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
- μ_X
- μ_{Y}
- uniform distribution

6.1 Discrete and Continuous Random Variables (pp.341-352)

- 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 μ_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 $P(X \ge 2)$ have the same value? Explain.
- 19. If X is a *continuous random variable*, do P(X > 2) and $P(X \ge 2)$ have the same value? Explain.
- 20. How is a Normal distribution related to probability distribution?

6.2 Transforming and Combining Random Variables (pp.358-375)

- 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 μ_x = 5 and μ_y = 10. According to the rules for means, what is μ_{X+Y} ?

- 14. Suppose μ_x = 2. According to the rules for means, what is μ_{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 σ_{X+Y}^2 ? What is σ_{X+Y}^2 ?
- 16. Suppose σ_X^2 = 4. According to the rules for variances, what is σ_{3+4x}^2 ? What is σ_{3+4x} ?

6.3 Binomial and Geometric Random Variables (pp.382-401)

- 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?