3.1

8.1 Exercises

1. Three balls are selected at random without replacement from an urn containing four green balls and six red balls. Let the random variable X denote the number of green balls drawn.
   a. List the outcomes of the experiment.
   b. Find the value assigned to each outcome of the experiment by the random variable X.
   c. Find the event consisting of the outcomes to which a value of 3 has been assigned by X.

2. A coin is tossed four times. Let the random variable X denote the number of tails that occur.
   a. List the outcomes of the experiment.
   b. Find the value assigned to each outcome of the experiment by the random variable X.
   c. Find the event consisting of the outcomes to which a value of 2 has been assigned by X.

3. A die is rolled repeatedly until a 6 falls uppermost. Let the random variable X denote the number of times the die is rolled. What are the values that X may assume?

4. Cards are selected one at a time without replacement from a well-shuffled deck of 52 cards until an ace is drawn. Let X denote the random variable that gives the number of cards drawn. What values may X assume?

5. Let X denote the random variable that gives the sum of the faces that fall uppermost when two fair dice are rolled. Find $P(X = 7)$.

6. Two cards are drawn from a well-shuffled deck of 52 playing cards. Let X denote the number of aces drawn. Find $P(X = 2)$.

In Exercises 7–12, give the range of values that the random variable X may assume and classify the random variable as finite discrete, infinite discrete, or continuous.

7. X = The number of times a die is thrown until a 2 appears

8. X = The number of defective iPods in a sample of eight iPods

9. X = The distance in miles a commuter travels to work

10. X = The number of hours a child watches television on a given day

11. X = The number of times an accountant takes the CPA examination before passing

12. X = The number of boys in a four-child family

In Exercises 13–16, determine whether the table gives the probability distribution of the random variable X. Explain your answer.

13.

x	−3	−2	−1	0	1	2
$P(X = x)$	0.2	0.4	0.3	−0.2	0.1	0.1

14.

x	−2	−1	0	1	2
$P(X = x)$	0.2	0.1	0.3	0.2	0.1

15.

x	1	2	3	4	5	6
$P(X = x)$	0.3	0.1	0.2	0.2	0.1	0.2

16.

x	−1	0	1	2	3
$P(X = x)$	0.3	0.1	0.2	0.2	0.2

In Exercises 17 and 18, find conditions on the numbers a and/or b such that the table gives the probability distribution of the random variable X.

17.

x	0	2	4	6	8
$P(X = x)$	0.1	0.4	a	0.1	0.2

18.

x	−1	0	1	2	4	5
$P(X = x)$	0.3	a	0.2	0.2	b	0.1

19. The probability distribution of the random variable X is shown in the accompanying table:

x	−10	−5	0	5	10	15	20
$P(X = x)$	.20	.15	.05	.1	.25	.1	.15

Find:
   a. $P(X = -10)$
   b. $P(X \geq 5)$
   c. $P(-5 \leq X \leq 5)$
   d. $P(X \leq 20)$
   e. $P(X < 5)$
   f. $P(X = 3)$

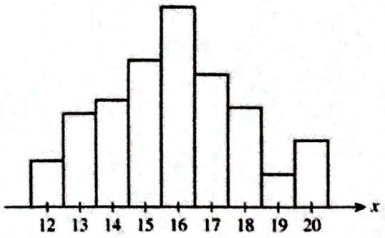
20. The probability distribution of the random variable X is shown in the accompanying table:

x	−5	−3	−2	0	2	3
$P(X = x)$	.17	.13	.33	.16	.11	.10

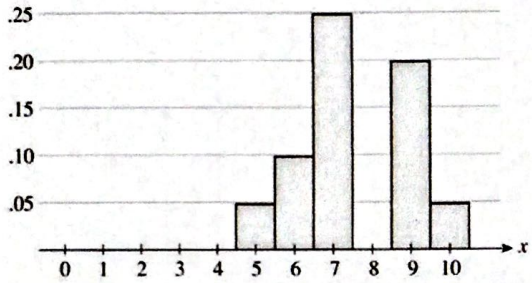
Find:
   a. $P(X \leq 0)$
   b. $P(X \leq -3)$
   c. $P(-2 \leq X \leq 2)$
   d. $P(X = -2)$
   e. $P(X > 0)$
   f. $P(X = 1)$

21. Suppose that the probability distribution of a random variable X is represented by the accompanying histogram.

Shade the part of the histogram whose area gives the probability $P(17 \le X \le 20)$.



22. **Exams** An examination consisting of ten true-or-false questions was taken by a class of 100 students. The probability distribution of the random variable X, where X denotes the number of questions answered correctly by a randomly chosen student, is represented by the accompanying histogram. The rectangle with base centered on the number 8 is missing. What should be the height of this rectangle?



23. Two dice are rolled. Let the random variable X denote the number that falls uppermost on the first die, and let Y denote the number that falls uppermost on the second die.
   a. Find the probability distributions of X and Y.
   b. Find the probability distribution of $X + Y$.

24. **Distribution of Families by Size** The Public Housing Authority in a certain community conducted a survey of 1000 families to determine the distribution of families by size. The results follow:

Family Size	2	3	4	5	6	7	8
Frequency of Occurrence	350	200	245	125	66	10	4

   a. Find the probability distribution of the random variable X, where X denotes the number of people in a randomly chosen family.
   b. Draw the histogram corresponding to the probability distribution found in part (a).
   c. Find the probability that a family chosen at random from those surveyed has more than five members.

25. **Waiting Lines** The accompanying data were obtained in a study conducted by the manager of SavMore Supermarket. In this study, the number of customers waiting in line at the express checkout at the beginning of each 3-min interval between 9 A.M. and 12 noon on Saturday was observed.

Customers	0	1	2	3	4
Frequency of Occurrence	1	4	2	7	14

Customers	5	6	7	8	9	10
Frequency of Occurrence	8	10	6	3	4	1

   a. Find the probability distribution of the random variable X, where X denotes the number of customers observed waiting in line.
   b. Draw the histogram representing the probability distribution.
   c. Find the probability that the number of customers waiting in line in any 3-min interval between 9 A.M. and 12 noon is between 1 and 3, inclusive.

26. **Money Market Rates** The interest rates paid by 30 financial institutions on a certain day for money market deposit accounts are shown in the accompanying table:

Rate, %	3	3.25	3.55	3.56
Institutions	1	7	7	1

Rate, %	3.58	3.60	3.65	3.85
Institutions	1	8	3	2

Let the random variable X denote the interest rate per year paid by a randomly chosen financial institution on its money market deposit accounts.
   a. Find the probability distribution associated with these data.
   b. Find the probability that the interest rate paid by a financial institution chosen at random is less than 3.56% per year.

27. **Television Pilots** After the private screening of a new television pilot, audience members were asked to rate the new show on a scale of 1 to 10 (10 being the highest rating). From a group of 140 people, the following responses were obtained:

Rating	1	2	3	4	5	6	7	8	9	10
Frequency of Occurrence	1	4	3	11	23	21	28	29	16	4

Let the random variable X denote the rating given to the show by a randomly chosen audience member.
   a. Find the probability distribution associated with these data.
   b. What is the probability that the new television pilot got a rating that is higher than 5?