3.1 Basic Concepts of Probability and Counting

1 Find Probabilities

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) A coin is tossed. Find the probability that the result is heads.
   A) 0.5      B) 0.1      C) 0.9      D) 1

2) A single six-sided die is rolled. Find the probability of rolling a number less than 3.
   A) 0.333    B) 0.1      C) 0.5      D) 0.25

3) A single six-sided die is rolled. Find the probability of rolling a seven.
   A) 0        B) 0.1      C) 0.5      D) 1

4) A study of 1000 randomly selected flights of a major airline showed that 782 of the flights arrived on time. What is the probability of a flight arriving on time?
   A) \(\frac{391}{500}\)    B) \(\frac{109}{500}\)    C) \(\frac{500}{109}\)    D) \(\frac{500}{391}\)

5) If one card is drawn from a standard deck of 52 playing cards, what is the probability of drawing an ace?
   A) \(\frac{1}{13}\)    B) \(\frac{1}{52}\)    C) \(\frac{1}{4}\)    D) \(\frac{1}{2}\)

6) If one card is drawn from a standard deck of 52 playing cards, what is the probability of drawing a red card?
   A) \(\frac{1}{2}\)    B) \(\frac{1}{52}\)    C) \(\frac{1}{4}\)    D) \(\frac{1}{13}\)

7) If one card is drawn from a standard deck of 52 playing cards, what is the probability of drawing a heart?
   A) \(\frac{1}{4}\)    B) \(\frac{1}{2}\)    C) \(\frac{3}{4}\)    D) 1

8) In a survey of college students, 880 said that they have cheated on an exam and 1721 said that they have not. If one college student is selected at random, find the probability that the student has cheated on an exam.
   A) \(\frac{880}{2601}\)    B) \(\frac{1721}{2601}\)    C) \(\frac{2601}{880}\)    D) \(\frac{2601}{1721}\)

9) If an individual is selected at random, what is the probability that he or she has a birthday in July? Ignore leap years.
   A) \(\frac{31}{365}\)    B) \(\frac{1}{365}\)    C) \(\frac{364}{365}\)    D) \(\frac{12}{365}\)
SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

10) The data in the table represent the number of consumer complaints against major U.S. airlines. If one complaint from the table is randomly selected, find the probability that it was filed against United Airlines.

<table>
<thead>
<tr>
<th>Airline</th>
<th>Number of Complaints</th>
</tr>
</thead>
<tbody>
<tr>
<td>United</td>
<td>1172</td>
</tr>
<tr>
<td>Northwest</td>
<td>765</td>
</tr>
<tr>
<td>Continental</td>
<td>563</td>
</tr>
</tbody>
</table>

11) The data in the table represent the number of consumer complaints against major U.S. airlines. If one complaint from the table is randomly selected, find the probability that it was filed against Northwest Airlines.

<table>
<thead>
<tr>
<th>Airline</th>
<th>Number of Complaints</th>
</tr>
</thead>
<tbody>
<tr>
<td>United</td>
<td>1172</td>
</tr>
<tr>
<td>Northwest</td>
<td>765</td>
</tr>
<tr>
<td>Continental</td>
<td>563</td>
</tr>
</tbody>
</table>

12) The data in the table represent the number of consumer complaints against major U.S. airlines. If one complaint from the table is randomly selected, find the probability that it was filed against Continental Airlines.

<table>
<thead>
<tr>
<th>Airline</th>
<th>Number of Complaints</th>
</tr>
</thead>
<tbody>
<tr>
<td>United</td>
<td>1172</td>
</tr>
<tr>
<td>Northwest</td>
<td>765</td>
</tr>
<tr>
<td>Continental</td>
<td>563</td>
</tr>
</tbody>
</table>

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

13) The distribution of blood types for 100 Americans is listed in the table. If one donor is selected at random, find the probability of selecting a person with blood type A+.

<table>
<thead>
<tr>
<th>Blood Type</th>
<th>O+</th>
<th>O-</th>
<th>A+</th>
<th>A-</th>
<th>B+</th>
<th>B-</th>
<th>AB+</th>
<th>AB-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>37</td>
<td>6</td>
<td>34</td>
<td>6</td>
<td>10</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

A) 0.34  B) 0.4  C) 0.45  D) 0.68

14) The distribution of blood types for 100 Americans is listed in the table. If one donor is selected at random, find the probability of selecting a person with blood type A+ or A-.

<table>
<thead>
<tr>
<th>Blood Type</th>
<th>O+</th>
<th>O-</th>
<th>A+</th>
<th>A-</th>
<th>B+</th>
<th>B-</th>
<th>AB+</th>
<th>AB-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>37</td>
<td>6</td>
<td>34</td>
<td>6</td>
<td>10</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

A) 0.4  B) 0.34  C) 0.02  D) 0.06
15) The distribution of blood types for 100 Americans is listed in the table. If one donor is selected at random, find the probability of not selecting a person with blood type B+.

<table>
<thead>
<tr>
<th>Blood Type</th>
<th>O+</th>
<th>O-</th>
<th>A+</th>
<th>A-</th>
<th>B+</th>
<th>B-</th>
<th>AB+</th>
<th>AB-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>37</td>
<td>6</td>
<td>34</td>
<td>6</td>
<td>10</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

A) 0.90  B) 0.82  C) 0.12  D) 0.10

16) The distribution of blood types for 100 Americans is listed in the table. If one donor is selected at random, find the probability of selecting a person with blood type AB-.

<table>
<thead>
<tr>
<th>Blood Type</th>
<th>O+</th>
<th>O-</th>
<th>A+</th>
<th>A-</th>
<th>B+</th>
<th>B-</th>
<th>AB+</th>
<th>AB-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>37</td>
<td>6</td>
<td>34</td>
<td>6</td>
<td>10</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

A) 0.01  B) 0.05  C) 0.99  D) 0.10

17) The distribution of Master's degrees conferred by a university is listed in the table.

<table>
<thead>
<tr>
<th>Major</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>216</td>
</tr>
<tr>
<td>English</td>
<td>207</td>
</tr>
<tr>
<td>Engineering</td>
<td>75</td>
</tr>
<tr>
<td>Business</td>
<td>176</td>
</tr>
<tr>
<td>Education</td>
<td>222</td>
</tr>
</tbody>
</table>

What is the probability that a randomly selected student graduating with a Master's degree has a major of Engineering? Round your answer to three decimal places.

A) 0.084  B) 0.916  C) 0.013  D) 0.987

18) The distribution of Master's degrees conferred by a university is listed in the table.

<table>
<thead>
<tr>
<th>Major</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>216</td>
</tr>
<tr>
<td>English</td>
<td>207</td>
</tr>
<tr>
<td>Engineering</td>
<td>86</td>
</tr>
<tr>
<td>Business</td>
<td>176</td>
</tr>
<tr>
<td>Education</td>
<td>243</td>
</tr>
</tbody>
</table>

What is the probability that a randomly selected student graduating with a Master's degree has a major of Education? Round your answer to three decimal places.

A) 0.262  B) 0.738  C) 0.004  D) 0.355
19) Use the following graph, which shows the types of incidents encountered with drivers using cell phones, to find the probability that a randomly chosen incident involves cutting off a car. Round your answer to three decimal places.

![Driving and Cell Phone Use Graph]

20) Use the following graph, which shows the types of incidents encountered with drivers using cell phones, to find the probability that a randomly chosen incident did not involve cutting off a car. Round your answer to three decimal places.

![Driving and Cell Phone Use Graph]
21) Use the pie chart, which shows the number of Congressional Medal of Honor recipients in the United States, to find the probability that a randomly chosen recipient served in the Navy.

Medal of Honor Recipients

- Army 2393
- Navy 743
- Air Force 13
- Civilian 8
- Coast Guard 1
- Marines 296

22) Use the pie chart, which shows the number of Congressional Medal of Honor recipients in the United States, to find the probability that a randomly chosen recipient did not serve in the Marines.

Medal of Honor Recipients

- Army 2393
- Navy 743
- Air Force 13
- Civilian 8
- Coast Guard 1
- Marines 296

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

23) A question has five multiple-choice answers. Find the probability of guessing an incorrect answer.

A) $\frac{4}{5}$  
B) $\frac{5}{2}$  
C) $\frac{1}{5}$  
D) $\frac{3}{5}$

24) A question has five multiple-choice questions. Find the probability of guessing the correct answer.

A) $\frac{1}{5}$  
B) $\frac{5}{4}$  
C) $\frac{4}{5}$  
D) $\frac{2}{5}$
SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

25) The distribution of Master’s degrees conferred by a university is listed in the table.

<table>
<thead>
<tr>
<th>Major</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>216</td>
</tr>
<tr>
<td>English</td>
<td>207</td>
</tr>
<tr>
<td>Engineering</td>
<td>86</td>
</tr>
<tr>
<td>Business</td>
<td>176</td>
</tr>
<tr>
<td>Education</td>
<td>222</td>
</tr>
</tbody>
</table>

Find the probability of randomly choosing a person graduating with a Master’s degree who did not major in Education. Round your answer to three decimal places.

26) The data in the table represent the number of consumer complaints against major U.S. airlines. If one complaint from the table is randomly selected, find the probability that it was not filed against Continental Airlines. (Round to three decimal places.)

<table>
<thead>
<tr>
<th>Airline</th>
<th>Number of Complaints</th>
</tr>
</thead>
<tbody>
<tr>
<td>United</td>
<td>287</td>
</tr>
<tr>
<td>Northwest</td>
<td>256</td>
</tr>
<tr>
<td>Continental</td>
<td>294</td>
</tr>
</tbody>
</table>

2  Identify the Sample Space

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

1) Identify the sample space of the probability experiment: shooting a free throw in basketball.

2) Identify the sample space of the probability experiment: answering a true or false question

3) Identify the sample space of the probability experiment: recording the number of days it snowed in Cleveland in the month of January.

4) Identify the sample space of the probability experiment: answering a multiple choice question with A, B, C, and D as the possible answers

5) Identify the sample space of the probability experiment: determining the children’s gender for a family of three children (Use B for boy and G for girl.)

6) Identify the sample space of the probability experiment: rolling a single 12-sided die with sides numbered 1–12

7) Identify the sample space of the probability experiment: rolling a pair of 12-sided dice (with sides numbered 1–12) and observing the total number of points of each roll

8) Identify the sample space of the probability experiment: A calculator has a function button to generate a random integer from −5 to 5
9) Identify the sample space of the probability experiment: recording a response to the survey question and the gender of the respondent.

*Americans say keep the penny*
Do you favor abolishing the penny?

- No 59%
- Not sure 18%
- Yes 23%

Source: Harris interactive poll of 2136 adults taken June 10-16.
By Shannon Reilly and Robert W. Ahrens, USA Today

10) Identify the sample space of the probability experiment: recording the day of the week and whether or not it rains.

**3 Classify Types of Probability**

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) Classify the statement as an example of classical probability, empirical probability, or subjective probability. The probability that a train will be in an accident on a specific route is 1%.

A) empirical probability  
B) classical probability  
C) subjective probability

2) Classify the statement as an example of classical probability, empirical probability, or subjective probability. The probability that interest rates will rise during the summer is 0.05.

A) subjective probability  
B) classical probability  
C) empirical probability

3) Classify the statement as an example of classical probability, empirical probability, or subjective probability. In California’s Pick Three lottery, a person selects a 3-digit number. The probability of winning California’s Pick Three lottery is \(\frac{1}{1000}\).

A) classical probability  
B) empirical probability  
C) subjective probability

4) Classify the statement as an example of classical probability, empirical probability, or subjective probability. The probability that a newborn baby is a boy is \(\frac{1}{2}\).

A) classical probability  
B) empirical probability  
C) subjective probability
5) Classify the statement as an example of classical probability, empirical probability, or subjective probability. The probability that it will rain tomorrow is 24%.

A) subjective probability  B) classical probability  C) empirical probability

4 Determine Odds

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) The \( P(A) = \frac{3}{5} \). Find the odds of winning an A.

A) 3:2  B) 2:3  C) 3:5  D) 5:2

2) A card is picked at random from a standard deck of 52 playing cards. Find the odds that it is not a heart.

A) 3:1  B) 1:3  C) 4:1  D) 1:4

3) At the local racetrack, the favorite in a race has odds 3:2 of winning. What is the probability that the favorite wins the race?

A) 0.6  B) 0.4  C) 0.2  D) 1.5

4) At the local racetrack, the favorite in a race has odds 3:2 of losing. What is the probability that the favorite wins the race?

A) 0.4  B) 0.6  C) 0.2  D) 0.67

5 Concepts

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) Which of the following cannot be a probability?

A) \(-87\)  B) 0  C) 0.001  D) \(\frac{\sqrt{5}}{3}\)

2) Which of the following cannot be a probability?

A) \(\frac{4}{3}\)  B) 0.0002  C) 1  D) 85%

3) Rank the probabilities of 10%, \(\frac{1}{5}\), and 0.06 from the least likely to occur to the most likely to occur.

A) 0.06, 10%, \(\frac{1}{5}\)  B) \(\frac{1}{5}\), 10%, 0.06  C) 0.06, \(\frac{1}{5}\), 10%  D) 10%, \(\frac{1}{5}\), 0.06

4) Rank the probabilities of 10%, \(\frac{1}{5}\), and 0.06 from the most likely to occur to the least likely to occur.

A) \(\frac{1}{5}\), 10%, 0.06  B) 0.06, 10%, \(\frac{1}{5}\)  C) 10%, \(\frac{1}{5}\), 0.06  D) 0.06, \(\frac{1}{5}\), 10%
5) Explain why the following statement is incorrect:
   He gave 110% effort.

3.2 Conditional Probability and the Multiplication Rule

1 Determine Between Independent and Dependent Events

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) Classify the events as dependent or independent. Events A and B where
   \( P(A) = 0.7, \ P(B) = 0.8, \) and \( P(A \text{ and } B) = 0.56 \)
   A) independent  B) dependent

2) Classify the events as dependent or independent. Events A and B where
   \( P(A) = 0.6, \ P(B) = 0.3, \) and \( P(A \text{ and } B) = 0.17 \)
   A) dependent  B) independent

3) Classify the events as dependent or independent.
   The events of getting two aces when two cards are drawn from a deck of playing cards and the first card is
   replaced before the second card is drawn.
   A) independent  B) dependent

4) Classify the events as dependent or independent. The events of getting two aces when two cards are drawn
   from a deck of playing cards and the first card is not replaced before the second card is drawn.
   A) dependent  B) independent

5) Classify the events as dependent or independent. Event A: A red candy is selected from a package with 30
   colored candies and eaten. Event B: A blue candy is selected from the same package and eaten.
   A) dependent  B) independent

2 Find Conditional Probabilities

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) A group of students were asked if they carry a credit card. The responses are listed in the table.

<table>
<thead>
<tr>
<th>Class</th>
<th>Credit Card Carrier</th>
<th>Not a Credit Card Carrier</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>24</td>
<td>36</td>
<td>60</td>
</tr>
<tr>
<td>Sophomore</td>
<td>37</td>
<td>3</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>39</td>
<td>100</td>
</tr>
</tbody>
</table>

If a student is selected at random, find the probability that he or she owns a credit card given that the student is
a freshman. Round your answer to three decimal places.

   A) 0.400  B) 0.600  C) 0.393  D) 0.240
2) A group of students were asked if they carry a credit card. The responses are listed in the table.

<table>
<thead>
<tr>
<th>Class</th>
<th>Credit Card Carrier</th>
<th>Not a Credit Card Carrier</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>18</td>
<td>42</td>
<td>60</td>
</tr>
<tr>
<td>Sophomore</td>
<td>40</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>58</td>
<td>42</td>
<td>100</td>
</tr>
</tbody>
</table>

If a student is selected at random, find the probability that he or she owns a credit card given that the student is a sophomore. Round your answer to three decimal places.

A) 1.000  B) 0.000  C) 0.690  D) 0.400

3) A group of students were asked if they carry a credit card. The responses are listed in the table.

<table>
<thead>
<tr>
<th>Class</th>
<th>Credit Card Carrier</th>
<th>Not a Credit Card Carrier</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>46</td>
<td>14</td>
<td>60</td>
</tr>
<tr>
<td>Sophomore</td>
<td>32</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>78</td>
<td>22</td>
<td>100</td>
</tr>
</tbody>
</table>

If a student is selected at random, find the probability that he or she is a freshman given that the student owns a credit card. Round your answers to three decimal places.

A) 0.590  B) 0.767  C) 0.410  D) 0.460

4) A group of students were asked if they carry a credit card. The responses are listed in the table.

<table>
<thead>
<tr>
<th>Class</th>
<th>Credit Card Carrier</th>
<th>Not a Credit Card Carrier</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>16</td>
<td>44</td>
<td>60</td>
</tr>
<tr>
<td>Sophomore</td>
<td>6</td>
<td>34</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>78</td>
<td>100</td>
</tr>
</tbody>
</table>

If a student is selected at random, find the probability that he or she is a sophomore given that the student owns a credit card. Round your answers to three decimal places.

A) 0.273  B) 0.727  C) 0.550  D) 0.060

5) A group of students were asked if they carry a credit card. The responses are listed in the table.

<table>
<thead>
<tr>
<th>Class</th>
<th>Credit Card Carrier</th>
<th>Not a Credit Card Carrier</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>14</td>
<td>46</td>
<td>60</td>
</tr>
<tr>
<td>Sophomore</td>
<td>17</td>
<td>23</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>69</td>
<td>100</td>
</tr>
</tbody>
</table>

If a student is selected at random, find the probability that he or she is a sophomore and owns a credit card. Round your answers to three decimal places.

A) 0.170  B) 0.452  C) 0.775  D) 0.548
3 Use the Multiplication Rule to Find Probabilities

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) You are dealt two cards successively without replacement from a standard deck of 52 playing cards. Find the probability that the first card is a two and the second card is a ten. Round your answer to three decimal places.
   A) 0.006  B) 0.994  C) 0.250  D) 0.500

2) Find the probability of answering two true or false questions correctly if random guesses are made. Only one of the choices is correct.
   A) 0.25  B) 0.5  C) 0.75  D) 0.1

3) Find the probability of answering the two multiple choice questions correctly if random guesses are made. Assume the questions each have five choices for the answer. Only one of the choices is correct.
   A) 0.04  B) 0.004  C) 0.4  D) 0.02

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

4) Find the probability of getting four consecutive aces when four cards are drawn without replacement from a standard deck of 52 playing cards.

5) Find the probability of selecting two consecutive threes when two cards are drawn without replacement from a standard deck of 52 playing cards. Round your answer to four decimal places.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

6) A multiple-choice test has five questions, each with five choices for the answer. Only one of the choices is correct. You randomly guess the answer to each question. What is the probability that you answer the first two questions correctly?
   A) 0.04  B) 0.2  C) 0.02  D) 0.4

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

7) A multiple-choice test has five questions, each with five choices for the answer. Only one of the choices is correct. You randomly guess the answer to each question. What is the probability that you answer all five questions correctly?

8) A multiple-choice test has five questions, each with five choices for the answer. Only one of the choices is correct. You randomly guess the answer to each question. What is the probability that you do not answer any of the questions correctly?

9) A multiple-choice test has five questions, each with five choices for the answer. Only one of the choices is correct. You randomly guess the answer to each question. What is the probability that you answer at least one of the questions correctly?

10) The probability it will rain is 40% each day over a three-day period. What is the probability it will rain at least one of the three days?
11) The probability it will rain is 40% each day over a three-day period. What is the probability it will not rain at least one of the three days?

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

12) Four students drive to school in the same car. The students claim they were late to school and missed a test because of a flat tire. On the makeup test, the instructor asks the students to identify the tire that went flat; front driver’s side, front passenger’s side, rear driver’s side, or rear passenger’s side. If the students didn’t really have a flat tire and each randomly selects a tire, what is the probability that all four students select the same tire?

A) \( \frac{1}{64} \)  
B) \( \frac{1}{4} \)  
C) \( \frac{1}{256} \)  
D) \( \frac{1}{8} \)

13) Find the probability that of 25 randomly selected students, no two share the same birthday.

A) 0.431  
B) 0.995  
C) 0.569  
D) 0.068

14) Find the probability that of 25 randomly selected students, at least two share the same birthday.

A) 0.569  
B) 0.068  
C) 0.432  
D) 0.995

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

15) What is the probability that a husband, wife, and daughter have the same birthday?

4 Use Bayes’s Theorem

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) Use Bayes' theorem to solve this problem. A storeowner purchases stereos from two companies. From Company A, 250 stereos are purchased and 1% are found to be defective. From Company B, 950 stereos are purchased and 10% are found to be defective. Given that a stereo is defective, find the probability that it came from Company A.

A) \( \frac{1}{39} \)  
B) \( \frac{19}{195} \)  
C) \( \frac{10}{39} \)  
D) \( \frac{38}{39} \)

2) Use Baye's Theorem to solve this problem. A paper bag contains two red balls and one blue ball. A plastic bag contains three blue balls and one red ball. A coin is tossed. If it falls heads up, the paper bag is selected and a ball is drawn. If the coin falls tails up, the plastic bag is selected and a ball is drawn. If a red ball is selected, what is the probability that it came from the paper bag?

A) \( \frac{8}{11} \)  
B) \( \frac{1}{3} \)  
C) \( \frac{1}{8} \)  
D) \( \frac{3}{8} \)
3.3 The Addition Rule

1 Determine if Events Are Mutually Exclusive

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) Decide if the events A and B are mutually exclusive or not mutually exclusive. A die is rolled.
   A: The result is an odd number.
   B: The result is an even number.
   A) mutually exclusive                  B) not mutually exclusive

2) Decide if the events A and B are mutually exclusive or not mutually exclusive, A die is rolled.
   A: The result is a 3.
   B: The result is an odd number.
   A) not mutually exclusive                  B) mutually exclusive

3) Decide if the events A and B are mutually exclusive or not mutually exclusive. A date in Philadelphia is selected.
   A: It rains that day.
   B: It snows that day.
   A) not mutually exclusive                  B) mutually exclusive

4) Decide if the events A and B are mutually exclusive or not mutually exclusive. A card is drawn from a standard deck of 52 playing cards.
   A: The result is a 7.
   B: The result is a jack.
   A) mutually exclusive                  B) not mutually exclusive

5) Decide if the events A and B are mutually exclusive or not mutually exclusive. A card is drawn from a standard deck of 52 playing cards.
   A: The result is a club.
   B: The result is a king.
   A) not mutually exclusive                  B) mutually exclusive

6) Decide if the events A and B are mutually exclusive or not mutually exclusive. A person is selected at random.
   A: Their birthday is in the fall.
   B: Their birthday is in October.
   A) not mutually exclusive                  B) mutually exclusive

7) Decide if the events A and B are mutually exclusive or not mutually exclusive. A student is selected at random.
   A: The student is taking a math course.
   B: The student is a business major.
   A) not mutually exclusive                  B) mutually exclusive
2 Use the Addition Rule to Find Probabilities

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) A card is drawn from a standard deck of 52 playing cards. Find the probability that the card is an ace or a king.
   A) \( \frac{2}{13} \)  
   B) \( \frac{1}{13} \)  
   C) \( \frac{4}{13} \)  
   D) \( \frac{8}{13} \)

2) A card is drawn from a standard deck of 52 playing cards. Find the probability that the card is an ace or a heart.
   A) \( \frac{4}{13} \)  
   B) \( \frac{7}{52} \)  
   C) \( \frac{17}{52} \)  
   D) \( \frac{3}{13} \)

3) A card is drawn from a standard deck of 52 playing cards. Find the probability that the card is an ace or a black card.
   A) \( \frac{7}{13} \)  
   B) \( \frac{15}{26} \)  
   C) \( \frac{29}{52} \)  
   D) \( \frac{4}{13} \)

4) The events A and B are mutually exclusive. If \( P(A) = 0.2 \) and \( P(B) = 0.4 \), what is \( P(A \text{ or } B) \)?
   A) 0.6  
   B) 0  
   C) 0.08  
   D) 0.2

5) Given that \( P(A \text{ or } B) = \frac{1}{4} \), \( P(A) = \frac{1}{6} \), and \( P(A \text{ and } B) = \frac{1}{7} \), find \( P(B) \).
   A) \( \frac{19}{84} \)  
   B) \( \frac{17}{168} \)  
   C) \( \frac{47}{84} \)  
   D) \( \frac{23}{84} \)

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

6) Use the following graph, which shows the types of incidents encountered with drivers using cell phones, to find the probability that a randomly chosen incident involves either swerving or almost hitting a car.

![Graph showing types of incidents encountered with drivers using cell phones]

\[ \text{Driving and Cell Phone Use} \]

- Swerved
- Speeded up
- Cut off a car
- Almost hit a car

Number of incidents

Page 68
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

7) The table lists the smoking habits of a group of college students.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Non-smoker</th>
<th>Regular Smoker</th>
<th>Heavy Smoker</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Man</td>
<td>135</td>
<td>46</td>
<td>5</td>
<td>186</td>
</tr>
<tr>
<td>Woman</td>
<td>187</td>
<td>21</td>
<td>11</td>
<td>219</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>67</td>
<td>16</td>
<td>405</td>
</tr>
</tbody>
</table>

If a student is chosen at random, find the probability of getting someone who is a regular or heavy smoker. Round your answer to three decimal places.

A) 0.205  B) 0.687  C) 0.239  D) 0.141

8) The table lists the smoking habits of a group of college students.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Non-smoker</th>
<th>Regular Smoker</th>
<th>Heavy Smoker</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Man</td>
<td>135</td>
<td>52</td>
<td>5</td>
<td>192</td>
</tr>
<tr>
<td>Woman</td>
<td>187</td>
<td>21</td>
<td>5</td>
<td>213</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>73</td>
<td>10</td>
<td>405</td>
</tr>
</tbody>
</table>

If a student is chosen at random, find the probability of getting someone who is a man or a non-smoker. Round your answer to three decimal places.

A) 0.936  B) 0.948  C) 0.941  D) 0.820

9) The table lists the smoking habits of a group of college students.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Non-smoker</th>
<th>Regular Smoker</th>
<th>Heavy Smoker</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Man</td>
<td>135</td>
<td>41</td>
<td>5</td>
<td>181</td>
</tr>
<tr>
<td>Woman</td>
<td>187</td>
<td>21</td>
<td>12</td>
<td>220</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>62</td>
<td>17</td>
<td>401</td>
</tr>
</tbody>
</table>

If a student is chosen at random, find the probability of getting someone who is a man or a woman. Round your answer to three decimal places.

A) 1  B) 0.918  C) 0.803  D) 0.197

10) The distribution of Master’s degrees conferred by a university is listed in the table. (assume that a student majors in only one subject)

<table>
<thead>
<tr>
<th>Major</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>230</td>
</tr>
<tr>
<td>English</td>
<td>206</td>
</tr>
<tr>
<td>Engineering</td>
<td>86</td>
</tr>
<tr>
<td>Business</td>
<td>176</td>
</tr>
<tr>
<td>Education</td>
<td>222</td>
</tr>
</tbody>
</table>

What is the probability that a randomly selected student with a Master’s degree majored in English or Mathematics? Round your answer to three decimal places.

A) 0.474  B) 0.526  C) 0.250  D) 0.224
11) One hundred people were asked, “Do you favor the death penalty?” Of the 33 that answered "yes" to the question, 14 were male. Of the 67 that answered "no" to the question, six were male. If one person is selected at random, what is the probability that this person answered "yes" or was a male?

A) 0.39  B) 0.53  C) 0.67  D) 0.13

3  Use the Addition Rule for Three Events

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

1) Use the pie chart, which shows the number of Congressional Medal of Honor recipients, to find the probability that a randomly chosen recipient served in the Army, Navy, or Marines.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

2) The distribution of Master’s degrees conferred by a university is listed in the table. (assume that a student majors in only one subject)

<table>
<thead>
<tr>
<th>Major</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>216</td>
</tr>
<tr>
<td>English</td>
<td>207</td>
</tr>
<tr>
<td>Engineering</td>
<td>79</td>
</tr>
<tr>
<td>Business</td>
<td>176</td>
</tr>
<tr>
<td>Education</td>
<td>226</td>
</tr>
</tbody>
</table>

What is the probability that a randomly selected student with a Master’s degree majored in Business, Education or Engineering? Round your answer to three decimal places.

A) 0.532  B) 0.468  C) 0.282  D) 0.337
SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

3) In the Venn diagram below, event A represents the adults who drink coffee, event B represents the adults who drink tea, and event C represents the adults who drink cola. List the region(s) which represent the adults who drink both coffee and tea.

4) In the Venn diagram below, event A represents the adults who drink coffee, event B represents the adults who drink tea, and event C represents the adults who drink cola. List the region(s) which represent the adults who drink only cola.

4 Concepts

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) The events A and B are mutually exclusive. If P(A) = 0.2 and P(B) = 0.1, what is P(A and B)?
   A) 0   B) 0.02   C) 0.5   D) 0.3
3.4 Additional Topics in Probability and Counting

1 Use Counting Principles

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) The access code to a house’s security system consists of seven digits. How many different codes are available if each digit can be repeated?
   A) 1,000,000   B) 46,656   C) 64   D) 6

2) A delivery route must include stops at eight cities. How many different routes are possible?
   A) 24   B) 4   C) 16   D) 256

3) A tourist in Ireland wants to visit six different cities. How many different routes are possible?
   A) 720   B) 120   C) 36   D) 46,656

4) Eight guests are invited for dinner. How many ways can they be seated at a dinner table if the table is straight with seats only on one side?
   A) 362,880   B) 3,628,800   C) 40,320   D) 1

5) The Environmental Protection Agency must visit nine factories for complaints of air pollution. In how many different ways can a representative visit five of these to investigate this week?
   A) 15,120   B) 362,880   C) 5   D) 126

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

6) How many ways can a jury of five men and three women be selected from twelve men and ten women?

7) How many ways can two Republicans, one Democrat, and one Independent be chosen from nine Republicans, five Democrats, and two Independents to fill four positions on city council?

8) How many different permutations of the letters in the word PROBABILITY are there?

9) How many different permutations of the letters in the word STATISTICS are there?

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

10) If a couple plans to have seven children, how many gender sequences are possible?
    A) 1024   B) 10   C) 1e+10   D) 100

11) If a couple has seven boys and eight girls, how many gender sequences are possible?
    A) 55   B) 11   C) 8   D) 16
SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

12) A student must answer six questions on an exam that contains twelve questions.
   a) How many ways can the student do this?
   b) How many ways are there if the student must answer the first and last question?

13) How many versions of a test are required to cover all possible question arrangements if there are eight open-ended questions on the test?

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

14) How many ways can five people, A, B, C, D, and E, sit in a row at a movie theater if A and B must sit together?
   A) 48
   B) 120
   C) 12
   D) 24

15) How many ways can five people, A, B, C, D, and E, sit in a row at a movie theater if C must sit to the right of but not necessarily next to B?
   A) 60
   B) 24
   C) 20
   D) 48

16) How many ways can five people, A, B, C, D, and E, sit in a row at a movie theater if D and E will not sit next to each other?
   A) 72
   B) 24
   C) 48
   D) 60

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

17) The access code to a house’s security system consists of five digits. How many different codes are available if the first digit cannot be zero and the arrangement of five fives is excluded?

18) In California, each automobile license plate consists of a single digit followed by three letters, followed by three digits. How many distinct license plates can be formed if there are no restrictions on the digits or letters?

19) In California, each automobile license plate consists of a single digit followed by three letters, followed by three digits. How many distinct license plates can be formed if the first number cannot be zero and the three letters cannot form "GOD"?

2  Use Counting Principles to Find Probabilities

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

1) A certain code is a sequence of 6 digits. What is the probability of generating 6 digits and getting the code consisting of 1,2,3, . . . , 6 if each digit can be repeated?

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

2) A delivery route must include stops at six cities. If the route is randomly selected, find the probability that the cities will be arranged in alphabetical order. Round your answer to three decimal places.
   A) 0.16666667
   B) 0.03703704
   C) 0.125
   D) 0.33333333
3) A tourist in Ireland wants to visit seven different cities. If the route is randomly selected, what is the probability that the tourist will visit the cities in alphabetical order? Round your answer to three decimal places.

A) 0.001   B) 0.008   C) 0.016   D) 0.167

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

4) In the California State lottery, you must select six numbers from fifty-two numbers to win the big prize. The numbers do not have to be in a particular order. What is the probability that you will win the big prize if you buy one ticket?
3.1 Basic Concepts of Probability and Counting

1 Find Probabilities

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) \( \frac{1172}{2500} \)
11) \( \frac{765}{2500} \)
12) \( \frac{563}{2500} \)
13) A
14) A
15) A
16) A
17) A
18) A
19) 0.163
20) 0.837
21) 0.215
22) 0.914
23) A
24) A
25) Let \( E \) = Master's degree in Education.
   \[ P(E) = \frac{222}{907}, \quad P(E') = 1 - P(E) = \frac{685}{907} = 0.755 \]
26) Let \( E \) = the event the complaint was against Continental
   \[ P(E) = \frac{98}{279} \]
   \[ P(E') = 1 - P(E) = 1 - \frac{98}{279} = \frac{181}{279} = 0.649 \]

2 Identify the Sample Space

1) (hit, miss)
2) (true, false)
3) (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, \ldots, 30, 31)
4) (A, B, C, D)
5) (BBB), (BBG), (BGB), (GBB), (GBG), (GGB), (GGG)
6) (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12)
7) (2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24)
8) (−5, −4, −3, −2, −1, 0, 1, 2, 3, 4, 5)
9) (YM, YF, NM, NF, UM, UF)
10) (MR, TR, WR, HR, FR, SAR, SUR, MN, TN, WN, HN, FN, SAN, SUN)

3 Classify Types of Probability

1) A
4 Determine Odds
1) A
2) A
3) A
4) A
5) A

5 Concepts
1) A
2) A
3) A
4) A
5) Maximum effort is 100%.

3.2 Conditional Probability and the Multiplication Rule

1 Determine Between Independent and Dependent Events
1) A
2) A
3) A
4) A
5) A

2 Find Conditional Probabilities
1) A
2) A
3) A
4) A
5) A

3 Use the Multiplication Rule to Find Probabilities
1) A
2) A
3) A
4) \( \frac{\binom{4}{5} \cdot \binom{3}{51} \cdot \binom{2}{50} \cdot \binom{1}{49}}{\binom{52}{3}} = 0.00000369 \)
5) \( \frac{\binom{4}{5} \cdot \binom{3}{51}}{\binom{52}{2}} = 0.0045 \)
6) A
7) \( \frac{\binom{1}{5} \cdot \binom{1}{5} \cdot \binom{1}{5} \cdot \binom{1}{5}}{\binom{5}{5}} = 0.00032 \)
8) \( \frac{\binom{4}{5} \cdot \binom{4}{5} \cdot \binom{4}{5}}{\binom{5}{5}} = 0.32768 \)
9) \( 1 - \frac{\binom{4}{5} \cdot \binom{4}{5} \cdot \binom{4}{5}}{\binom{5}{5}} = 1 - 0.32768 = 0.67232 \)
10) \( 1 - (0.60)(0.60)(0.60) = 0.784 \)
11) \( 1 - (0.40)(0.40)(0.40) = 0.936 \)
12) A
13) A
14) A
4 Use Bayes's Theorem

3.3 The Addition Rule

1. Determine if Events Are Mutually Exclusive

2. Use the Addition Rule to Find Probabilities

3. Use the Addition Rule for Three Events

4. Concepts

3.4 Additional Topics in Probability and Counting

1. Use Counting Principles

Page 77
18) \(10(26^3)(10^3) = 175,760,000\)
19) \(9(26^3)(10^3) - 9,000 = 158,175,000\)

2 Use Counting Principles to Find Probabilities

1) \(\frac{1}{1,000,000} = 0.000001\)
2) \(A\)
3) \(A\)
4) \(\frac{1}{\binom{52}{6}} = \frac{1}{20,358,520} = 0.0000000491\)