

**Directions:** *Work on these sheets.*

**Part 1: Multiple Choice.** *Circle the letter corresponding to the best answer.*

- Suppose  $X$  is a random variable with mean  $\mu$ . Suppose we observe  $X$  many times and keep track of the average of the observed values. The law of large numbers says that
  - the value of  $\mu$  will get larger and larger as we observe  $X$ .
  - as we observe  $X$  more and more, this average and the value of  $\mu$  will get larger and larger.
  - this average will get closer and closer to  $\mu$  as we observe  $X$  more and more often.
  - as we observe  $X$  more and more, this average will get to be a larger and larger multiple of  $\mu$ .
  - None of the above.
- In a population of students, the number of calculators owned is a random variable  $X$  with  $P(X = 0) = 0.2$ ,  $P(X = 1) = 0.6$ , and  $P(X = 2) = 0.2$ . The mean of this probability distribution is
  - 0.
  - 2.
  - 1.
  - 0.5.
  - The answer cannot be computed from the information given.
- Refer to the previous problem. The variance of this probability distribution is
  - 1.
  - 0.63.
  - 0.5.
  - 0.4.
  - The answer cannot be computed from the information given.
- The number of calories in a one-ounce serving of a certain breakfast cereal is a random variable with mean 110. The number of calories in a full cup of whole milk is a random variable with mean 140. For breakfast you eat one ounce of the cereal with  $1/2$  cup of whole milk. Let  $Z$  be the random variable that represents the total number of calories in this breakfast. The mean of  $Z$  is
  - 110.
  - 140.
  - 180.
  - 250.
  - 195.
- The weight of reports produced in a certain department has a Normal distribution with mean 60 g and standard deviation 12 g. What is the probability that the next report will weigh less than 45 g?
  - 0.1042

(b) 0.1056

(c) 0.3944

(d) 0.0418

(e) The answer cannot be computed from the information given.

6. Let  $X$  and  $Y$  be discrete random variables and let  $a$  and  $b$  be constants. Which of the following is FALSE?
- (a)  $\text{mean}(X + Y) = \text{mean}(X) + \text{mean}(Y)$ .
  - (b)  $\text{mean}(X - Y) = \text{mean}(X) - \text{mean}(Y)$ .
  - (c)  $\text{mean}(aX) = (a)(\text{mean}(X))$
  - (d)  $\text{mean}(a + bX) = a + b \text{ mean } X$
  - (e) If  $X$  and  $Y$  are independent, then  $\text{mean}(X/Y) = \text{mean}(X)/\text{mean}(Y)$
7.  $X$  and  $Y$  are independent random variables, and  $a$  and  $b$  are constants. Here are some statements about variances and standard deviations.
- I.  $\text{Variance}(X + Y) = \text{Var}(X) + \text{Var}(Y)$
  - II.  $\sigma_{X+Y} = \sigma_X + \sigma_Y$
  - III.  $\text{Var}(a + bX) = b \text{ Var}(X)$
  - IV.  $\sigma_{X-Y} = \sigma_X - \sigma_Y$
  - V.  $\text{Var}(X - Y) = \text{Var}(X) + \text{Var}(Y)$

Which of the following statements are TRUE?

- (a) V
  - (b) I, V
  - (c) I, II
  - (d) III, V
  - (e) None of the statements is true.
8. A randomly chosen subject arrives for a study of exercise and fitness. Consider these statements.
- I. After 10 minutes on an exercise bicycle, you ask the subject to rate his or her effort on the Rate of Perceived Exertion (RPE) scale. RPE ranges in whole-number steps from 6 (no exertion at all) to 20 (maximum exertion).
  - II. You measure  $\text{VO}_2$ , the maximum volume of oxygen consumed per minute during exercise.  $\text{VO}_2$  is generally between 2.5 liters per minute and 6 liters per minute.
  - III. You measure the maximum heart rate (beats per minute).

The statements that describe a discrete random variable are

- (a) None of the statements describes a discrete random variable.
- (b) I.
- (c) II.
- (d) I, III.
- (e) I, II, III.

**Directions:** *Work on these sheets.*

**Part 1: Multiple Choice.** *Circle the letter corresponding to the best answer.*

1. A random variable  $Y$  has the following distribution:

$Y$	-1	0	1	2
$P(Y)$	$3C$	$2C$	0.4	0.1

The value of the constant  $C$  is:

- (a) 0.10.
  - (b) 0.15.
  - (c) 0.20.
  - (d) 0.25.
  - (e) 0.75.
2. A random variable  $X$  has a probability distribution as follows:

$X$	0	1	2	3
$P(X)$	$2k$	$3k$	$13k$	$2k$

Then the probability that  $P(X < 2.0)$  is equal to

- (a) 0.90.
  - (b) 0.25.
  - (c) 0.65.
  - (d) 0.15.
  - (e) 1.00.
3. Cans of soft drinks cost \$ 0.30 in a certain vending machine. What is the expected value and variance of daily revenue ( $Y$ ) from the machine, if  $X$ , the number of cans sold per day has

$E(X) = 125$ , and  $\text{Var}(X) = 50$  ?

- (a)  $E(Y) = 37.5$ ,  $\text{Var}(Y) = 50$
- (b)  $E(Y) = 37.5$ ,  $\text{Var}(Y) = 4.5$
- (c)  $E(Y) = 37.5$ ,  $\text{Var}(Y) = 15$
- (d)  $E(Y) = 37.5$ ,  $\text{Var}(Y) = 30$
- (e)  $E(Y) = 125$ ,  $\text{Var}(Y) = 4.5$

4. A rock concert producer has scheduled an outdoor concert. If it is warm that day, she expects to make a \$20,000 profit. If it is cool that day, she expects to make a \$5000 profit. If it is very cold that day, she expects to suffer a \$12,000 loss. Based upon historical records, the weather office has estimated the chances of a warm day to be 0.60; the chances of a cool day to be 0.25. What is the producer's expected profit?

- (a) \$5000
- (b) \$13,000
- (c) \$15,050
- (d) \$13,250
- (e) \$11,450

5. In a particular game, a fair die is tossed. If the number of spots showing is either 4 or 5, you win \$1, if the number of spots showing is 6, you win \$4, and if the number of spots showing is 1, 2, or 3, you win nothing. Let  $X$  be the amount that you win. The expected value of  $X$  is

- (a) \$0.00.
- (b) \$1.00.
- (c) \$2.50.
- (d) \$4.00.
- (e) \$6.00.

*Questions 6 and 7 use the following:* Suppose  $X$  is a random variable with mean  $\mu_X$  and standard deviation  $\sigma_X$ . Suppose  $Y$  is a random variable with mean  $\mu_Y$  and standard deviation  $\sigma_Y$ .

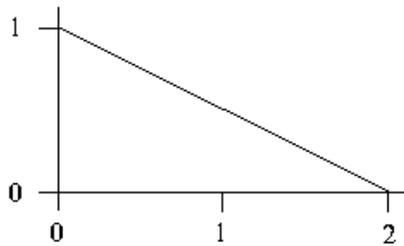
6. The mean of  $X + Y$  is

- (a)  $\mu_X + \mu_Y$ .
- (b)  $(\mu_X / \sigma_X) + (\mu_Y / \sigma_Y)$ .
- (c)  $\mu_X + \mu_Y$ , but only if X and Y are independent.
- (d)  $(\mu_X / \sigma_X) + (\mu_Y / \sigma_Y)$ , but only if X and Y are independent.
- (e) None of these.

7. The variance of  $X + Y$  is

- (a)  $\sigma_X + \sigma_Y$ .
- (b)  $(\sigma_X)^2 + (\sigma_Y)^2$ .
- (c)  $\sigma_X + \sigma_Y$ , but only if X and Y are independent.
- (d)  $(\sigma_X)^2 + (\sigma_Y)^2$ , but only if X and Y are independent.
- (e) None of these.

8. Suppose X is a continuous random variable taking values between 0 and 2 and having the probability



density function below.

$P(1 \leq X \leq 2)$  has value

- (a) 0.50.
- (b) 0.33.
- (c) 0.25.
- (d) 0.00.
- (e) None of these.

ANSWERS:

7A

- 1) C
- 2) C
- 3) D
- 4) C
- 5) B
- 6) E
- 7) B
- 8) D

7C

- 1) A
- 2) B
- 3) B
- 4) E
- 5) B
- 6) A
- 7) D
- 8) C