

# Statistics and Probability

## Chapter 4 Review Assignment

### True or False

1. If  $A$  and  $B$  are any two events of a sample space  $S$ , then the addition rule is:  $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ .
2. If  $A$  and  $B$  are any two independent events of a sample space  $S$ , then  $A$  and  $B$  may be mutually exclusive.
3. The value found for experimental probability will always be exactly equal to the theoretical probability assigned to the same event.
4. If  $P(A) = 0.3$ ,  $P(B) = 0.6$ , and  $P(A \text{ and } B) = 0.18$ , then  $A$  and  $B$  are independent events.
5. If  $P(A) = 0.4$ ,  $P(B) = 0.3$ , and  $P(A \text{ and } B) = 0.15$ , then  $P(B | A) = 0.45$ .

### Multiple Choice

6. Suppose  $A$  and  $B$  are events of a sample space  $S$  with  $P(A) = 0.22$ ,  $P(B) = 0.40$ , and  $P(A \text{ and } B) = 0.04$ , then  $P(A|B)$  is...
  - A. 0.462
  - B. 0.300
  - C. 0.182
  - D. 0.100
7. If  $P(A) = 0.80$ ,  $P(B) = 0.70$  and  $P(A \text{ or } B) = 0.90$ , then  $P(A \text{ and } B)$  is:
  - A. 0.10
  - B. 0.14
  - C. 0.60
  - D. 0.72
8. If  $A$  and  $B$  are mutually exclusive events with  $P(A) = 0.40$ , then  $P(B)$ :
  - A. can be any value between 0 and 1
  - B. cannot be larger than 0.40
  - C. cannot be larger than 0.60
  - D. cannot be determined with the information given
9. Two events  $A$  and  $B$  are said to be independent if:
  - A.  $P(A \text{ and } B) = P(A) \cdot P(B)$
  - B.  $P(A \text{ and } B) = P(A) + P(B)$
  - C.  $P(A | B) = P(B)$
  - D.  $P(B | A) = P(A)$
10. Which of the following statements is always correct?
  - A.  $P(A \text{ and } B) = P(A) \cdot P(B)$
  - B.  $P(A \text{ or } B) = P(A) + P(B)$
  - C.  $P(A \text{ or } B) = P(A) + P(B) + P(A \text{ and } B)$
  - D.  $P(A) = 1 - P(A)$

### Short Answers

11. A computer program produces a random integer between 0 and 9 (inclusive). Find the probability that the integer is a number greater than 5.
12. After examining 5000 records of children of age 5, a dentist finds that 2235 had at least one cavity on their first dental check-up. What empirical probability would the dentist assign to the event that a 5-year-old would have at least one cavity on his/her first dental check-up?
13. Three identical slips of paper with the numbers 1, 2, and 3 (one number on each slip) are placed in a box. One slip is randomly selected, and then, without replacement, a second slip is selected. Find the probability that the sum of the two numbers is even.
14. A sample space is composed of three outcomes, called  $A$ ,  $B$ , and  $C$ . Outcome  $B$  is twice as probable as  $A$ , and  $C$  is twice as probable as  $B$ . Find the probabilities of the events of  $A$ ,  $B$ , and  $C$ .
15. Five cards are randomly selected from a standard deck. Let  $A$  be the event that all five selected cards are the same suit. Using counting techniques, the  $P(A)$  can be computed to be 0.002. Find the probability that all the cards are not the same suit.
16. Explain why events  $A$  and  $B$  cannot be mutually exclusive if they are defined on a common sample space with  $P(A) = 0.56$  and  $P(B) = 0.61$ .
17. Events  $A$  and  $B$  are mutually exclusive events defined on a common sample space. If  $P(A) = 0.4$  and  $P(A \text{ or } B) = 0.9$ , find  $P(B)$ .
18. Events  $A$  and  $B$  are defined on a common sample space. If  $P(A) = 0.20$ ,  $P(B) = 0.40$ , and  $P(A \text{ or } B) = 0.56$ , find  $P(A \text{ and } B)$ .
19. A box contains five red, three blue, and two white poker chips. Two are selected without replacement. Find the probability that both are the same color.
20. Events  $A$  and  $B$  are mutually exclusive events defined on a common sample space. If  $P(A) = 0.4$  and  $P(A \text{ or } B) = 0.9$ , find  $P(B)$ .

### Calculated Answers

21. A two-stage experiment is performed, in which the first stage a coin is tossed and heads ( $H$ ) or tails ( $T$ ) is observed. In the second stage, a single card is randomly selected from a standard deck of 52 cards, and the suit of clubs ( $C$ ), spades ( $S$ ), diamonds ( $D$ ), or hearts ( $H$ ) is observed. List the sample space for this experiment.
22. The probability that a first-time tourist to the city of Chicago will visit the Art Institute is 0.4, will visit the Museum of Science and Industry is 0.3, and will visit both is 0.1. If a first-time tourist to Chicago is randomly selected, find the probability that the tourist will visit:
  - a. the Art Institute or the Museum of Science and Industry,
  - b. neither of these attractions, and
  - c. one, but not both, of these attractions.

23. The probability that a first-time tourist to the city of Toledo will visit the Art Museum is 0.5, will visit the Toledo Zoo is 0.4, and will visit both is 0.25. If a first-time tourist to Toledo is randomly selected, find the probability that the tourist will visit:
- the Art Museum or the Toledo Zoo
  - neither of these attractions, and
  - one, but not both, of these attractions.

24. Five hundred people are classified based on their smoking habits and whether or not they have prominent wrinkles. The results are shown below:

	<i>Prominent Wrinkles</i>	<i>Wrinkles Not Prominent</i>
<i>Heavy smoker</i>	120	60
<i>Light or nonsmoker</i>	75	245

One individual is randomly selected from that group of 500 people.

- Given that the individual is a heavy smoker, what is the probability that he/she does not have prominent wrinkles?
  - What is the probability that the selected individual is a heavy smoker or has prominent wrinkles?
25. Events  $A$  and  $B$  are events of a sample space  $S$  with  $P(A) = 0.32$ ,  $P(B) = 0.11$ , and  $P(A \text{ and } B) = 0.08$ . Are  $A$  and  $B$  independent events? You must give a written explanation. A simple answer of "yes" or "no" will receive no credit.
26. A box contains 12 red marbles and 8 blue marbles. Three marbles are randomly selected, one at a time. Find the probability that all three are blue if they are selected:
- with replacement
  - without replacement
27. Suppose  $A$  and  $B$  are events of a sample space  $S$  with  $P(A) = 0.36$ ,  $P(B) = 0.24$ , and  $P(A \text{ and } B) = 0.06$ . Find each of the following:
- $P(A \text{ or } B)$
  - $P(A|B)$
  - $P(A|B)$
  - $P(B|A)$
  - $P(B|A)$
28. Suppose that a box of marbles contains an equal number of red and white marbles but twice as many blue marbles as red marbles. Draw one marble from the box and observe its color. Assign probabilities to the elements in the sample space.
29. Five cards are randomly selected from a standard deck of 52 cards. Find the probability that all five cards are red if they are selected:
- without replacement
  - with replacement
30. A box contains 50 parts, of which 6 are defective and 44 are nondefective. If two parts are selected *without replacement*, find the following probabilities:
- $P(\text{both are defective})$
  - $P(\text{exactly one is defective})$

c.  $P(\text{neither is defective})$

31. A company that manufactures windows has three factories. Factory 1 produces 30% of the company's windows, Factory 2 produces 60%, and Factory 3 produces 10%. One percent of the windows produced by Factory 1 are mislabeled, 0.5% of those produced by Factory 2 are mislabeled, and 2% of those produced by Factory 3 are mislabeled. If you purchase one window manufactured by this company, what is the probability that the window is mislabeled?
32. A published article in a medical journal stated that one out of every ten American women will get breast cancer. It also states that of those who one out of four will die of it. Use these probabilities to find the probability that a randomly selected American woman will
- a. never get breast cancer
  - b. get breast cancer and not die of it
  - c. get breast cancer and die from it
33. Two hundred employees were polled about worker satisfaction.

	<b>Male Skilled</b>	<b>Male Unskilled</b>	<b>Female Skilled</b>	<b>Female Unskilled</b>	<b>Total</b>
<b>satisfied</b>	70	30	5	20	125
<b>unsatisfied</b>	30	20	15	10	75
<b>Total</b>	100	50	20	30	200

One employee is selected at random.

- a. Find the probability that an unskilled worker is satisfied with work.
  - b. Find the probability that a skilled woman employee is satisfied with work.
  - c. Is satisfaction for women employees independent of their being skilled or unskilled?
34. A shipment of grapefruit arrived containing the following proportions of types: 10% pink seedless, 20% white seedless, 30% pink with seeds, 40% white with seeds. A grapefruit is selected random from the shipment. Find the probability that
- a. it is seedless.
  - b. it is pink.
  - c. it is pink and seedless.
  - d. it is pink or seedless.
  - e. it is pink, given that it is seedless.
  - f. it is seedless, given that it is pink.