8.3 Self-Check Exercises

1. Compute the mean, variance, and standard deviation of the random variable X with probability distribution as follows:

x	-4	-3	-1	0	2	5
$P(X = x)$	.1	.1	.2	.3	.1	.2

2. James recorded the following travel times (the length of time in minutes it took him to drive to work) on ten consecutive days:

55 50 52 48 50 52 46 48 50 51

Calculate the mean and standard deviation of the random variable X associated with these data.

Solutions to Self-Check Exercises 8.3 can be found on page 462.

8.3 Concept Questions

1. **a.** What is the variance of a random variable X?
   b. What is the standard deviation of a random variable X?

2. What does Chebychev's inequality measure?

3.3 8.3 Exercises #1-16 all

In Exercises 1–6, the probability distribution of a random variable X is given. Compute the mean, variance, and standard deviation of X.

1.

x	1	2	3	4
$P(X = x)$	.4	.3	.2	.1

2.

x	-4	-2	0	2	4
$P(X = x)$	.1	.2	.3	.1	.3

3.

x	-2	-1	0	1	2
$P(X = x)$	1/16	4/16	6/16	4/16	1/16

4.

x	10	11	12	13	14	15
$P(X = x)$	1/8	2/8	1/8	2/8	1/8	1/8

5.

x	430	480	520	565	580
$P(X = x)$	.1	.2	.4	.2	.1

6.

| x	-198	-195	-193	-188	-185
$P(X = x)$	.15	.30	.10	.25	.20

7. The following histograms represent the probability distributions of the random variables X and Y. Determine by inspection which probability distribution has the larger variance.
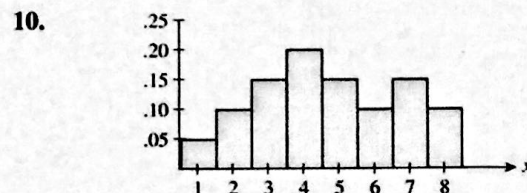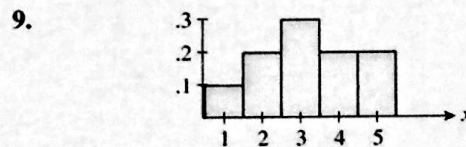
(a)

(b)
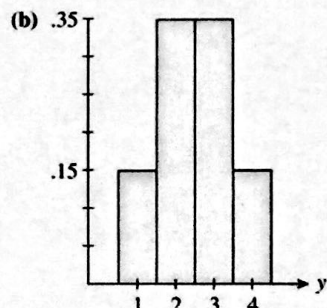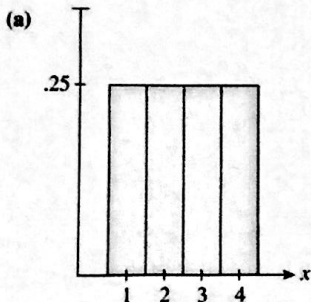
8. The following histograms represent the probability distributions of the random variables X and Y. Determine by inspection which probability distribution has the larger variance.

(a)

(b)
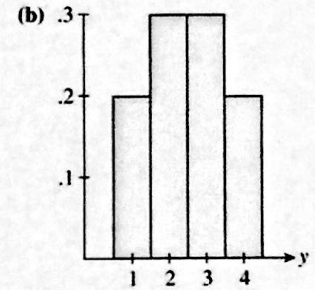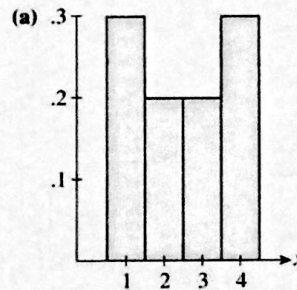
In Exercises 9 and 10, find the variance of the probability distribution for the histogram shown.

9.

10.

11. An experiment consists of rolling an eight-sided die (numbered 1 through 8) and observing the number that appears uppermost. Find the mean and variance of this experiment.

12. **DRIVING AGE REQUIREMENTS** The minimum age requirement for a regular driver's license differs from state to state. The

frequency distribution for this age requirement in the 50 states is given in the following table:

Minimum Age	15	16	17	18	19	21
Frequency of Occurrence	1	15	4	28	1	1

a. Describe a random variable X that is associated with these data.
b. Find the probability distribution for the random variable X.
c. Compute the mean, variance, and standard deviation of X.

13. **BIRTHRATES** The birthrates in the United States for the years 1997–2006 are given in the following table. (The birthrate is the number of live births/1000 population.)

Year	1997	1998	1999	2000
Birthrate	14.5	14.6	14.7	14.5

Year	2001	2002	2003
Birthrate	14.1	13.9	14.1

Year	2004	2005	2006
Birthrate	14.0	14.0	14.2

a. Describe a random variable X that is associated with these data.
b. Find the probability distribution for the random variable X.
c. Compute the mean, variance, and standard deviation of X.

Source: National Center for Health Statistics.

14. **INVESTMENT ANALYSIS** Paul Hunt is considering two business ventures. The anticipated returns (in thousands of dollars) of each venture are described by the following probability distributions:

Venture A

Earnings	Probability
−20	.3
40	.4
50	.3

Venture B

Earnings	Probability
−15	.2
30	.5
40	.3

a. Compute the mean and variance for each venture.
b. Which investment would provide Paul with the higher expected return (the greater mean)?

c. In which investment would the element of risk be less (that is, which probability distribution has the smaller variance)?

15. **INVESTMENT ANALYSIS** Rosa Walters is considering investing $10,000 in two mutual funds. The anticipated returns from price appreciation and dividends (in hundreds of dollars) are described by the following probability distributions:

Mutual Fund A

Returns	Probability
−4	.2
8	.5
10	.3

Mutual Fund B

Returns	Probability
−2	.2
6	.4
8	.4

a. Compute the mean and variance associated with the returns for each mutual fund.
b. Which investment would provide Rosa with the higher expected return (the greater mean)?
c. In which investment would the element of risk be less (that is, which probability distribution has the smaller variance)?

16. The distribution of the number of chocolate chips (x) in a cookie is shown in the following table. Find the mean and the variance of the number of chocolate chips in a cookie.

x	0	1	2
$P(X = x)$	.01	.03	.05

x	3	4	5
$P(X = x)$	.11	.13	.24

x	6	7	8
$P(X = x)$	.22	.16	.05

17. Equation (5) can also be expressed in the form

$$\text{Var}(X) = (p_1x_1^2 + p_2x_2^2 + \cdots + p_nx_n^2) - \mu^2$$

Find the variance of the distribution of Exercise 1 using this equation.

18. Find the variance of the distribution of Exercise 16 using the equation

$$\text{Var}(X) = (p_1x_1^2 + p_2x_2^2 + \cdots + p_nx_n^2) - \mu^2$$