Chapter 9 Sequences, Series, and Probability

Course/Section
Lesson Number
Date

Section 9.7 Probability

Section Objectives: Students will know how to find the probabilities of events and their complements.

I. The Probability of an Event (pp. 701−704) Pace: 15 minutes

- Define the following terms. Any happening for which the result is uncertain is called an **experiment.** The possible results of the experiment are **outcomes,** the set of all possible outcomes of the experiment is the **sample space** of the experiment, and any subset of the sample space is an **event.**

  Example 1. Find the sample space of the experiment of one fair coin being tossed and one fair, six-sided die being rolled.

  $S = \{H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6\}$

- State the following probability formula.
  If an event E has $n(E)$ equally likely outcomes and its sample space S has $n(S)$ equally likely outcomes, the **probability** of event E is

  $$P(E) = \frac{n(E)}{n(S)}.$$

- State the following three facts that come from this formula.
  1. $0 \le P(E) \le 1$
  2. $P(E) = 0$ if E is impossible.
  3. $P(E) = 1$ if E must occur.

  Example 2. A single card is drawn from a standard deck of playing cards.

  a) What is the probability of drawing a king?

  $$P(E) = \frac{n(E)}{n(S)} = \frac{4}{52} = \frac{1}{13}.$$

  b) What is the probability of drawing a club?

  $$P(E) = \frac{n(E)}{n(S)} = \frac{13}{52} = \frac{1}{4}.$$

  Example 3. Two six-sided dice are tossed.

  a) What is the probability that the total is 4?

  $$P(E) = \frac{n(E)}{n(S)} = \frac{3}{36} = \frac{1}{12}$$

  b) What is the probability that the total is less than 4?

  $$P(E) = \frac{n(E)}{n(S)} = \frac{3}{36} = \frac{1}{12}$$

  Example 4. A committee of three is to be picked at random from a group of four boys and five girls. What is the probability that the committee will consist entirely of boys?

  $$P(E) = \frac{n(E)}{n(S)} = \frac{{}_4C_3}{{}_9C_3} = \frac{4}{84} = \frac{1}{21}.$$

II. Mutually Exclusive Events (pp. 705−706) Pace: 10 minutes

- State that two events A and B are **mutually exclusive** if A and B have no outcomes in common.
- State the following probability formula.
  If A and B are events in the same sample space, the probability of A *or* B occurring is given by
  $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.
  If A and B are mutually exclusive, then
  $P(A \cup B) = P(A) + P(B)$.

  Example 5. A single card is drawn from a standard deck of playing cards. What is the probability of drawing a club or a face card?

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$
$$= \frac{13}{52} + \frac{12}{52} - \frac{3}{52} = \frac{22}{52} = \frac{11}{13}$$

  Example 6. Two fair, six-sided dice are rolled. What is the probability of getting a total of more than 10?
  This is the same question as, "What is the probability of getting a total of 11 or 12?" Also, note that the events are mutually exclusive.

$$P(A \cup B) = P(A) + P(B) = \frac{2}{36} + \frac{1}{36} = \frac{1}{12}.$$

III. Independent Events (p. 707) Pace: 5 minutes

- State that two events are **independent** if the occurrence of one has no effect on the occurrence of the other.
- State the following probability formula.
  If A and B are independent events, the probability that both A and B will occur is
  $P(A \text{ and } B) = P(A) \bullet P(B)$.

  Example 7. A fair coin is tossed three times. What is the probability of getting all heads?

$$P(E) = \left(\frac{1}{2}\right)^3 = \frac{1}{8}$$

IV. The Complement of an Event (p. 708) Pace: 5 minutes

- State that the **complement of an event** A, denoted by A', is the collection of all outcomes in the sample space that are not in A.
  $P(A \cup A') = P(A) + P(A') - P(A \cap A') = P(A) + P(A') - 0 = 1$
  Therefore, $P(A') = 1 - P(A)$.

  Example 8. Two fair, six-sided dice are rolled. What is the probability of getting a total of less than or equal to 10?
  The complement of this event is getting a total of more than 10. We found the probability of this complement in Example 6 above.
  $P(A') = 1 - P(A) = 1 - 1/12 = 11/12$

- Discuss the *Exploration* on page 708 of the text.