

## Chapter 6: Random Variables

### Key Vocabulary:

- random variable
- discrete random variable
- probability distribution
- mean of a random variable
- variance of a random variable
- probability density curve
- continuous random variable
- standard deviation

- binomial setting
- binomial random variable
- binomial distribution
- binomial coefficient
- binomial probability
- linear transformation
- normal approximation



- geometric setting
- geometric distribution
- geometric random variable
- Normal approximation
- geometric probability

- factorial
- expected value
- standard deviation
- $\mu_X$
- $\mu_Y$
- uniform distribution

## **Discrete and Continuous Random Variables**

1. What is a *random variable*?
2. Define *probability distribution*.
3. What is a *discrete* random variable?
4. What are the *two requirements* for the probability distributions of discrete random variables?
5. If  $X$  is a *discrete random variable*, what information does the *probability distribution of  $X$*  give?
6. In a probability *histogram* what does the height of each bar represent (assuming the width of each bar is the same)?
7. In a probability *histogram*, what is the sum of the height of each bar?
8. What is the mean  $\mu_X$  of a discrete random variable  $X$ ?
9. How do you calculate the *mean of a discrete random variable*?
10. Define *expected value*. What notation is used for expected value?
11. Does the expected value of a random variable have to equal one of the possible values of the random variable? Explain.

12. Explain how to *calculate the variance and standard deviation* of a discrete random variable.
13. Explain the meaning of the standard deviation of a random variable  $X$ .
14. What is a *continuous random variable* and how is it displayed?
15. If  $X$  is a *continuous random variable*, how is the *probability distribution of  $X$*  described?
16. What is the area under a *probability density curve* equal to?
17. What is the difference between a *discrete random variable* and a *continuous random variable*?
18. If  $X$  is a *discrete random variable*, do  $P(X > 2)$  and  $P(X \geq 2)$  have the same value? Explain.
19. If  $X$  is a *continuous random variable*, do  $P(X > 2)$  and  $P(X \geq 2)$  have the same value? Explain.
20. How is a *Normal distribution* related to *probability distribution*?

## **Transforming and Combining Random Variables**

1. What is the effect on a random variable of *multiplying or dividing by a constant*?

2. How does *multiplying by a constant* effect the variance?
3. What is the effect on a random variable of *adding or subtracting by a constant*?
4. Define *linear transformation*.
5. What are the effects of a *linear transformation* on the *mean* and *standard deviation*?
6. Define the *mean of the sum of random variables*.
7. What are *independent random variables*?
8. Define the *variance of the sum of independent random variables*. What types of variables does it apply to?
9. When can you *add the variances* of two random variables?
10. State the equation for the *mean of the difference* of random variables?
11. State the formula for the *variance of the difference* of random variables.

12. What happens if two independent Normal random variables are combined?

13. Suppose  $\mu_X = 5$  and  $\mu_Y = 10$ . According to the rules for means, what is  $\mu_{X+Y}$ ?

14. Suppose  $\mu_X = 2$ . According to the rules for means, what is  $\mu_{3+4X}$ ?

15. Suppose  $\sigma_X^2 = 2$  and  $\sigma_Y^2 = 3$  and  $X$  and  $Y$  are independent random variables.

According to the rules for variances, what is  $\sigma_{X+Y}^2$ ? What is  $\sigma_{X+Y}$ ?

16. Suppose  $\sigma_X^2 = 4$ . According to the rules for variances, what is  $\sigma_{3+4X}^2$ ? What is  $\sigma_{3+4X}$ ?

## **Binomial and Geometric Random Variables**

1. What is a *binomial setting*?
2. Describe the *conditions* of a binomial setting.
3. What is a *binomial random variable* and what are its possible values?
4. Define the *parameters* of a binomial distribution.
5. Explain the meaning of the *binomial coefficient* and state the *formula*.
6. Explain how to *calculate binomial probabilities*.
7. What commands on the calculator are used to calculate binomial probabilities?
8. Explain how to calculate the *mean* and *standard deviation* of a *binomial random variable*.
9. When can the binomial distribution be used to sample without replacement? Explain why this is an issue.

10. What is a *geometric setting*?

11. Describe the *conditions* for a geometric setting.

12. What is a *geometric random variable* and what are its possible values?

13. Describe the *parameters* of a geometric distribution.

14. What is the *formula* for geometric probability?

15. How is the *mean* of a geometric random variable calculated?