MULTIPLE-CHOICE QUESTIONS

In the following multiple-choice questions, circle the correct answer.

1. The set of all possible sample points (experimental outcomes) is called
   a. a sample
   b. an event
   c. the sample space
   d. a population
   ANSWER: c

2. The probability assigned to each experimental outcome must be
   a. any value larger than zero
   b. smaller than zero
   c. one
   d. between zero and one
   ANSWER: d

3. A(n) __________ is a graphical representation in which the sample space is represented by a rectangle and events are represented as circles.
   a. frequency polygon
   b. histogram
   c. Venn diagram
   d. tree diagram
   ANSWER: c

4. A(n) __________ is a collection of sample points.
   a. probability
   b. permutation
   c. experiment
   d. event
   ANSWER: d

5. If A and B are independent events with P(A) = 0.38 and P(B) = 0.55, then P(A | B) =
   a. 0.209
   b. 0.000
   c. 0.550
   d. None of the other answers is correct.
   ANSWER: d

6. Events A and B are mutually exclusive. Which of the following statements is also true?
a. A and B are also independent.
b. \( P(A \cup B) = P(A)P(B) \)
c. \( P(A \cup B) = P(A) + P(B) \)
d. \( P(A \cap B) = P(A) + P(B) \)

ANSWER: c

7. Excel’s RAND function
   a. determines sample size
   b. selects a simple random sample
   c. randomizes a population
   d. generates random numbers

ANSWER: d

8. A single numerical value used as an estimate of a population parameter is known as
   a. a parameter
   b. a population parameter
   c. both a parameter or a population parameter are correct
   d. a point estimate

ANSWER: d

Exhibit 1
The following data was collected from a simple random sample from an infinite population

\[
13 \quad 15 \quad 14 \quad 16 \quad 12
\]

9. Refer to Exhibit 1. The point estimate of the population mean
   a. is 5
   b. is 14
   c. is 4
   d. cannot be determined because the population is infinite

ANSWER: b

10. Refer to Exhibit 1. The mean of the population
    a. is 14
    b. is 15
    c. is 15.1581
    d. could be any value

ANSWER: d

11. As the sample size increases, the variability among the sample means
    a. increases
    b. decreases
    c. remains the same
12. For a population with an unknown distribution, the form of the sampling distribution of the sample mean is
   a. approximately normal for all sample sizes
   b. exactly normal for large sample sizes
   c. exactly normal for all sample sizes
   d. approximately normal for large sample sizes
   ANSWER: d

13. As a general rule, the sampling distribution of the sample proportions can be approximated by a normal probability distribution whenever
   a. \( np \geq 5 \)
   b. \( n(1 - p) \geq 5 \)
   c. \( n \geq 30 \)
   d. Both \( np \geq 5 \) and \( n(1 - p) \geq 5 \) are true.
   ANSWER: d

14. The expected value of a random variable is the
   a. value of the random variable that should be observed on the next repeat of the experiment
   b. value of the random variable that occurs most frequently
   c. square root of the variance
   d. None of the alternative answers is correct.
   ANSWER: d

15. The variance is a weighted average of the
   a. square root of the deviations from the mean
   b. square root of the deviations from the median
   c. squared deviations from the median
   d. squared deviations from the mean
   ANSWER: d

Exhibit 2
The probability distribution for the number of goals the Lions soccer team makes per game is given below.

<table>
<thead>
<tr>
<th>Number Of Goals</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.05</td>
</tr>
<tr>
<td>1</td>
<td>0.15</td>
</tr>
<tr>
<td>2</td>
<td>0.35</td>
</tr>
<tr>
<td>3</td>
<td>0.30</td>
</tr>
<tr>
<td>4</td>
<td>0.15</td>
</tr>
</tbody>
</table>
16. Refer to Exhibit 2. What is the probability that in a given game the Lions will score at least 1 goal?
   a. 0.20  
   b. 0.55  
   c. 1.0   
   d. 0.95  
   ANSWER: d

17. Refer to Exhibit 2. What is the probability that in a given game the Lions will score less than 3 goals?
   a. 0.85  
   b. 0.55  
   c. 0.45  
   d. 0.80  
   ANSWER: b

For the standard normal probability distribution, the area to the left of the mean is
   a. -0.5  
   b. 0.5   
   c. any value between 0 to 1  
   d. 1   
   ANSWER: b

18. Z is a standard normal random variable. The P(1.20 ≤ z ≤ 1.85) equals
   a. 0.4678  
   b. 0.3849  
   c. 0.8527  
   d. 0.0829  
   ANSWER: d

19. Z is a standard normal random variable. What is the value of z if the area between -z and z is 0.754?
   a. 0.377  
   b. 0.123  
   c. 2.16  
   d. 1.16  
   ANSWER: d

**Exhibit 3**
The weight of items produced by a machine is normally distributed with a mean of 8 ounces and a standard deviation of 2 ounces.

20. Refer to Exhibit 3. What percentage of items will weigh between 6.4 and 8.9 ounces?
a. 0.1145  
b. 0.2881  
c. 0.1736  
d. 0.4617  
ANSWER: d

21. Refer to Exhibit 3. What is the probability that a randomly selected item weighs exactly 8 ounces?
   a. 0.5  
b. 1.0  
c. 0.3413  
d. None of the alternative answers is correct.  
ANSWER: d

22. Excel’s NORMSDIST function can be used to compute  
a. cumulative probabilities for a standard normal $z$ value  
b. the standard normal $z$ value given a cumulative probability  
c. cumulative probabilities for a normally distributed $x$ value  
d. the normally distributed $x$ value given a cumulative probability  
ANSWER: a

**PROBLEMS**

1. Assume two events A and B are mutually exclusive and, furthermore, $P(A) = 0.2$ and $P(B) = 0.4$.
   a. Find $P(A \cap B)$.  
b. Find $P(A \cup B)$.  
c. Find $P(A \mid B)$.  
ANSWERS:  
a. 0.0  
b. 0.6  
c. 0.0

2. A survey of a sample of business students resulted in the following information regarding the genders of the individuals and their selected major.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Management</th>
<th>Marketing</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>40</td>
<td>10</td>
<td>30</td>
<td>80</td>
</tr>
<tr>
<td>Female</td>
<td>30</td>
<td>20</td>
<td>70</td>
<td>120</td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
<td>30</td>
<td>100</td>
<td>200</td>
</tr>
</tbody>
</table>

   a. What is the probability of selecting an individual who is majoring in Marketing?
b. What is the probability of selecting an individual who is majoring in Management, given that the person is female?
c. Given that a person is male, what is the probability that he is majoring in Management?
d. What is the probability of selecting a male individual?

ANSWERS:
  a. 0.15  
b. 0.25  
c. 0.50  
d. 0.40

3. On a recent holiday evening, a sample of 500 drivers was stopped by the police. Three hundred were under 30 years of age. A total of 250 were under the influence of alcohol. Of the drivers under 30 years of age, 200 were under the influence of alcohol.

Let A be the event that a driver is under the influence of alcohol.
Let Y be the event that a driver is less than 30 years old.

a. Determine P(A) and P(Y).
b. What is the probability that a driver is under 30 and not under the influence of alcohol?
c. Given that a driver is not under 30, what is the probability that he/she is under the influence of alcohol?
d. What is the probability that a driver is under the influence of alcohol if we know the driver is under 30?
e. Show the joint probability table.
g. Are A and Y independent events? Explain.

ANSWERS:
  a. \[ P(Y) = 0.6 \quad P(A) = 0.5 \]
  b. 0.2  
  c. 0.25  
  d. 0.667  
  e. 
    \[
    \begin{array}{cccc}
    & A & A^c \\
    Y & 0.4 & 0.2 \\
    Y^c & 0.1 & 0.3 \\
    \end{array}
    \]
  f. No \( P(A \cap Y) \neq 0 \)
  g. No, \( P(A \mid Y) \neq P(A) \)

4. Assume you have applied to two different universities (let's refer to them as Universities A and B) for your graduate work. In the past, 25% of students (with similar credentials as yours) who applied to University A were accepted, while University B accepted 35% of the applicants. Assume events are independent of each other.

a. What is the probability that you will be accepted in both universities?
b. What is the probability that you will be accepted to at least one graduate program?
c. What is the probability that one and only one of the universities will accept you?
5. An applicant has applied for positions at Company A and Company B. The probability of getting an offer from Company A is 0.4, and the probability of getting an offer from Company B is 0.3. Assuming that the two job offers are independent of each other, what is the probability that
a. the applicant gets an offer from both companies?
b. the applicant will get at least one offer?
c. the applicant will not be given an offer from either company?
d. Company A does not offer the applicant a job, but Company B does?

ANSWERS:

a. 0.12
b. 0.58
c. 0.42
d. 0.18

6. A corporation has 15,000 employees. Sixty-two percent of the employees are male. Twenty-three percent of the employees earn more than $30,000 a year. Eighteen percent of the employees are male and earn more than $30,000 a year.

a. If an employee is taken at random, what is the probability that the employee is male?
b. If an employee is taken at random, what is the probability that the employee earns more than $30,000 a year?
c. If an employee is taken at random, what is the probability that the employee is male and earns more than $30,000 a year?
d. If an employee is taken at random, what is the probability that the employee is male or earns more than $30,000 a year or both?
e. The employee taken at random turns out to be male. Compute the probability that he earns more than $30,000 a year.
f. Are being male and earning more than $30,000 a year independent?

ANSWERS:

a. 0.62
b. 0.23
c. 0.18
d. 0.67
e. 0.2903
f. No

7. The probability distribution for the rate of return on an investment is

<table>
<thead>
<tr>
<th>Rate of Return (In Percent)</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>M</td>
</tr>
<tr>
<td>BS2 T</td>
<td>B</td>
</tr>
</tbody>
</table>
9.5 .1
9.8 .2
10.0 .3
10.2 .3
10.6 .1

a. What is the probability that the rate of return will be at least 10%?
b. What is the expected rate of return?
c. What is the variance of the rate of return?

ANSWERS:
  a. 0.7
  b. 10.03
  c. 0.0801

8. The random variable \( x \) has the following probability distribution:

<table>
<thead>
<tr>
<th>( x )</th>
<th>( f(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.25</td>
</tr>
<tr>
<td>1</td>
<td>0.20</td>
</tr>
<tr>
<td>2</td>
<td>0.15</td>
</tr>
<tr>
<td>3</td>
<td>0.30</td>
</tr>
<tr>
<td>4</td>
<td>0.10</td>
</tr>
</tbody>
</table>

a. Is this probability distribution valid? Explain and list the requirements for a valid probability distribution.
b. Calculate the expected value of \( x \).
c. Calculate the variance of \( x \).
d. Calculate the standard deviation of \( x \).

ANSWERS:
  a. yes \( f(x) \geq 0 \) and \( \Sigma f(x) = 1 \)
  b. 1.8
  c. 1.86
  d. 1.364

9. \( Z \) is a standard normal random variable. Compute the following probabilities.

a. \( P(-1.33 \leq z \leq 1.67) \)

b. \( P(1.23 \leq z \leq 1.55) \)

c. \( P(z \geq 2.32) \)

d. \( P(z \geq -2.08) \)

e. \( P(z \leq -1.08) \)

ANSWERS:
  a. 0.8607
  b. 0.0487
  c. 0.0102
  d. 0.9812
10. The salaries at a corporation are normally distributed with an average salary of $19,000 and a standard deviation of $4,000.
   a. What is the probability that an employee will have a salary between $12,520 and $13,480?
   b. What is the probability that an employee will have a salary more than $11,880?
   c. What is the probability that an employee will have a salary less than $28,440?

   **ANSWERS:**
   a. 0.0312
   b. 0.9625
   c. 0.9909

11. A manufacturing process produces items whose weights are normally distributed. It is known that 22.57% of all the items produced weigh from 100 grams up to the mean and 49.18% weigh from the mean up to 190 grams. Determine the mean and the standard deviation.

   **ANSWER:**
   Mean = 118  
   Standard deviation = 30

12. A population of 1,000 students spends an average of $10.50 a day on dinner. The standard deviation of the expenditure is $3. A simple random sample of 64 students is taken.
   a. What are the expected value, standard deviation, and shape of the sampling distribution of the sample mean?
   b. What is the probability that these 64 students will spend a combined total of more than $715.21?
   c. What is the probability that these 64 students will spend a combined total between $703.59 and $728.45?

   **ANSWERS:**
   a. 10.5  0.363  normal
   b. 0.0314
   c. 0.0794

13. There are 8,000 students at the University of Tennessee at Chattanooga. The average age of all the students is 24 years with a standard deviation of 9 years. A random sample of 36 students is selected.
   a. Determine the standard error of the mean.
   b. What is the probability that the sample mean will be larger than 19.5?
   c. What is the probability that the sample mean will be between 25.5 and 27 years?

   **ANSWERS:**
   a. 1.5
   b. 0.9986
14. A bank has kept records of the checking balances of its customers and determined that the average daily balance of its customers is $300 with a standard deviation of $48. A random sample of 144 checking accounts is selected.
   a. What is the probability that the sample mean will be more than $306.60?
   b. What is the probability that the sample mean will be less than $308?
   c. What is the probability that the sample mean will be between $302 and $308?
   d. What is the probability that the sample mean will be at least $296?

   ANSWERS:
   a. 0.0495
   b. 0.9772
   c. 0.2857
   d. 0.8413

15. The average lifetime of a light bulb is 3,000 hours with a standard deviation of 696 hours. A simple random sample of 36 bulbs is taken.
   a. What are the expected value, standard deviation, and shape of the sampling distribution of \( \bar{x} \)?
   b. What is the random variable in this problem? Define it in words.
   c. What is the probability that the average life in the sample will be between 2,670.56 and 2,809.76 hours?
   d. What is the probability that the average life in the sample will be greater than 3,219.24 hours?
   e. What is the probability that the average life in the sample will be less than 3,180.96 hours?

   ANSWERS:
   a. 3,000; 116; normal
   b. \( \bar{x} \) the average life in a sample of 36 bulbs
   c. 0.0482
   d. 0.0294
   e. 0.9406