Chapter 7 Review Problems

1. Consider the following five sets of outcomes from random phenomena:

I. The total number of points scored in a randomly selected college football game.
II. Lifespan in hours of a randomly selected halogen light bulb.
III. The number of passengers in a randomly selected city bus.
IV. The airline of the next plane to land at O'Hare International Airport.
V. Length in inches of the next rattlesnake caught in a trap.

Which of the above are <u>continuous</u> random variables?

A. II and III only B. II and V only

C. None of these are continuous random variables.

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2. Which of the following probability distributions of a discrete random variable X is a legitimate probability distribution?

A.

x	1	2	3
$p(x)$	0.3	0.4	0.4

B.

x	−1	0	1
$p(x)$	0.2	0.2	0.5

C.

x	−1	0	1
$p(x)$	0.3	0.4	0.3

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3. In a particular game, a single card is randomly chosen from a box that contains 3 red cards, 1 green card, and 6 blue card. If a red card is selected, you win \$2. If a green card is selected, you win \$4. If a blue card is selected, you lose \$1. Let X be the amount that you win. The expected value of X is

A. \$0.40. B. \$1.00 C. \$1.60

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4. Let Z = the number students in Mr. Rooney's English class who arrive late on a randomly selected day. The expected value of$Z$ is 2. Which one of the following is the best interpretation of what this means?

A. We can be confident that at least 2 students will be late to Mr. Rooney's class on a randomly selected day.

B. On average, the number of students who are late to Mr. Rooney's class on a randomly selected day is 2.

C. There are 2 students in Mr. Rooney's class who almost always arrive late.

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5. Let X = the number of times that a randomly selected customer visits a grocery store during a one-week period. Suppose that the probability distribution of X is as follows:

X	0	1	2	3
$P(X)$	0.1	0.4	0.4	0.1

Determine the probability that a randomly chosen customer visits the grocery store at least twice during a one-week period.

A. 0.9 B. 0.5 C. 0.4

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6. Let X = the number of times that a randomly selected customer visits a grocery store during a one-week period. Suppose that the probability distribution of X is as follows:

X	0	1	2	3
$P(X)$	0.1	0.4	0.4	0.1

Which of the following calculations yield the standard deviation of X, σ_X?

A. (0.1) (0 - 1.5) + (0.4) (1 - 1.5) + (0.4) (2 - 1.5) + (0.1) (3 - 1.5)

B. $\sqrt{(0)(0.1-0.25)^2+(1)(0.4-0.25)^2+(2)(0.4-0.25)^2+(3)(0.1-0.25)^2}$

C. $\sqrt{(0.1)(0-1.5)^2+(0.4)(1-1.5)^2+(0.4)(2-1.5)^2+(0.1)^2(3-1.5)^2}$

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7. The time in minutes X that you must wait before a train arrives at your local subway station is a uniformly distributed random variable that takes on values between 5 minutes and 15 minutes. That is, the density curve of the distribution of X has constant height between $X = 5$ and $X = 15$ and height 0 outside this interval. Determine $P(6 < x < 8)$.

A. 0.1 B. 0.5 C. 0.2

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8. If X and Y are random variables, and $Z = X + Y$, which of the following is a condition for calculating σ_Z^2 by using $\sigma_X^2 + \sigma_Y^2$?

A. X and Y are both normally distributed.

B. X and Y are independent.

C. X and Y are mutually exclusive.

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9. The weight of a medium-sized orange selected at random from a large bin of oranges at a local supermarket is a random variable with mean $\mu = 12$ ounces and standard deviation $\sigma = 1.2$ ounces. Suppose we independently select two oranges at random from the bin. The difference in the weights of the two oranges (the weight of the first orange minus the weight of the second orange) is a random variable with a standard deviation equal to

A. 0 ounces. B. 1.70 ounces.

C. 2.88 ounces

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10. The weight of a medium-sized orange selected at random from a large bin of oranges at a local supermarket is a Normally distributed random variable with mean $\mu = 12$ ounces and standard deviation $\sigma = 1.2$ ounces. Suppose we independently select two oranges at random from the bin. What is the probability that the difference in the weights of the two oranges exceeds 3 ounces?

A. 0.0026 B. 0.0392 C. 0.0784

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11. A widget manufacturer estimates that the total weekly cost in dollars, C, to produce x widgets is given by the linear function $C(x) = 500 + 10x$, where the intercept 500 represents the fixed cost of manufacturing any number of widgets and the slope 10 represents the variable cost of producing x widgets. Analysis of weekly widget production reveals that the number of widgets X produced in a week is a random variable with mean $\mu_X = 200$ and standard deviation $\sigma_X = 20$. What are the mean and the standard deviation of C?

A. $\mu_C = \$2500$; $\sigma_C = \$200$

B. $\mu_C = \$2500$; $\sigma_C = \$700$

C. $\mu_C = \$2000$; $\sigma_C = \$700$

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12. The daily total sales (excluding Saturday) at a small restaurant has a probability distribution that is approximately Normal with a mean of $\mu = \$530$ and a standard deviation of $\sigma = \$120$ The probability the sales will exceed \$700 on a given day is approximately

A. 0.9222. B. 0.5778. C. 0.0778.

Short Answer

13. The probabilities that a randomly selected customer purchases 1, 2, 3, 4, or 5 items at a convenience store are 0.32, 0.12, 0.23, 0.18, and 0.15, respectively.

(a) Construct a probability distribution (table) for the data, and verify that this is a legitimate probability distribution.

(b) Calculate μ_x. Interpret this value in the context of this problem.

(c) Find the standard deviation of X.

(d) Suppose two customers, A and B, are selected at random. Find the mean and standard deviation of the difference in the number of items purchased by A and by B. Show your work.

14. Suppose that the mean height of policemen is 70 inches with a standard deviation of 3 inches. And suppose that the mean height for policewomen is 65 inches with a standard deviation of 2.5 inches. If heights of policemen and policewomen are Normally distributed,

(a) find the probability that a randomly selected policewoman is taller than a randomly selected policeman.

(b) Find the probability that the heights of a randomly selected policewoman and a randomly selected policeman differ by more than 4 inches.

15. A report of the National Center for Health Statistics says that the heights of 20-year-old men have mean 176.8 centimeters (cm) and standard deviation 7.2 cm. There are 2.54 centimeters in an inch. What are the mean and standard deviation in inches?

16. In a large introductory statistics class, the distribution of raw scores on a test X follows a Normal distribution with a mean of 17.2 and a standard deviation of 3.8. The professor decides to scale the scores by multiplying the raw scores by 4 and adding 10.

(a) Define the variable Y to be the scaled score of a randomly selected student from this class. Find the mean and standard deviation of Y.

(b) What is the probability that a randomly selected student has a scaled test score of at least 90?