# Chapter 6 The Binomial Probability Distribution and Related Topics

Course Number

Instructor

Date

## Section 6.1 Introduction to Random Variables and Probability Distribution

**Objective:**
In this section you learned how to distinguish between discrete and continuous random variables, how to graph discrete probability distributions, and how to compute $\mu$ and $\sigma$ for a discrete probability distribution.

| **Important Vocabulary** | Define each term or concept. |
|---|---|
| **Random variable** | |
| **Discrete random variable** | |
| **Continuous random variable** | |
| **Probability distribution** | |
| **Mean of a discrete probability distribution** | |
| **Standard deviation of a discrete probability distribution** | |
| **Expected value** | |

### I. Random Variable

***Focus Points***
how to distinguish between discrete and continuous random variables

A quantitative variable $x$ is a _____ if the value that $x$ takes on is a random outcome from a given experiment. If $x$ can take on only a finite number of values or a countable number of values, then $x$ is a _____ random variable. If $x$ can take on any value in a line interval, then it is a _____ random variable.

**Example 1.** Which of the following random variables are discrete and which are continuous?

(a) the time it takes for a boy to run 100 meters

(b) the number of pencils left on a table

(c) the amount of gasoline left in a tank

(d) the number of history majors in a random sample of 100 college students

## II. Probability Distribution of a Discrete Random Variable

***Focus Points***
how to graph discrete probability distributions, how to compute $\mu$ and $\sigma$ for a discrete probability distribution

An assignment of probabilities to each distinct value of a _____ random variable or to each interval of values of a _____ random variable is called a _____.

The _____ of a discrete probability distribution if the a "central point" or "cluster point" for the entire distribution. It is also called the _____. The _____ is a measure of the likelihood that the variable $x$ is different from the mean.

**Example 2.** A quiz with possible scores 1, 2, 3, and 4 was given to a class of 20 students. The score distribution is listed in this table:

| Score $x$ | Number of students |
|---|---|
| 1 | 3 |
| 2 | 7 |
| 3 | 6 |
| 4 | 4 |

(a) If you randomly select a student from this class, what is the probability that his or her score is 2?

(b) Make a probability distribution table for this distribution.

(c) Make a graph for this probability distribution.

(d) Find $P(3 \text{ or } 4)$.

**Example 3.** The same quiz as in Example 2, with possible scores 1, 2, 3, and 4, was also given to another class of 25 students.

(a) Part of the score distribution and corresponding probability distribution table is given below. Complete the table.

| Score $x$ | Number of students | Probability |
|---|---|---|
| 1 | ___ | 0.2 |
| 2 | 6 | ___ |
| 3 | 10 | ___ |
| 4 | ___ | 0.16 |

(b) Do the probabilities of all the scores add up to 1?

(c) If a student is selected from this class at random, what is the probability that his or her score is below 3?

**Example 4.** For the probability distribution in Example 2, find the mean and standard deviation.

**Example 5.** At a carnival, you pay \$1.00 to play a coin-flipping game with two fair coins. If you get Head on both coins, then you win \$3.00. Are your expected earnings equal to the cost to play?

(a) What is the random variable of interest in this case? What is the sample space for this random variable?

(b) There are four equally likely outcomes for throwing two coins. What are they?

(c) Complete the following table regarding the earning.

| Earning $x$ | Frequency | $P(x)$ | $xP(x)$ |
|---|---|---|---|
| 0 | 3 | ___ | ___ |
| 3 | ___ | 0.25 | ___ |

(d) Find the expected earnings. Is that more than, equal to, or less than the cost to play? What does that mean in the long run?

## Additional Notes

**Homework Assignment**

Page(s)

Exercises