.205

5) In a recent survey, 66% of the community favored building a police substation in their neighborhood. If 14 citizens are chosen, find the probability that exactly 11 of them favor the building of the police substation.

A) 0.148  
B) 0.001  
C) 0.786  
D) 0.660
6) The probability that an individual is left-handed is 0.11. In a class of 40 students, what is the probability of finding five left-handers?
   A) 0.179  B) 0.125  C) 0.000  D) 0.11

7) A recent survey found that 70% of all adults over 50 wear glasses for driving. In a random sample of 10 adults over 50, what is the probability that at least six wear glasses?
   A) 0.850  B) 0.700  C) 0.200  D) 0.006

8) According to government data, the probability that a woman between the ages of 25 and 29 was never married is 40%. In a random survey of 10 women in this age group, what is the probability that two or fewer were never married?
   A) 0.167  B) 1.002  C) 0.013  D) 0.161

9) According to government data, the probability that a woman between the ages of 25 and 29 was never married is 40%. In a random survey of 10 women in this age group, what is the probability that at least eight were married?
   A) 0.167  B) 1.002  C) 0.013  D) 0.161

10) According to police sources, a car with a certain protection system will be recovered 85% of the time. Find the probability that 5 of 7 stolen cars will be recovered.
    A) 0.210  B) 0.714  C) 0.85  D) 0.15

11) The probability that a tennis set will go to a tie-breaker is 20%. What is the probability that two of three sets will go to tie-breakers?
    A) 0.096  B) 0.2  C) 0.384  D) 0.04

12) Fifty percent of the people that get mail-order catalogs order something. Find the probability that exactly six of 10 people getting these catalogs will order something.
    A) 0.205  B) 0.600  C) 0.001  D) 3.281

13) The probability that a house in an urban area will be burglarized is 5%. If 50 houses are randomly selected, what is the probability that none of the houses will be burglarized?
    A) 0.077  B) 0.050  C) 0.000  D) 0.001

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

14) An airline has a policy of booking as many as 150 persons on a plane that seats 140. Past studies indicate that only 85% of booked passengers show up for their flight. Find the probability that if the airline books 150 persons for a 140-seat plane, not enough seats will be available.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

15) Sixty-five percent of men consider themselves knowledgeable football fans. If 12 men are randomly selected, find the probability that exactly two of them will consider themselves knowledgeable fans.
    A) 0.001  B) 0.109  C) 0.65  D) 0.167
4 Construct Binomial Distributions

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.
1) You observe the gender of the next 100 babies born at a local hospital. You count the number of girls born. Identify the values of \( n, p, \) and \( q \), and list the possible values of the random variable \( x \).

2) Twenty-six percent of people in the United States with Internet access go online to get news. A random sample of five Americans with Internet access is selected and asked if they get the news online. Identify the values of \( n, p, \) and \( q \), and list the possible values of the random variable \( x \).

3) Fifty-seven percent of families say that their children have an influence on their vacation plans. Consider a sample of eight families who are asked if their children influence their vacation plans. Identify the values of \( n, p, \) and \( q \), and list the possible values of the random variable \( x \).

4) Thirty-eight percent of people in the United States have type O+ blood. You randomly select 30 Americans and ask them if their blood type is O+. Identify the values of \( n, p, \) and \( q \), and list the possible values of the random variable \( x \).

4.3 More Discrete Probability Distributions

1 Find Probabilities Using the Geometric Distribution

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.
1) A company ships computer components in boxes that contain 20 items. Assume that the probability of a defective computer component is 0.2. Find the probability that the first defect is found in the seventh component tested. Round your answer to four decimal places.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

2) Basketball player Chauncey Billups of the Detroit Pistons makes free throw shots 88% of the time. Find the probability that he misses his first shot and makes the second.

A) 0.1056  B) 0.7744  C) 0.0144  D) 0.50

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

3) A company ships computer components in boxes that contain 60 items. Assume that the probability of a defective computer component is 0.1. Use the geometric mean to find the mean number of defective parts. Interpret the results.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

4) A company ships computer components in boxes that contain 30 items. Assume that the probability of a defective computer component is 0.2. Use the geometric variance to find the variance of defective parts.

A) 20  B) 0.3125  C) 0  D) 400
2 Find Probabilities Using the Poisson Distribution

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) A statistics professor finds that when he schedules an office hour at the 10:30 a.m. time slot, an average of three students arrive. Use the Poisson distribution to find the probability that in a randomly selected office hour in the 10:30 a.m. time slot exactly five students will arrive.
   A) 0.1008  B) 0.0137  C) 0.0519  D) 0.0070

2) A statistics professor finds that when he schedules an office hour at the 10:30 a.m. time slot, an average of three students arrives. Use the Poisson distribution to find the probability that in a randomly selected office hour no students will arrive.
   A) 0.0498  B) 0.1225  C) 0.1108  D) 0.0743

3) A sales firm receives an average of four calls per hour on its toll-free number. For any given hour, find the probability that it will receive exactly nine calls. Use the Poisson distribution.
   A) 0.0132  B) 0.0001  C) 146.3700  D) 0.0003

4) A sales firm receives an average of three calls per hour on its toll-free number. For any given hour, find the probability that it will receive at least three calls. Use the Poisson distribution.
   A) 0.5768  B) 0.1891  C) 0.4232  D) 0.6138

5) A mail-order company receives an average of five orders per 500 solicitations. If it sends out 100 advertisements, find the probability of receiving at least two orders. Use the Poisson distribution.
   A) 0.2642  B) 0.1839  C) 0.9048  D) 0.9596

6) A local fire station receives an average of 0.55 rescue calls per day. Use the Poisson distribution to find the probability that on a randomly selected day, the fire station will receive fewer than two calls.
   A) 0.894  B) 0.106  C) 0.317  D) 0.087

7) A car towing service company averages two calls per hour. Use the Poisson distribution to determine the probability that in a randomly selected hour the number of calls is three.
   A) 0.1805  B) 0.0664  C) 0.2030  D) 0.0747

8) A book contains 500 pages. If there are 200 typing errors randomly distributed throughout the book, use the Poisson distribution to determine the probability that a page contains exactly three errors.
   A) 0.0072  B) 0.0005  C) 0.1734  D) 0.0129
Decide if the Probability Distribution is Binomial, Geometric, or Poisson

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Decide which probability distribution—binomial, geometric, or Poisson—applies to the question. You do not need to answer the question.

1) Given: The probability that a federal income tax return is filled out incorrectly with an error in favor of the taxpayer is 20%. Question: What is the probability that of the ten tax returns randomly selected for an audit, three returns will contain only errors favoring the taxpayer?
   A) binomial  B) geometric  C) Poisson

2) Given: The probability that a federal income tax return is filled out incorrectly with an error in favor of the taxpayer is 20%. Question: What is the probability that of the ten tax returns randomly selected for an audit in a given week, three returns will contain only errors favoring the taxpayer?
   A) Poisson  B) geometric  C) binomial

3) Given: The probability that a federal income tax return is filled out incorrectly with an error in favor of the taxpayer is 20%. Question: What is the probability that when the ten tax returns are randomly selected for an audit, the sixth return will contain only errors favoring the taxpayer?
   A) geometric  B) binomial  C) Poisson
Ch. 4  Discrete Probability Distributions
Answer Key

4.1  Probability Distributions

1  Decide if a Random Variable is Discrete or Continuous

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) A

2  Find Probabilities

1) A
2) A
3) A
4) The student is not correct. For a student to have five accidents is unusual because the probability of this event is 0.026.
5) The sports announcer is correct. For a baseball player to get four or more hits during a World Series is not unusual because the probability is 0.15625.

3  Construct Probability Distributions

1) 

<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>P(x)</td>
<td>0.71</td>
<td>0.12</td>
<td>0</td>
<td>0.12</td>
<td>0</td>
<td>0</td>
<td>0.06</td>
</tr>
</tbody>
</table>

2) 

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>P(x)</td>
<td>0.16</td>
<td>0.12</td>
<td>0.48</td>
<td>0.12</td>
<td>0.08</td>
<td>0.04</td>
</tr>
</tbody>
</table>

3) 

<table>
<thead>
<tr>
<th>x</th>
<th>P(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.21875</td>
</tr>
<tr>
<td>1</td>
<td>0.28125</td>
</tr>
<tr>
<td>2</td>
<td>0.21875</td>
</tr>
<tr>
<td>3</td>
<td>0.125</td>
</tr>
<tr>
<td>4</td>
<td>0.03125</td>
</tr>
<tr>
<td>5</td>
<td>0.03125</td>
</tr>
<tr>
<td>6</td>
<td>0.0625</td>
</tr>
<tr>
<td>7</td>
<td>0.03125</td>
</tr>
</tbody>
</table>

4) A
5) A
6) A
7) (a)

<table>
<thead>
<tr>
<th>x</th>
<th>P(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$\frac{1}{8}$</td>
</tr>
<tr>
<td>1</td>
<td>$\frac{3}{8}$</td>
</tr>
<tr>
<td>2</td>
<td>$\frac{3}{8}$</td>
</tr>
<tr>
<td>3</td>
<td>$\frac{1}{8}$</td>
</tr>
</tbody>
</table>

(b)

Probability Distribution

Relative frequency

0.40

0.30

0.20

0.10

Boys

0 1 2 3 4

8)

Probability Distribution

Relative frequency

0.40

0.30

0.20

0.10

Tests

0 1 2 3 4
9) Probability Distribution

10) Probability Distribution

Relative frequency

Credit cards

Toppings
11) (a) 

<table>
<thead>
<tr>
<th>x</th>
<th>P(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.125</td>
</tr>
<tr>
<td>1</td>
<td>0.428</td>
</tr>
<tr>
<td>2</td>
<td>0.256</td>
</tr>
<tr>
<td>3</td>
<td>0.108</td>
</tr>
<tr>
<td>4</td>
<td>0.083</td>
</tr>
</tbody>
</table>

(b) 

Determine if a Distribution is a Probability Distribution
1) probability distribution
2) Not a probability distribution. A probability value cannot be negative.
3) Not a probability distribution. A probability value cannot be greater than one.
4) probability distribution
5) Not a probability distribution. A probability value cannot be negative.

Find the Expected Value of the Probability Distribution
1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) \( \mu = 1.596; \sigma = 1.098 \)

4.2 Binomial Distributions

Determine if an Experiment is a Binomial Experiment
1) binomial experiment
2) Not a binomial experiment. There are more than two outcomes.
3) Not a binomial experiment. There are more than two outcomes.
4) Not a binomial experiment. There are more than two outcomes.
5) binomial experiment.
6) Not a binomial experiment. There are more than two outcomes.
7) binomial experiment.
8) binomial experiment.
9) Not a binomial experiment. The probability of success is not the same for each trial.
2 Find the Mean, Variance, and Standard Deviation of a Binomial Distribution
1) $\mu = np = 650(0.5) = 325$; $\sigma = \sqrt{npq} = \sqrt{650(0.5)(0.5)} = 12.75$

3 Find Binomial Probabilities
1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) A
11) A
12) A

4 Construct Binomial Distributions
1) $n = 100; p = 0.5; q = 0.5; x = 0, 1, 2, \ldots, 99, 100$
2) $n = 5; p = 0.26; q = 0.74; x = 0, 1, 2, 3, 4, 5$
3) $n = 8; p = 0.57; q = 0.43; x = 0, 1, 2, 3, 4, 5, 6, 7, 8$
4) $n = 30; p = 0.38; q = 0.62; x = 0, 1, 2, \ldots, 29, 30$

4.3 More Discrete Probability Distributions
1 Find Probabilities Using the Geometric Distribution
1) $(0.8)^6(0.2) = 0.0524$
2) A
3) Geometric mean = 10; on average, 10 items will be examined before finding one that is defective.
4) A

2 Find Probabilities Using the Poisson Distribution
1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A

3 Decide if the Probability Distribution is Binomial, Geometric, or Poisson
1) A
2) A
3) A