Ch. 5 Probability

5.1 Probability Rules

1 Apply the rules of probabilities.

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: tossing a coin

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

3) Identify the sample space of the probability experiment: tossing four coins and recording the number of heads

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

5) Identify the sample space of the probability experiment: determining the puppie's gender for a litter of three puppies (Use M for male and F for female.)

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

6) Which of the following probabilities for the sample points A, B, and C could be true if A, B, and C are the only sample points in an experiment?
   A) P(A) = 0, P(B) = 1/5, P(C) = 4/5
   B) P(A) = 1/6, P(B) = 1/7, P(C) = 1/4
   C) P(A) = –1/4, P(B) = 1/2, P(C) = 3/4
   D) P(A) = 1/10, P(B) = 1/10, P(C) = 1/10

7) If A, B, C, and D, are the only possible outcomes of an experiment, find the probability of D using the table below.

Outcome	A	B	C	D
Probability	1/14	1/14	1/14	

   A) 11/14
   B) 1/14
   C) 1/4
   D) 3/14

8) In a 1–pond bag of skittles the possible colors were red, green, yellow, orange, and purple. The probability of drawing a particular color from that bag is given below. Is this a probability model? Answer Yes or No.

Color	Probability
Red	0.2299
Green	0.1908
Orange	0.2168
Yellow	0.1889
Purple	0.1816

   A) Yes
   B) No

9) A bag contains 25 wooden beads. The colors of the beads are red, blue, white, green, black, brown, and grey. The probability of randomly selecting a bead of a particular color from the bag is given below. Is this a probability model? Answer yes or No.

Color	Red	Blue	White	Green	Black	Brown	Grey
Probability	0.28	0.24	0.20	0.16	0.12	0.08	0.03

   A) No
   B) Yes

10) Which of the following cannot be the probability of an event?

A) –82 B) 0 C) 0.001 D) $\frac{\sqrt{2}}{3}$

11) The probability that event A will occur is $P(A) = \frac{\text{Number of successful outcomes}}{\text{Number of unsuccessful outcomes}}$

A) False B) True

12) The probability that event A will occur is $P(A) = \frac{\text{Number of successful outcomes}}{\text{Total number of all possible outcomes}}$

A) True B) False

13) In terms of probability, a(n) _____ is any process with uncertain results that can be repeated.

A) Experiment B) Sample space C) Event D) Outcome

14) A(n) _____ of a probability experiment is the collection of all outcomes possible.

A) Sample space B) Event set C) Bernoulli space D) Prediction set

15) True or False: An event is any collection of outcomes from a probability experiment.

A) True B) False

16) An unusual event is an event that has a

A) Low probability of occurrence B) Probability of 1
C) Probability which exceeds 1 D) A negative probability

2 Compute and interpret probabilities using the empirical method.

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

Provide an appropriate response.

17) The table below represents a random sample of the number of deaths per 100 cases for a certain illness over time. If a person infected with this illness is randomly selected from all infected people, find the probability that the person lives 3–4 years after diagnosis. Express your answer as a simplified fraction and as a decimal.

Years after Diagnosis	Number deaths
1–2	15
3–4	35
5–6	16
7–8	9
9–10	6
11–12	4
13–14	2
15+	13

A) $\frac{35}{100}$; 0.35 B) $\frac{1}{35}$; 0.029 C) $\frac{35}{65}$; 0.538 D) $\frac{7}{120}$; 0.058

18) Recently, the stock market took big swings up and down. A survey of 969 adult investors asked how often they tracked their portfolio. The table shows the investor responses. What is the probability that an adult investor tracks his or her portfolio daily? Express your answer as a simplified fraction and as a decimal rounded to three decimal places.

How frequently?	Response
Daily	231
Weekly	269
Monthly	274
Couple times a year	143
Don't track	52

A) $\frac{231}{969}$; 0.238 B) $\frac{269}{969}$; 0.278 C) $\frac{274}{969}$; 0.283 D) $\frac{143}{969}$; 0.148

The chart below shows the percentage of people in a questionnaire who bought or leased the listed car models and were very satisfied with the experience.

Model A	**81%**
Model B	**79%**
Model C	**73%**
Model D	**61%**
Model E	**59%**
Model F	**57%**

19) With which model was the greatest percentage satisfied? Estimate the empirical probability that a person with this model is very satisfied with the experience. Express the answer as a fraction with a denominator of 100.

A) Model A; $\frac{81}{100}$ B) Model A: $\frac{0.81}{100}$ C) Model F; $\frac{57}{100}$ D) Model F; $\frac{0.57}{100}$

20) The empirical probability that a person with a model shown is very satisfied with the experience is $\frac{61}{100}$. What is the model?

A) D B) E C) F D) A

Provide an appropriate response.

21) True or False: The probability of an event E in an empirical experiment may change from experiment to experiment.

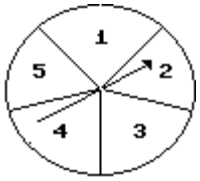
A) True B) False

3 Compute and interpret probabilities using the classical method.

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

Provide an appropriate response.

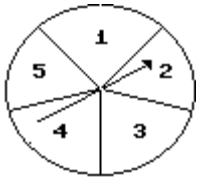
22) Use the spinner below to answer the question. Assume that it is equally probable that the pointer will land on any one of the five numbered spaces. If the pointer lands on a borderline, spin again.



Find the probability that the arrow will land on 2 or 1.

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

23) Use the spinner below to answer the question. Assume that it is equally probable that the pointer will land on any one of the five numbered spaces. If the pointer lands on a borderline, spin again.



Find the probability that the arrow will land on an odd number.

A) $\frac{3}{5}$ B) $\frac{2}{5}$ C) 1 D) 0

24) You are dealt one card from a standard 52-card deck. Find the probability of being dealt an ace or a 9.

A) $\frac{2}{13}$ B) $\frac{5}{13}$ C) $\frac{13}{2}$ D) 10

25) A die is rolled. The set of equally likely outcomes is {1, 2, 3, 4, 5, 6}. Find the probability of getting a 3.

A) $\frac{1}{6}$ B) $\frac{1}{2}$ C) 3 D) 0

26) A die is rolled. The set of equally likely outcomes is {1, 2, 3, 4, 5, 6}. Find the probability of getting a 10.

A) 0 B) 1 C) 10 D) $\frac{10}{6}$

27) You are dealt one card from a standard 52-card deck. Find the probability of being dealt a picture card.

A) $\frac{3}{13}$ B) $\frac{1}{13}$ C) $\frac{3}{26}$ D) $\frac{3}{52}$

28) A fair coin is tossed two times in succession. The set of equally likely outcomes is {HH, HT, TH, TT}. Find the probability of getting the same outcome on each toss.

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

29) A single die is rolled twice. The set of 36 equally likely outcomes is {(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)}. Find the probability of getting two numbers whose sum is greater than 10.

A) $\frac{1}{12}$ B) $\frac{5}{18}$ C) $\frac{1}{18}$ D) 3

30) A single die is rolled twice. The set of 36 equally likely outcomes is {(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)}. Find the probability of getting two numbers whose sum is less than 13.

A) 1 B) 0 C) $\frac{1}{2}$ D) $\frac{1}{4}$

31) A single die is rolled twice. The set of 36 equally likely outcomes is {(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)}. Find the probability of getting two numbers whose sum is greater than 9 and less than 13.

A) $\frac{1}{6}$ B) 0 C) $\frac{5}{36}$ D) $\frac{7}{36}$

32) This problem deals with eye color, an inherited trait. For purposes of this problem, assume that only two eye colors are possible, brown and blue. We use b to represent a blue eye gene and B a brown eye gene. If any B genes are present, the person will have brown eyes. The table shows the four possibilities for the children of two Bb (brown–eyed) parents, where each parent has one of each eye color gene.

		Second Parent	
		B	b
First Parent	B	BB	Bb
	b	Bb	bb

Find the probability that these parents give birth to a child who has blue eyes.

A) $\frac{1}{4}$ B) $\frac{1}{2}$ C) 1 D) 0

33) Three fair coins are tossed in the air and land on a table. The up side of each coin is noted. How many elements are there in the sample space?

A) 8 B) 3 C) 6 D) 4

34) The sample space for tossing three fair coins is {HHH, HHT, HTH, HTT, THH, THT, TTH, TTT}. What is the probability of exactly two heads?

A) $\frac{3}{8}$ B) 3 C) $\frac{1}{2}$ D) $\frac{5}{8}$

35) In the game of roulette in the United States a wheel has 38 slots: 18 slots are black, 18 slots are red, and 2 slots are green. We watched a friend play roulette for two hours. In that time we noted that the wheel was spun 50 times and that out of those 50 spins black came up 22 times. Based on this data, the $P(\text{black}) = \frac{22}{50} = 0.44$. This is an example of what type of probability?

A) Empirical B) Classical C) Subjective D) Observational

36) In the game of roulette in the United States a wheel has 38 slots: 18 slots are black, 18 slots are red, and 2 slots are green. The $P(\text{Red}) = \frac{18}{38} \approx 0.47$. This is an example of what type of probability?

A) Classical B) Empirical C) Simulated D) Subjective

4 Recognize and interpret subjective probabilities.

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

Provide an appropriate response.

37) Classify the statement as an example of classical probability, empirical probability, or subjective probability. The probability that it will snow tomorrow is 49%.

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

38) Classify the statement as an example of classical probability, empirical probability, or subjective probability. It is known that the probability of hitting a pothole while driving on a certain road is 1%.

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

39) Classify the statement as an example of classical probability, empirical probability, or subjective probability.
The probability that cab fares will rise during the winter is 0.05.
A) subjective probability B) classical probability C) empirical probability

40) Classify the statement as an example of classical probability, empirical probability, or subjective probability.
In one state lottery, a person selects a 4-digit number. The probability of winning this state's lottery is $\frac{1}{10,000}$.
A) classical probability B) empirical probability C) subjective probability

41) Classify the statement as an example of classical probability, empirical probability, or subjective probability.
The probability that a newborn kitten is a male is $\frac{1}{2}$.
A) classical probability B) empirical probability C) subjective probability

42) The _____ probability of an outcome is a probability based on personal judgment.
A) Subjective B) Classical C) Empirical D) Conditional

43) The _____ probability of an outcome is obtained by dividing the frequency of occurrence of an event by the number of trials of the experiment.
A) Empirical B) Subjective C) Classical D) Conditional

44) The _____ probability of an outcome is obtained by dividing the number of ways an event can occur by the number of possible outcomes.
A) Classical B) Subjective C) Empirical D) Conditional

5 Know Concepts: Probability Rules

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

Solve the problem.

45) (a) Roll a pair of dice 40 times, recording the sum each time. Use your results to approximate the probability of getting a sum of 8.
(b) Roll a pair of dice 100 times, recording the sum each time. Use your results to approximate the probability of getting a sum of 8.
Compare the results of (a) and (b) to the probability that would be obtained using the classical method.
Which answer was closer to the probability that would be obtained using the classical method? Is this what you would expect?

46) (a) Simulate the experiment of sampling 100 four-child families to estimate the probability that a four-child family has three girls. Assume that the outcomes "have a girl" and "have a boy" are equally likely.
(b) Simulate the experiment of sampling 1000 four-child families to estimate the probability that a four-child family has three girls. Assume that the outcomes "have a girl" and "have a boy" are equally likely.
The classical probability that a four-child family has three girls is $\frac{1}{4}$.

Compare the results of (a) and (b) to the probability that would be obtained using the classical method.
Which answer was closer to the probability that would be obtained using the classical method? Is this what you would expect?

47) (a) Use a graphing calculator or statistical software to simulate drawing a card from a standard deck 100 times (with replacement of the card after each draw). Use an integer distribution with numbers 1 through 4 and use the results of the simulation to estimate the probability of getting a spade when a card is drawn from a standard deck.
(b) Simulate drawing a card from a standard deck 400 times (with replacement of the card after each draw). Estimate the probability of getting a spade when a card is drawn from a standard deck.
Compare the results of (a) and (b) to the probability that would be obtained using the classical method.
Which simulation resulted in the closest estimate to the probability that would be obtained using the classical method? Is this what you would expect?

5.2 The Addition Rule and Complements

1 Use the Addition Rule for Disjoint Events.

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

Solve the problem.

1) A probability experiment is conducted in which the sample space of the experiment is S = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15}. Let event A = {2, 3, 4, 5} and event B = {13, 14, 15}. Assume that each outcome is equally likely. List the outcomes in A and B. Are A and B mutually exclusive?
A) { }; yes
B) { }; no
C) {2, 3, 4, 5, 13, 14, 15}; no
D) {2, 3, 4, 5, 13, 14, 15}; yes

2) The events A and B are mutually exclusive. If P(A) = 0.7 and P(B) = 0.2, what is P(A or B)?
A) 0.9
B) 0
C) 0.14
D) 0.5

3) The table lists the drinking habits of a group of college students. If a student is chosen at random, find the probability of getting someone who is a regular or heavy drinker. Round your answer to three decimal places.

Sex	Non-drinker	Regular Drinker	Heavy Drinker	Total
Man	135	30	5	170
Woman	187	21	6	214
Total	322	51	11	384

A) 0.161
B) 0.581
C) 0.178
D) 0.094

4) The table lists the drinking habits of a group of college students. 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.

Sex	Non-drinker	Regular Drinker	Heavy Drinker	Total
Man	135	61	5	201
Woman	187	21	8	216
Total	322	82	13	417

A) 1
B) 0.930
C) 0.772
D) 0.228

5) The table lists the drinking habits of a group of college students. If a student is chosen at random, find the probability of getting someone who is a non-drinker. Round your answer to three decimal places.

Sex	Non-drinker	Regular Drinker	Heavy Drinker	Total
Man	135	42	5	182
Woman	187	21	10	218
Total	322	63	15	400

A) 0.805
B) 0.923
C) 1
D) 0.195

6) The distribution of Bachelor's degrees conferred by a university is listed in the table. Assume that a student majors in only one subject. What is the probability that a randomly selected student with a Bachelor's degree majored in Physics or Philosophy? Round your answer to three decimal places.

Major	Frequency
Physics	228
Philosophy	201
Engineering	86
Business	176
Chemistry	222

A) 0.470 B) 0.530 C) 0.250 D) 0.220

7) The distribution of Bachelor's degrees conferred by a university is listed in the table. Assume that a student majors in only one subject. What is the probability that a randomly selected student with a Bachelor's degree majored in Business, Chemistry or Engineering? Round your answer to three decimal places.

Major	Frequency
Physics	216
Philosophy	207
Engineering	90
Business	170
Chemistry	218

A) 0.531 B) 0.469 C) 0.289 D) 0.342

8) A card is drawn from a standard deck of 52 playing cards. Find the probability that the card is a picture card.

A) $\frac{3}{13}$ B) $\frac{1}{13}$ C) $\frac{4}{13}$ D) $\frac{8}{13}$

9) If two events have no outcomes in common they are said to be

A) Disjoint B) Independent C) Conditional D) At odds

10) True or False: Mutually exclusive events are not disjoint events.

A) False B) True

11) The table below shows the probabilities generated by rolling one die 50 times and recording the number rolled. Are the events A = { roll an odd number } and B = {roll a number less than or equal to two} disjoint?

Roll	1	2	3	4	5	6
Probability	0.22	0.10	0.18	0.12	0.18	0.20

A) No B) Yes

12) In the game of craps, two dice are tossed and the up faces are totaled. Is the event getting a total of 9 and one of the dice showing a 6 mutually exclusive? Answer Yes or No.

A) No B) Yes

13) Using a standard deck of 52 playing cards are the events of getting an ace and getting a jack on the card drawn mutually exclusive? Answer Yes or No.

A) Yes B) No

14) The below table shows the probabilities generated by rolling one die 50 times and noting the up face. What is the probability of getting an odd up face?

Roll	1	2	3	4	5	6
Probability	0.22	0.10	0.18	0.12	0.18	0.20

A) 0.58 B) 0.42 C) 0.50 D) 0.55

15) In the game of craps two dice are rolled and the up faces are totaled. If the person rolling the dice on the first roll rolls a 7 or an 11 total they win. If they roll a 2, 3, or 12 on the first roll they lose. If they roll any other total then on subsequent rolls they must roll that total before rolling a 7 to win. What is the probability of winning on the first roll?

A) 0.22 B) 0.17 C) 0.06 D) 0.50

2 Use the General Addition Rule.

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

Solve the problem.

16) A probability experiment is conducted in which the sample space of the experiment is S = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15}. Let event A = {6, 7, 8, 9} and event B = {8, 9, 10, 11, 12}. Assume that each outcome is equally likely. List the outcomes in A and B. Are A and B mutually exclusive?

A) {8, 9}; no B) {8, 9}; yes
C) {6, 7, 8, 9, 10, 11, 12}; no D) {6, 7, 8, 9, 10, 11, 12}; yes

17) A probability experiment is conducted in which the sample space of the experiment is S = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15}. Let event A = {8, 9, 10, 11} and event B = {10, 11, 12, 13, 14}. Assume that each outcome is equally likely. List the outcomes in A or B. Find P(A or B).

A) {8, 9, 10, 11, 12, 13, 14}; $\frac{7}{15}$ B) {10, 11}; $\frac{2}{15}$
C) {8, 9, 10, 11, 12, 12, 13, 14}; $\frac{3}{5}$ D) {8, 9, 10, 11, 13, 14}; $\frac{2}{5}$

18) 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

19) Given that P(A or B) = $\frac{1}{4}$, P(A) = $\frac{1}{6}$, and P(A and B) = $\frac{1}{7}$, find P(B). Express the probability as a simplified fraction.

A) $\frac{19}{84}$ B) $\frac{17}{168}$ C) $\frac{47}{84}$ D) $\frac{23}{84}$

20) The table lists the drinking habits of a group of college students. If a student is chosen at random, find the probability of getting someone who is a man or a non-drinker. Round your answer to three decimal places.

Sex	Non-drinker	Regular Drinker	Heavy Drinker	Total
Man	135	47	5	187
Woman	187	21	7	215
Total	322	68	12	402

A) 0.930 B) 0.947 C) 0.941 D) 0.831

21) The table lists the drinking habits of a group of college students. If a student is chosen at random, find the probability of getting someone who is a woman or a heavy drinker. Round your answer to three decimal places.

Sex	Non–drinker	Regular Drinker	Heavy Drinker	Total
Man	135	69	5	209
Woman	187	21	5	213
Total	322	90	10	422

A) 0.517 B) 0.938 C) 0.787 D) 0.175

22) A card is drawn from a standard deck of 52 playing cards. Find the probability that the card is a queen or a club. Express the probability as a simplified fraction.

A) $\frac{4}{13}$ B) $\frac{7}{52}$ C) $\frac{2}{13}$ D) $\frac{3}{13}$

23) One hundred people were asked, "Do you favor stronger laws on gun control?" 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? Round the the nearest hundredth.

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

24) The below table shows the probabilities generated by rolling one die 50 times and noting the up face. What is the probability of getting an odd up face and a two or less? Round the the nearest hundredth.

Roll	1	2	3	4	5	6
Probability	0.22	0.10	0.18	0.12	0.18	0.20

A) 0.68 B) 0.90 C) 0.66 D) 0.32

25) You roll two dice and total the up faces. What is the probability of getting a total of 8 or two up faces that are the same? Round the the nearest hundredth.

A) 0.28 B) 0.31 C) 0.33 D) 0.50

26) Consider the data in the table shown which represents the marital status of males and females 18 years or older in the United States in 2003. Determine the probability that a randomly selected U.S. resident 18 years or older is divorced or a male? Round to the nearest hundredth.

	Males (in millions)	Females (in millions)	Total (in millions)
Never married	28.6	23.3	51.9
Married	62.1	62.8	124.9
Widowed	2.7	11.3	14.0
Divorced	9.0	12.7	21.7
Total (in millions)	102.4	110.1	212.5

Source: U.S. Census Bureau, Current Population reports

A) 0.54 B) 0.58 C) 0.50 D) 0.04

27) If one card is drawn from a standard 52 card playing deck, determine the probability of getting a ten, a king or a diamond. Round to the nearest hundredth.

A) 0.37 B) 0.40 C) 0.31 D) 0.29

28) If one card is drawn from a standard 52 card playing deck, determine the probability of getting a jack, a three, a club or a diamond. Round to the nearest hundredth.

A) 0.58 B) 0.65 C) 0.50 D) 0.15

29) Two dice are rolled. What is the probability of having both faces the same (doubles) or a total of 4 or 10? Round to the nearest hundredth.

A) 0.28 B) 0.33 C) 0.06 D) 0.15

3 Compute the probability of an event using the Complement Rule.

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

Solve the problem.

30) A probability experiment is conducted in which the sample space of the experiment is S = {6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16}. Let event A = {9, 10, 11, 12, 13}. Assume that each outcome is equally likely. List the outcomes in A^c. Find $P(A^c)$.

A) {6, 7, 8, 14, 15, 16}; $\frac{6}{11}$ B) {9, 10, 11, 12, 13}; $\frac{5}{11}$

C) {14, 15, 16}; $\frac{3}{11}$ D) {6, 7, 8, 13, 14, 15, 16}; $\frac{7}{11}$

31) You are dealt one card from a 52-card deck. Find the probability that you are not dealt a 5. Express the probability as a simplified fraction.

A) $\frac{12}{13}$ B) $\frac{1}{13}$ C) $\frac{9}{10}$ D) $\frac{1}{10}$

32) You are dealt one card from a 52-card deck. Find the probability that you are not dealt a spade. Express the probability as a simplified fraction.

A) $\frac{3}{4}$ B) $\frac{1}{4}$ C) $\frac{4}{13}$ D) $\frac{2}{5}$

33) In 5-card poker, played with a standard 52-card deck, 2,598,960 different hands are possible. If there are 624 different ways a "four-of-a-kind" can be dealt, find the probability of not being dealt a "four-of-a-kind". Express the probability as a fraction, but do not simplify.

A) $\frac{2{,}598{,}336}{2{,}598{,}960}$ B) $\frac{624}{2{,}598{,}960}$ C) $\frac{625}{2{,}598{,}960}$ D) $\frac{1248}{2{,}598{,}960}$

34) A certain disease only affects men 20 years of age or older. The chart shows the probability that a man with the disease falls in the given age group. What is the probability that a randomly selected man with the disease is not between the ages of 55 and 64?

Age Group	Probability
20–24	0.004
25–34	0.006
35–44	0.14
45–54	0.29
55–64	0.32
65–74	0.17
75+	0.07

A) 0.68 B) 0.32 C) 0.29 D) 0.24

35) A certain disease only affects men 20 years of age or older. The chart shows the probability that a man with the disease falls in the given age group. What is the probability that a randomly selected man with the disease is between the ages of 35 and 64?

Age Group	Probability
20–24	0.004
25–34	0.006
35–44	0.14
45–54	0.29
55–64	0.32
65–74	0.17
75+	0.07

A) 0.75 B) 0.14 C) 0.32 D) 0.29

36) The overnight shipping business has skyrocketed in the last ten years. The single greatest predictor of a company's success has been proven time and again to be customer service. A study was conducted to study the customer satisfaction levels for one overnight shipping business. In addition to the customer's satisfaction level, the customers were asked how often they used overnight shipping. The results are shown below in the following table. What is the probability that a respondent did not have a high level of satisfaction with the company? Round the the nearest hundredth.

	Satisfaction level			
Frequency of Use	High	Medium	Low	TOTAL
< 2 per month	250	140	10	400
2 – 5 per month	140	55	5	200
> 5 per month	70	25	5	100
TOTAL	460	220	20	700

A) 0.34 B) 0.66 C) 0.57 D) 0.43

37) A sample of 250 shoppers at a large suburban mall were asked two questions: (1) Did you see a television ad for the sale at department store X during the past 2 weeks? (2) Did you shop at department store X during the past 2 weeks? The responses to the questions are summarized in the table. What is the probability that a randomly selected shopper from the 250 questioned did not shop at department store X? Round the the nearest thousandth.

	Shopped at X	Did Not Shop at X
Saw ad	115	35
Did not see ad	35	65

A) 0.4 B) 0.14 C) 0.26 D) 0.6

38) After completing an inventory of three warehouses, a golf club shaft manufacturer described its stock of 12,246 shafts with the percentages given in the table. Suppose a shaft is selected at random from the 12,246 currently in stock, and the warehouse number and type of shaft are observed. Find the probability that the shaft was produced in a warehouse other than warehouse 1. Round the the nearest hundredth.

		Type of Shaft		
		Regular	Stiff	Extra Stiff
Warehouse	1	19%	8%	4%
	2	14%	12%	16%
	3	9%	18%	0%

A) 0.69 B) 0.31 C) 0.42 D) 0.80

39) The breakdown of workers in a particular state according to their political affiliation and type of job held is shown here. Suppose a worker is selected at random within the state and the worker's political affiliation and type of job are noted. Find the probability the worker is not an Independent. Round the the nearest hundredth.

		Political Affiliation		
		Republican	Democrat	Independent
Type of job	White collar	11%	16%	18%
	Blue Collar	10%	12%	33%

A) 0.49 B) 0.51 C) 0.27 D) 0.22

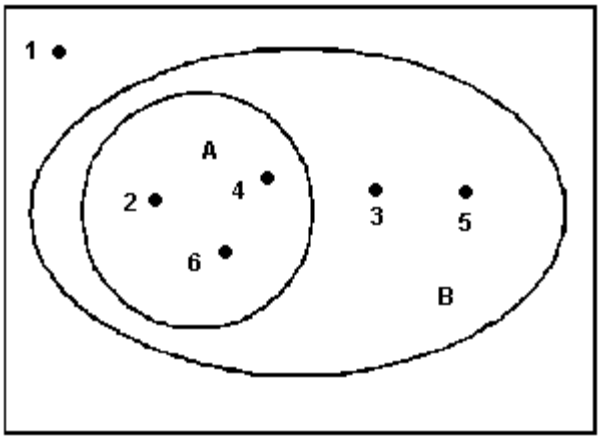
40) A local country club has a membership of 600 and operates facilities that include an 18–hole championship golf course and 12 tennis courts. Before deciding whether to accept new members, the club president would like to know how many members regularly use each facility. A survey of the membership indicates that 64% regularly use the golf course, 48% regularly use the tennis courts, and 5% use neither of these facilities regularly. What percentage of the 600 use at least one of the golf or tennis facilities?

A) 95% B) 5% C) 107% D) 17%

41) Fill in the blank. The _____ of an event A is the event that A does not occur.

A) complement B) intersection C) union D) Venn diagram

42) The following Venn diagram is for the six sample points possible when rolling a fair die. Let A be the event rolling an even number and let B be the event rolling a number greater than 1. Which of the following events describes the event rolling a 1?



A) B^C B) A^C C) B D) $A \cup B$

43) True or False: $P(E) + P(E^C) > 1$

A) False B) True

44) The complement of 4 heads in the toss of 4 coins is

A) At least one tail B) All tails C) Exactly one tail D) Three heads

45) A game has three outcomes. The probability of a win is 0.4, the probability of tie is 0.5, and the probability of a loss is 0.1. What is the probability of not winning in a single play of the game.

A) 0.6 B) 0.5 C) 0.1 D) 0.33

5.3 Independence and the Multiplication Rule

1 Identify independent events.

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

Provide an appropriate response.

1) There are 30 chocolates in a box, all identically shaped. There are 11 filled with nuts, 10 filled with caramel, and 9 are solid chocolate. You randomly select one piece, eat it, and then select a second piece. Is this an example of independence? Answer Yes or No.
   A) No B) Yes

2) Numbered disks are placed in a box and one disk is selected at random. There are 6 red disks numbered 1 through 6, and 7 yellow disks numbered 7 through 13. In an experiment a disk is selected, the number and color noted, replaced, and then a second disk is selected. Is this an example of independence? Answer Yes or No.
   A) Yes B) No

3) After completing an inventory of three warehouses, a golf club shaft manufacturer described its stock of 12, 246 shafts with percentages given in the table. Is the event of selecting a shaft independent of the warehouse? Answer Yes or No.
   A) No B) Yes

4) Two events are _____ if the occurrence if the occurrence of event E in a probability experiment does not affect the probability of event F in the same experiment.
   A) independent B) mutually exclusive C) dependent D) disjoint

5) Two events are _____ if the occurrence of event E in a probability experiment changes the probability of event F in the same experiment.
   A) dependent B) mutually exclusive C) independent D) disjoint

6) True or False: Mutually exclusive events are always independent.
   A) False B) True

2 Use the Multiplication Rule for independent events.

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

Solve the problem.

7) Suppose that events E and F are independent, P(E) = 0.7 and P(F) = 0.2. What is the P(E and F)?
   A) 0.14 B) 0.9 C) 0.014 D) 0.76

8) A single die is rolled twice. Find the probability of getting a 3 the first time and a 3 the second time. Express the probability as a simplified fraction.
   A) $\frac{1}{36}$ B) $\frac{1}{6}$ C) $\frac{1}{12}$ D) $\frac{1}{3}$

9) You are dealt one card from a 52 card deck. Then the card is replaced in the deck, the deck is shuffled, and you draw again. Find the probability of getting a picture card the first time and a club the second time. Express the probability as a simplified fraction.
   A) $\frac{3}{52}$ B) $\frac{1}{13}$ C) $\frac{3}{13}$ D) $\frac{1}{4}$

10) If you toss a fair coin 3 times, what is the probability of getting all heads? Express the probability as a simplified fraction.

A) $\frac{1}{8}$ B) $\frac{1}{4}$ C) $\frac{1}{16}$ D) $\frac{1}{2}$

11) A human gene carries a certain disease from the mother to the child with a probability rate of 57%. That is, there is a 57% chance that the child becomes infected with the disease. Suppose a female carrier of the gene has three children. Assume that the infections of the three children are independent of one another. Find the probability that all three of the children get the disease from their mother. Round to the nearest thousandth.

A) 0.185 B) 0.815 C) 0.08 D) 0.105

12) A machine has four components, A, B, C, and D, set up in such a manner that all four parts must work for the machine to work properly. Assume the probability of one part working does not depend on the functionality of any of the other parts. Also assume that the probabilities of the individual parts working are $P(A) = P(B) = 0.95$, $P(C) = 0.99$, and $P(D) = 0.91$. Find the probability that the machine works properly. Round to the nearest ten–thousandth.

A) 0.8131 B) 0.8559 C) 0.8935 D) 0.1869

13) Suppose a basketball player is an excellent free throw shooter and makes 94% of his free throws (i.e., he has a 94% chance of making a single free throw). Assume that free throw shots are independent of one another. Suppose this player gets to shoot three free throws. Find the probability that he misses all three consecutive free throws. Round to the nearest ten–thousandth.

A) 0.0002 B) 0.1694 C) 0.8306 D) 0.9998

14) What is the probability that in three consecutive rolls of two fair dice, a person gets a total of 7, followed by a total of 11, followed by a total of 7? Round to the nearest ten–thousandth.

A) 0.0015 B) 0.1667 C) 0.2876 D) 0.0012

15) A bag contains 10 white, 12 blue, 13 red, 7 yellow, and 8 green wooded balls. A ball is selected from the bag, its color noted, then replaced. You then draw a second ball, note its color and then replace the ball. What is the probability of selecting 2 red balls? Round to the nearest ten–thousandth.

A) 0.0676 B) 0.5200 C) 0.2600 D) 0.0624

16) A bag contains 10 white, 12 blue, 13 red, 7 yellow, and 8 green wooded balls. A ball is selected from the bag, its color noted, then replaced. You then draw a second ball, note its color and then replace the ball. What is the probability of selecting one white ball and one blue ball? Round to the nearest ten–thousandth.

A) 0.0480 B) 0.4400 C) 0.2200 D) 0.0088

3 Compute at–least probabilities.

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

Provide an appropriate response.

17) A human gene carries a certain disease from the mother to the child with a probability rate of 34%. That is, there is a 34% chance that the child becomes infected with the disease. Suppose a female carrier of the gene has three children. Assume that the infections of the three children are independent of one another. Find the probability that at least one of the children get the disease from their mother. Round to the nearest thousandth.

A) 0.713 B) 0.148 C) 0.444 D) 0.287

18) A machine has four components, A, B, C, and D, set up in such a manner that all four parts must work for the machine to work properly. Assume the probability of one part working does not depend on the functionality of any of the other parts. Also assume that the probabilities of the individual parts working are P(A) = P(B) = 0.94, P(C) = 0.98, and P(D) = 0.99. Find the probability that at least one of the four parts will work. Round to six decimal places.

A) 0.999999 B) 0.857269 C) 0.000001 D) 0.142731

19) Investing is a game of chance. Suppose there is a 34% chance that a risky stock investment will end up in a total loss of your investment. Because the rewards are so high, you decide to invest in three independent risky stocks. Find the probability that at least one of your three investments becomes a total loss. Round to the nearest ten–thousandth when necessary.

A) 0.7125 B) 0.4443 C) 0.1481 D) 0.0393

20) Find the probability that of 25 randomly selected students, at least two share the same birthday. Round to the nearest thousandth.

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

21) Two companies, A and B, package and market a chemical substance and claim 0.15 of the total weight of the substance is sodium. However, a careful survey of 4,000 packages (half from each company) indicates that the proportion varies around 0.15, with the results shown below. Find the percentage of all chemical B packages that contain a sodium total weight proportion above 0.150.

		Proportion of Sodium			
		< 0.100	0.100 – 0.149	0.150 – 0.199	> 0.200
Chemcal Brand	A	25%	10%	10%	5%
	B	5%	5%	10%	30%

A) 80% B) 40% C) 50% D) 55%

22) 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

23) The probability that a region prone to hurricanes will be hit by a hurricane in any single year is $\frac{1}{10}$. What is the probability of a hurricane at least once in the next 5 years?

A) 0.40951 B) $\frac{1}{2}$ C) 0.99999 D) 0.00001

24) Investment in new issues (the stock of newly formed companies) can be both suicidal and rewarding. Suppose that of 500 newly formed companies in 2010, only 16 appeared to have outstanding prospects. Suppose that you had selected two of these 500 companies back in 2010. Find the probability that at least one of your companies had outstanding prospects.

A) 0.0630381 B) 0.3185892 C) 0.9369619 D) 0.0310381

25) You toss a fair coin 5 times. What is the probability of at least one head? Round to the nearest ten–thousandth.

A) 0.9688 B) 0.7500 C) 0.5000 D) 0.0313

26) You are playing roulette at a casino in the United States. The wheel has 18 red slots, 18 black slots, and two green slots. In 4 spins of the wheel what is the probability of at least one red? Round to the nearest ten–thousandth.

A) 0.9048 B) 0.9375 C) 0.0625 D) 0.0953

5.4 Conditional Probability and the General Multiplication Rule

1 Compute conditional probabilities.

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

Find the indicated probability. If necessary, round to three decimal places.

1) Suppose that E and F are two events and that P(E and F) = 0.38 and P(E) = 0.8. What is P(F | E)?
A) 0.475 B) 2.105 C) 0.304 D) 1.18

2) Suppose that E and F are two events and that N(E and F) = 370 and N(E) = 760. What is P(F | E)?
A) 0.487 B) 2.054 C) 0.327 D) 0.049

3) Suppose that E and F are two events and that P(E) = 0.2 and P(F | E) = 0.5. What is P(E and F)?
A) 0.1 B) 0.7 C) 0.4 D) 0.01

Find the indicated probability. Give your answer as a simplified fraction.

4) The overnight shipping business has skyrocketed in the last ten years. The single greatest predictor of a company's success has been proven time and again to be customer service. A study was conducted to study the customer satisfaction levels for one overnight shipping business. In addition to the customer's satisfaction level, the customers were asked how often they used overnight shipping. The results are shown below in the following table. A customer is chosen at random. Given that the customer uses the company two to five times per month, what is the probability that they expressed low satisfaction with the company?

	Satisfaction level			
Frequency of Use	High	Medium	Low	TOTAL
< 2 per month	250	140	10	400
2 – 5 per month	140	55	5	200
> 5 per month	70	25	5	100
TOTAL	460	220	20	700

A) $\frac{1}{40}$ B) $\frac{1}{4}$ C) $\frac{1}{140}$ D) $\frac{43}{140}$

5) The managers of a corporation were surveyed to determine the background that leads to a successful manager. Each manager was rated as being either a good, fair, or poor manager by his/her boss. The manager's educational background was also noted. The data appear below. Given that a manager is only a fair manager, what is the probability that this manager has no college background?

	Educational Background				
Manager Rating	H. S. Degree	Some College	College Degree	Master's or Ph.D.	Totals
Good	7	5	24	3	39
Fair	9	13	45	20	87
Poor	6	2	4	22	34
Totals	22	20	73	45	160

A) $\frac{3}{29}$ B) $\frac{9}{22}$ C) $\frac{9}{160}$ D) $\frac{5}{8}$

6) The managers of a corporation were surveyed to determine the background that leads to a successful manager. Each manager was rated as being either a good, fair, or poor manager by his/her boss. The manager's educational background was also noted. The data appear below. Given that a manager is only a fair manager, what is the probability that this manager has a college degree?

Educational Background

Manager Rating	H. S. Degree	Some College	College Degree	Master's or Ph.D.	Totals
Good	3	8	22	6	39
Fair	9	15	44	19	87
Poor	4	5	6	19	34
Totals	16	28	72	44	160

A) $\frac{44}{87}$ B) $\frac{11}{40}$ C) $\frac{9}{20}$ D) $\frac{24}{29}$

7) The managers of a corporation were surveyed to determine the background that leads to a successful manager. Each manager was rated as being either a good, fair, or poor manager by his/her boss. The manager's educational background was also noted. The data appear below. Given that a manager is a good manager, what is the probability that this manager has some college background?

Educational Background

Manager Rating	H. S. Degree	Some College	College Degree	Master's or Ph.D.	Totals
Good	6	2	23	8	39
Fair	5	14	46	22	87
Poor	7	1	9	17	34
Totals	18	17	78	47	160

A) $\frac{2}{39}$ B) $\frac{23}{39}$ C) $\frac{1}{80}$ D) $\frac{2}{17}$

8) A study was recently done that emphasized the problem we all face with drinking and driving. Four hundred accidents that occurred on a Saturday night were analyzed. Two items noted were the number of vehicles involved and whether alcohol played a role in the accident. The numbers are shown below. Given that an accident involved multiple vehicles, what is the probability that it involved alcohol?

Number of Vehicles Involved

Did Alcohol Play a Role?	1	2	3 or more	Totals
Yes	59	91	20	170
No	23	180	27	230
Totals	82	271	47	400

A) $\frac{37}{106}$ B) $\frac{111}{400}$ C) $\frac{20}{47}$ D) $\frac{1}{20}$

9) A researcher at a large university wanted to investigate if a student's seat preference was related in any way to the gender of the student. The researcher divided the lecture room into three sections (1–front, middle of the room, 2–front, sides of the classroom, and 3–back of the classroom, both middle and sides) and noted where his students sat on a particular day of the class. The researcher's summary table is provided below. Suppose a person sitting in the front, middle portion of the class is randomly selected to answer a question. Find the probability the person selected is a female.

	Area (1)	Area (2)	Area (3)	Total
Males	16	7	10	33
Females	11	15	13	39
Total	27	22	23	72

A) $\frac{11}{27}$ B) $\frac{11}{39}$ C) $\frac{9}{13}$ D) $\frac{11}{72}$

10) The manager of a used car lot took inventory of the automobiles on his lot and constructed the following table based on the age of his car and its make (foreign or domestic). A car was randomly selected from the lot. Given that the car selected was a foreign car, what is the probability that it was older than 2 years? Age of Car (in years)

Make	0 – 2	3 – 5	6 – 10	over 10	Total
Foreign	45	29	12	14	100
Domestic	36	28	15	21	100
Total	81	57	27	35	200

A) $\frac{11}{20}$ B) $\frac{9}{20}$ C) $\frac{55}{119}$ D) $\frac{45}{119}$

11) The manager of a used car lot took inventory of the automobiles on his lot and constructed the following table based on the age of his car and its make (foreign or domestic). A car was randomly selected from the lot. Given that the car selected was a domestic car, what is the probability that it was older than 2 years?

Age of Car (in years)

Make	0 – 2	3 – 5	6 – 10	over 10	Total
Foreign	37	28	13	22	100
Domestic	35	21	14	30	100
Total	72	49	27	52	200

A) $\frac{13}{20}$ B) $\frac{35}{72}$ C) $\frac{7}{40}$ D) $\frac{9}{25}$

12) The manager of a used car lot took inventory of the automobiles on his lot and constructed the following table based on the age of his car and its make (foreign or domestic).

Age of Car (in years)

Make	0 – 2	3 – 5	6 – 10	over 10	Total
Foreign	36	26	14	24	100
Domestic	41	27	11	21	100
Total	77	53	25	45	200

A car was randomly selected from the lot. Given that the car selected is older than two years old, find the probability that it is not a foreign car.

A) $\frac{59}{123}$ B) $\frac{64}{123}$ C) $\frac{59}{100}$ D) $\frac{16}{25}$

Find the indicated probability. Give your answer as a decimal rounded to the nearest thousandth.

13) A fast–food restaurant chain with 700 outlets in the United States describes the geographic location of its restaurants with the accompanying table of percentages. A restaurant is to be chosen at random from the 700 to test market a new style of chicken. Given that the restaurant is located in the eastern United States, what is the probability it is located in a city with a population of at least 10,000?

		Region			
		NE	SE	SW	NW
	<10,000	1%	6%	3%	0%
Population of City	10,000 – 100,000	15%	6%	12%	5%
	>100,000	20%	4%	3%	25%

A) 0.865 B) 0.5 C) 0.45 D) 0.135

14) After completing an inventory of three warehouses, a golf club shaft manufacturer described its stock of 12,246 shafts with the percentages given in the table. Suppose a shaft is selected at random from the 12,246 currently in stock, and the warehouse number and type of shaft are observed. Given that the shaft is produced in warehouse 2, find the probability it has an extra stiff shaft.

		Type of Shaft		
		Regular	Stiff	Extra Stiff
Warehouse	1	19%	8%	8%
	2	14%	9%	21%
	3	3%	18%	0%

A) 0.477 B) 0.724 C) 0.404 D) 0.52

15) The breakdown of workers in a particular state according to their political affiliation and type of job held is shown here. Suppose a worker is selected at random within the state and the worker's political affiliation and type of job are noted. Given the worker is a Democrat, what is the probability that the worker is in a white collar job.

		Political Affiliation		
		Republican	Democrat	Independent
Type of job	White collar	19%	17%	14%
	Blue Collar	20%	13%	17%

A) 0.567 B) 0.34 C) 0.27 D) 0.476

16) A local country club has a membership of 600 and operates facilities that include an 18–hole championship golf course and 12 tennis courts. Before deciding whether to accept new members, the club president would like to know how many members regularly use each facility. A survey of the membership indicates that 69% regularly use the golf course, 41% regularly use the tennis courts, and 8% use neither of these facilities regularly. Given that a randomly selected member uses the tennis courts regularly, find the probability that they also use the golf course regularly.

A) 0.439 B) 0.261 C) 0.164 D) 0.196

Provide an appropriate response.

17) The conditional probability of event G, given the knowledge that event H has occurred, would be written as _____.

A) P(G|H) B) P(G) C) P(H|G) D) P(H)

18) Computing the probability of the event "drawing a second red ball from a bag of colored balls after having kept the red ball that was drawn first from the bag" is an example of

A) conditional probability. B) independence of events.
C) mutual exclusiveness. D) disjoint events.

19) True or False: Conditional probabilities leave the sample space the same when considering sequential events.

A) False B) True

20) Numbered disks are placed in a box and one disk is selected at random. If there are 6 red disks numbered 1 through 6, and 4 yellow disks numbered 7 through 10, find the probability of selecting a yellow disk, given that the number selected is less than or equal to 3 or greater than or equal to 8.

A) $\frac{1}{2}$ B) $\frac{3}{4}$ C) $\frac{3}{5}$ D) $\frac{3}{10}$

2 Compute probabilities using the General Multiplication Rule.

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

Provide an appropriate response. Express your answer as a simplified fraction unless otherwise noted.

21) There are 32 chocolates in a box, all identically shaped. There 12 are filled with nuts, 11 with caramel, and 9 are solid chocolate. You randomly select one piece, eat it, and then select a second piece. Find the probability of selecting 2 solid chocolates in a row.

A) $\frac{9}{124}$ B) $\frac{81}{1024}$ C) $\frac{9}{992}$ D) $\frac{9}{128}$

22) There are 26 chocolates in a box, all identically shaped. There 5 are filled with nuts, 8 with caramel, and 13 are solid chocolate. You randomly select one piece, eat it, and then select a second piece. Find the probability of selecting 2 nut candies.

A) $\frac{2}{65}$ B) $\frac{25}{676}$ C) $\frac{1}{50}$ D) $\frac{5}{169}$

23) There are 35 chocolates in a box, all identically shaped. There 8 are filled with nuts, 12 with caramel, and 15 are solid chocolate. You randomly select one piece, eat it, and then select a second piece. Find the probability of selecting a solid chocolate candy followed by a nut candy.

A) $\frac{12}{119}$ B) $\frac{3}{35}$ C) $\frac{3}{238}$ D) $\frac{24}{245}$

24) Consider a political discussion group consisting of 4 Democrats, 6 Republicans, and 5 Independents. Suppose that two group members are randomly selected, in succession, to attend a political convention. Find the probability of selecting an Independent and then a Democrat.

A) $\frac{2}{21}$ B) $\frac{4}{45}$ C) $\frac{2}{105}$ D) $\frac{1}{42}$

25) Consider a political discussion group consisting of 5 Democrats, 6 Republicans, and 8 Independents. Suppose that two group members are randomly selected, in succession, to attend a political convention. Find the probability of selecting an Independent and then a Republican.

A) $\frac{8}{57}$ B) $\frac{48}{361}$ C) $\frac{5}{342}$ D) $\frac{4}{171}$

26) An ice chest contains 4 cans of apple juice, 6 cans of grape juice, 9 cans of orange juice, and 2 cans of pineapple juice. Suppose that you reach into the container and randomly select three cans in succession. Find the probability of selecting no grape juice.

A) $\frac{13}{38}$ B) $\frac{225}{532}$ C) $\frac{130}{441}$ D) $\frac{2}{133}$

27) Numbered disks are placed in a box and one disk is selected at random. If there are 3 red disks numbered 1 through 3, and 2 yellow disks numbered 4 through 5, find the probability of selecting a disk numbered 3, given that a red disk is selected.

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

28) Numbered disks are placed in a box and one disk is selected at random. If there are 4 red disks numbered 1 through 4, and 6 yellow disks numbered 5 through 10, find the probability of selecting a red disk, given that an odd–numbered disk is selected.

A) $\frac{2}{5}$ B) $\frac{3}{5}$ C) $\frac{1}{5}$ D) $\frac{3}{10}$

29) A group of students were asked if they carry a n ATM card The responses are listed in the table. If a student is selected at random, find the probability that he or she owns an ATM card given that the student is a freshman. Round your answer to three decimal places. Round your answer to the nearest thousandth.

Class	ATM Card Carrier	Not an ATM Card Carrier	Total
Freshman	38	22	60
Sophomore	15	25	40
Total	53	47	100

A) 0.633 B) 0.367 C) 0.717 D) 0.380

30) Four employees drive to work in the same car. The workers claim they were late to work because of a flat tire. Their managers ask the workers 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 workers didn't really have a flat tire and each randomly selects a tire, what is the probability that all four workers select the same tire?

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

31) Find the probability that of 25 randomly selected housewives, no two share the same birthday. Round your answer to the nearest thousandth.

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

32) A fast–food restaurant chain with 700 outlets in the United States describes the geographic location of its restaurants with the accompanying table of percentages. A restaurant is to be chosen at random from the 700 to test market a new style of chicken. Given that the restaurant is located in the eastern United States, what is the probability it is located in a city with a population of at least 10,000? Round your answer to the nearest thousandth.

		Region			
		NE	SE	SW	NW
	<10,000	9%	6%	3%	0%
Population of City	10,000 – 100,000	15%	10%	12%	5%
	>100,000	20%	4%	7%	9%

A) 0.766 B) 0.598 C) 0.49 D) 0.234

33) After completing an inventory of three warehouses, a golf club shaft manufacturer described its stock of 12,246 shafts with the percentages given in the table. Suppose a shaft is selected at random from the 12,246 currently in stock, and the warehouse number and type of shaft are observed. Given that the shaft is produced in warehouse 2, find the probability it has an extra stiff shaft. Round your answer to the nearest thousandth.

		Type of Shaft		
		Regular	Stiff	Extra Stiff
	1	19%	8%	12%
Warehouse	2	14%	17%	5%
	3	7%	18%	0%

A) 0.139 B) 0.294 C) 0.104 D) 0.48

34) A bag contains 10 white, 12 blue, 13 red, 7 yellow, and 8 green wooded balls. A ball is selected from the bag and kept. You then draw a second ball and keep it also. What is the probability of selecting one white ball and one blue ball? Round your answer to four decimal places.

A) 0.0490 B) 0.0480 C) 0.0090 D) 0.0088

35) A bag contains 10 white, 12 blue, 13 red, 7 yellow, and 8 green wooded balls. A ball is selected from the bag and kept. You then draw a second ball and keep it also. What is the probability of selecting two blue balls? Round your answer to four decimal places.

A) 0.0539 B) 0.0588 C) 0.0528 D) 0.0576

36) Five cards are randomly selected without replacement from a standard deck of 52 playing cards. What is the probability of getting 5 hearts? Round your answer to four decimal places.
A) 0.0005 B) 0.0012 C) 0.0010 D) 0.0004

37) CampusFest is a student festival where local businesses come on campus to sell their goods to students at vastly reduced prices. As part of a give–away promotion, a local cellular phone company gave away 200 cellular phones to students who signed up for their calling service. Unbeknownst to the company is that 90 of these cellular phones were faulty and will cause a small explosion when dialed outside the local calling area. Suppose you and your roommate each received one of the giveaway phones. Find the probability that both of you received faulty phones. Round to five decimal places when necessary.
A) 0.20126 B) 0.2025 C) 0.9 D) 0.24874

38) A county welfare agency employs 36 welfare workers who interview prospective food stamp recipients. Periodically, the supervisor selects, at random, the forms completed by two workers to audit for illegal deductions. Unknown to the supervisor, seven of the workers have regularly been giving illegal deductions to applicants. Given that the first worker chosen has not been giving illegal deductions, what is the probability that the second worker chosen has been giving illegal deductions? Round to the nearest thousandth.
A) 0.2 B) 0.171 C) 0.167 D) 0.194

39) A county welfare agency employs 34 welfare workers who interview prospective food stamp recipients. Periodically, the supervisor selects, at random, the forms completed by two workers to audit for illegal deductions. Unknown to the supervisor, eight of the workers have regularly been giving illegal deductions to applicants. What is the probability both workers chosen have been giving illegal deductions? Round to the nearest thousandth.
A) 0.05 B) 0.055 C) 0.057 D) 0.048

40) True or False: If A and B are independent events, then A and B are mutually exclusive also.
A) False B) True

41) True or False: Two events, A and B, are independent if $P(A \text{ and } B) = P(A) \cdot P(B)$.
A) True B) False

42) Assume that $P(A) = 0.7$ and $P(B) = 0.2$. If A and B are independent, find $P(A \text{ and } B)$.
A) 0.14 B) 0.76 C) 0.90 D) 1.00

43) If $P(A) = 0.45$, $P(B) = 0.25$, and $P(B|A) = 0.45$, are A and B independent?
A) no B) yes C) cannot determine

44) If $P(A) = 0.72$, $P(B) = 0.11$, and A and B are independent, find $P(A|B)$.
A) 0.72 B) 0.0792 C) 0.83 D) 0.11

45) Assume that $P(E) = 0.15$ and $P(F) = 0.48$. If E and F are independent, find $P(E \text{ and } F)$.
A) 0.072 B) 0.15 C) 0.558 D) 0.630

46) If two events A and B are _____, then $P(A \text{ and } B) = P(A)\,P(B)$.
A) independent B) simple events C) mutually exclusive D) complements

47) True or False: For two events A and B, suppose $P(A) = 0.35$, $P(B) = 0.65$, and $P(B|A) = 0.35$. Then A and B are independent.
A) False B) True

48) True or False: For two events A and B, suppose $P(A) = 0.1$, $P(B) = 0.8$, and $P(A|B) = 0.1$. Then A and B are independent.
A) True B) False

49) Given that events A and B are mutually exclusive and P(A) = 0.5 and P(B) = 0.7, are A and B independent?
A) no B) yes C) cannot be determined

50) Given that events C and D are independent, P(C) = 0.3, and P(D) = 0.6, are C and D mutually exclusive?
A) no B) yes C) cannot be determined

51) Given events A and B with probabilities P(A) = 0.5, P(B) = 0.4, and P(A and B) = 0.2, are A and B independent?
A) yes B) no C) cannot be determined

52) Given events C and D with probabilities P(C) = 0.3, P(D) = 0.2, and P(C and D) = 0.1, are C and D independent?
A) no B) yes C) cannot be determined

53) Given events A and B with probabilities P(A) = 0.75 and P(B) = 0.15, are A and B mutually exclusive?
A) cannot be determined B) no C) yes

5.5 Counting Techniques

1 Solve counting problems using the Multiplication Rule.

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

Evaluate the factorial expression.

1) $\frac{4!}{2!}$

A) 12 B) 2! C) $\frac{4}{2}$ D) 4

2) $\frac{700!}{699!}$

A) 700 B) 489,300 C) 1 D) 699

Provide an appropriate response.

3) A person can order a new car with a choice of 7 possible colors, with or without air conditioning, with or without heated seats, with or without anti-lock brakes, with or without power windows, and with or without a CD player. In how many different ways can a new car be ordered in terms of these options?
A) 224 B) 112 C) 448 D) 14

4) You are taking a multiple-choice test that has 8 questions. Each of the questions has 4 choices, with one correct choice per question. If you select one of these options per question and leave nothing blank, in how many ways can you answer the questions?
A) 65,536 B) 32 C) 4096 D) 12

5) License plates in a particular state display 3 letters followed by 4 numbers. How many different license plates can be manufactured? (Repetitions are allowed.)
A) 175,760,000 B) 12 C) 36 D) 260

6) How many different four-letter secret codes can be formed if the first letter must be an S or a T?
A) 35,152 B) 456,976 C) 72 D) 421,824

7) There are 5 performers who are to present their acts at a variety show. How many different ways are there to schedule their appearances?
A) 120 B) 5 C) 25 D) 20

8) There are 8 performers who are to present their acts at a variety show. One of them insists on being the first act of the evening. If this request is granted, how many different ways are there to schedule the appearances?
A) 5040 B) 40,320 C) 64 D) 56

9) You want to arrange 12 of your favorite CD's along a shelf. How many different ways can you arrange the CD's assuming that the order of the CD's makes a difference to you?
A) 479,001,600 B) 39,916,800 C) 144 D) 132

10) True or False: 0! = 1!
A) True B) False

11) How many different breakfasts can you have at the local diner if you can select 3 different egg dishes (scrambled, fried, poached), 4 choices of meat (steak, ham, bacon, sausage), 5 breads (white, wheat, rye, muffin, bagel), 6 juices (tomato, grape, apple, orange, mixed berry, vegetable cocktail), and 4 beverages (water, milk, coffee, tea)?
A) 1440 B) 5 C) 22 D) 360

12) A medical salesperson is to visit the various members of the staff at a clinic. He must see 8 doctors, 6 physicians assistants, 12 nurses, 3 medical technologists, and 3 receptionists. How many different ways can these people be visited by the salesperson if the order is not important?
A) 5184 B) 32 C) 25,920 D) 6,220,800

2 Solve counting problems using permutations.

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

Find the value of the permutation.

13) ${}_{10}P_6$
A) 151,200 B) 5040 C) 604,800 D) 3,628,800

14) ${}_{6}P_0$
A) 1 B) 60 C) 0 D) 720

15) ${}_{8}P_8$
A) 40,320 B) 1 C) 20,160 D) 2

Provide an appropriate response.

16) A church has 9 bells in its bell tower. Before each church service 5 bells are rung in sequence. No bell is rung more than once. How many sequences are there?
A) 15,120 B) 3024 C) 126 D) 6048

17) A club elects a president, vice–president, and secretary–treasurer. How many sets of officers are possible if there are 12 members and any member can be elected to each position? No person can hold more than one office.
A) 1320 B) 660 C) 440 D) 11,880

18) In a contest in which 9 contestants are entered, in how many ways can the 5 distinct prizes be awarded?
A) 15,120 B) 3024 C) 756 D) 6048

19) How many arrangements can be made using 2 letters of the word HYPERBOLAS if no letter is to be used more than once?
A) 90 B) 1,814,400 C) 45 D) 3,628,800

20) The Environmental Protection Agency must inspect nine factories for complaints of water 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) 45

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

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

23) How many ways can five people, A, B, C, D, and E, sit in a row at a concert hall if D and E will not sit next to each other?

A) 72 B) 24 C) 48 D) 60

24) In how many different ways can a ski club consisting of 20 people select a person for its officers? The positions available are president, vice president, treasurer, and secretary. No person can hold more than one positions and the each office is filled in order.
A) 116,280 B) 4845 C) 1440 D) 74

3 Solve counting problems using combinations.

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

Find the value of the combination.

25) ${}_9C_8$
A) 9 B) 8 C) 72 D) 362,880

26) ${}_8C_6$
A) 28 B) 56 C) 10,080 D) 4

27) ${}_7C_0$
A) 1 B) 7 C) 1260 D) 2520

28) ${}_9C_1$
A) 9 B) 362,880 C) 4.5 D) 80,640

29) ${}_4C_4$
A) 1 B) 24 C) 6 D) 0.5

30) $\dfrac{{}_{12}C_3}{{}_6C_4}$
A) $\dfrac{44}{3}$ B) $\dfrac{11}{3}$ C) $\dfrac{22}{3}$ D) 5,322,240

Provide an appropriate response.

31) From 9 names on a ballot, a committee of 5 will be elected to attend a political national convention. How many different committees are possible?
A) 126 B) 15,120 C) 3024 D) 7560

32) To win at LOTTO in a certain state, one must correctly select 6 numbers from a collection of 55 numbers (one through 55.) The order in which the selections is made does not matter. How many different selections are possible?
A) 28,989,675 B) 25,827,165 C) 330 D) 720

33) In how many ways can a committee of three men and four women be formed from a group of 9 men and 9 women?
A) 10,584 B) 1,524,096 C) 5040 D) 42

34) A physics exam consists of 9 multiple–choice questions and 6 open–ended problems in which all work must be shown. If an examinee must answer 5 of the multiple–choice questions and 4 of the open–ended problems, in how many ways can the questions and problems be chosen?
A) 1890 B) 1080 C) 261,273,600 D) 5,443,200

35) A professor wants to arrange his books on a shelf. He has 30 books and only space on the shelf for 20 of them. How many different 20–book arrangements can he make using the 30 books? This is an example of a problem that can be solved using which method?
A) Permutations B) Combinations
C) Conditional probability D) Randomness

36) Professor Alle Whet teaches French and has a class of 24 students. Part of his grading system includes an observation of groups of 3 students engaged in a conversation in French. This is an example of a problem that can be solved using which method?
A) Combinations B) Permutations
C) Conditional probability D) Randomness

4 Solve counting problems involving permutations with nondistinct items.

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

Provide an appropriate response.

37) How many distinct arrangements can be formed from all the letters of "students"?
A) 10,080 B) 1680 C) 720 D) 40,320

38) How many distinct arrangements can be formed from all the letters of "statistics"?
A) 50,400 B) 201,600 C) 259,200 D) 72 E) 3,628,800

39) Given the sets of digits {1, 3, 4, 6, 8}, how many different numbers between 40,000 and 80,000 can be written using these digits if repetition of digits is allowed?
A) 1250 B) 3125 C) 120 D) 1875 E) 22

40) How many distinct arrangements of the letters in the word Mississippi are possible?
A) 34,650 B) 39,916,800 C) 1152 D) 7920

41) How many distinct arrangements of the letters in the word football are possible?
A) 10,080 B) 1680 C) 720 D) 40,320

42) A man has 12 coins that consist of 3 pennies, 4 nickels, and 5 quarters. How many distinct arrangements of the coins can he make if he lays them in a row one at a time?
A) 27,720 B) 479,001,600 C) 9240 D) 83,160

5 Compute probabilities involving permutations and combinations.

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

Provide an appropriate response.

43) Amy, Jean, Keith, Tom, Susan, and Dave have all been invited to a birthday party. They arrive randomly and each person arrives at a different time. In how many ways can they arrive? In how many ways can Jean arrive first and Keith last? Find the probability that Jean will arrive first and Keith will arrive last.

A) 720; 24; $\frac{1}{30}$ B) 720; 15; $\frac{1}{48}$ C) 120; 6; $\frac{1}{20}$ D) 120; 10; $\frac{1}{12}$

44) Six students, A, B, C, D, E, F, are to give speeches to the class. The order of speaking is determined by random selection. Find the probability that (a) E will speak first (b) that C will speak fifth and B will speak last (c) that the students will speak in the following order: DECABF (d) that A or B will speak first.

A) $\frac{1}{6}; \frac{1}{24}; \frac{1}{720}; \frac{1}{3}$ B) $\frac{1}{6}; \frac{1}{12}; \frac{1}{720}; \frac{1}{3}$ C) $\frac{1}{6}; \frac{1}{36}; \frac{1}{720}; \frac{1}{12}$ D) $\frac{1}{6}; \frac{1}{36}; \frac{1}{360}; \frac{1}{3}$

45) A group consists of 6 men and 5 women. Five people are selected to attend a conference. In how many ways can 5 people be selected from this group of 11? In how many ways can 5 men be selected from the 6 men? Find the probability that the selected group will consist of all men.

A) 462; 6; $\frac{1}{77}$ B) 55,440; 720; $\frac{1}{77}$ C) 462; 6; $\frac{1}{55,440}$ D) 462; 6; $\frac{1}{518,400}$

46) To play the lottery in a certain state, a person has to correctly select 5 out of 45 numbers, paying $1 for each five–number selection. If the five numbers picked are the same as the ones drawn by the lottery, an enormous sum of money is bestowed. What is the probability that a person with one combination of five numbers will win? What is the probability of winning if 100 different lottery tickets are purchased?

A) $\frac{1}{1,221,759}; \frac{100}{1,221,759}$ B) $\frac{1}{146,611,080}; \frac{10}{14,661,108}$

C) $\frac{1}{8,145,060}; \frac{1}{814,506}$ D) $\frac{1}{5,864,443,200}; \frac{1}{58,644,432}$

47) A box contains 23 widgets, 4 of which are defective. If 4 are sold at random, find the probability that (a) all are defective (b) none are defective.

A) $\frac{1}{8855}; \frac{3876}{8855}$ B) $\frac{4}{23}; \frac{19}{23}$ C) $\frac{1}{212,520}; \frac{1}{53,130}$ D) $\frac{1}{23}; \frac{4}{23}$

48) A committee consisting of 6 people is to be selected from eight parents and four teachers. Find the probability of selecting three parents and three teachers.

A) $\frac{8}{33}$ B) $\frac{2}{33}$ C) $\frac{100}{231}$ D) $\frac{10}{11}$

49) If you are dealt 5 cards from a shuffled deck of 52 cards, find the probability that all 5 cards are picture cards.

A) $\frac{33}{108,290}$ B) $\frac{3}{13}$ C) $\frac{1}{2,598,960}$ D) $\frac{1}{216,580}$

50) If you are dealt 5 cards from a shuffled deck of 52 cards, find the probability that none of the 5 cards are picture cards.

A) $\frac{108,257}{108,290}$ B) $\frac{3}{13}$ C) $\frac{33}{108,290}$ D) $\frac{1}{216,580}$

51) If you are dealt 6 cards from a shuffled deck of 52 cards, find the probability of getting 3 jacks and 3 aces.

A) $\frac{2}{2,544,815}$ B) $\frac{2}{13}$ C) $\frac{1}{1,017,926}$ D) $\frac{3}{26}$

52) A club elects a president, vice–president, and secretary–treasurer. How many sets of officers are possible if there are 13 members and any member can be elected to each position? No person can hold more than one office.

A) 1716 B) 858 C) 572 D) 17,160

53) From 9 names on a ballot, a committee of 4 will be elected to attend a political national convention. How many different committees are possible?

A) 126 B) 3024 C) 15,120 D) 1512

54) To win at LOTTO in a certain state, one must correctly select 6 numbers from a collection of 55 numbers (one through 55.) The order in which the selections is made does not matter. How many different selections are possible?

A) 28,989,675 B) 25,827,165 C) 330 D) 720

55) In how many ways can a committee of three men and four women be formed from a group of 9 men and 9 women?

A) 10584 B) 1,524,096 C) 5040 D) 42

56) A physics exam consists of 9 multiple–choice questions and 6 open–ended problems in which all work must be shown. If an examinee must answer 5 of the multiple–choice questions and 4 of the open–ended problems, in how many ways can the questions and problems be chosen?

A) 1890 B) 1080 C) 261,273,600 D) 5,443,200

5.6 Putting It Together: Which Method Do I Use?

1 Determine the appropriate probability rule to use.

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

Find the indicated probability.

1) Find P(A or B) given that P(A) = 0.5, P(B) = 0.2, and A and B are mutually exclusive.

A) 0.7 B) 0 C) 0.1 D) 0.3

2) Find P(A and B) given that P(A) = 0.2, P(B) = 0.4, and A and B are independent.

A) 0.08 B) 0 C) 0.6 D) 0.2

3) Suppose that the sample space is S = {a, b, c, d, e, f, g, h} and that outcomes are equally likely. Find the probability of the event E = {b, f, h}.

A) 0.375 B) 0.3 C) 3 D) 0.33

4) Suppose that the sample space is S = {a, b, c, d, e, f, g, h, i, j} and that outcomes are equally likely. Find the probability of the event F = "a vowel".

A) 0.3 B) 0.2 C) 3 D) 0.33

5) If P(A) = 0.6, P(B) = 0.3, and P(A and B) = 0.3, find P(A or B).

A) 0.6 B) 0.5 C) 0.8 D) 0.9

6) If P(A) = 0.4, P(B) = 0.6, and P(A or B) = 0.7, find P(A and B).

A) 0.3 B) 0.2 C) 0.7 D) 1

7) If P(B) = 0.3, P(A or B) = 0.6, and P(A and B) = 0.1, find P(A).
A) 0.4 B) 0.3 C) 0.1 D) 0.9

8) Suppose that S and T are two events, P(S) = 0.67 and P(T|S) = 0.13. What is P(S and T)?
A) 0.0871 B) 0.8 C) 0.7129 D) 0.5829

9) Suppose that M and N are two events, P(M) = 0.23, P(N) = 0.08, and P(M and N) = 0.05. What is P(M|N)?
A) 0.625 B) 0.217 C) 0.030 D) 0.260

10) Of 1518 people who came into a blood bank to give blood, 356 were ineligible to give blood. Estimate the probability that the next person who comes in to give blood will be ineligible to give blood.
A) 0.235 B) 0.286 C) 0.203 D) 0.154

11) A study conducted at a certain college shows that 56% of the school's graduates move to a different state after graduating. Find the probability that among 5 randomly selected graduates, at least one moves to a different state after graduating.
A) 0.984 B) 0.945 C) 0.200 D) 0.560

12) In one town, 36% of adults are employed in the tourism industry. What is the probability that three adults selected at random from the town are all employed in the tourism industry?
A) 0.047 B) 0.953 C) 0.262 D) 0.147

13) The age distribution of members of a gymnastics association is shown in the table. A member of the association is selected at random. Find the probability that the person selected is between 26 and 35 inclusive. Round your answer to three decimal places.

Age (years)	Frequency
Under 21	411
21–25	420
26–30	205
31–35	50
Over 35	27
	1113

A) 0.229 B) 0.184 C) 255 D) 0.045

14) The age distribution of members of a gymnastics association is shown in the table. A member of the association is selected at random. Find the probability that the person selected is at least 31. Round your answer to three decimal places.

Age (years)	Frequency
Under 21	406
21–25	419
26–30	212
31–35	56
Over 35	27
	1120

A) 0.074 B) 0.050 C) 83 D) 0.926

15) At Bill's community college, 49.2% of students are Caucasian and 4.1% of students are Caucasian math majors. What percentage of Caucasian students are math majors?
A) 8.3% B) 12.0% C) 45.1% D) 53.3%

16) 61% of students at one college drink alcohol regularly, and 13% of those who drink alcohol regularly suffer from depression. What is the probability that a randomly selected student drinks alcohol regularly and suffers from depression?
A) 0.0793 B) 0.74 C) 0.6607 D) 0.5307

17) At a certain college, 15% of students speak Spanish, 8% speak Italian, and 5% speak both languages. A student is chosen at random from the college. What is the probability that the student speaks Spanish given that he or she speaks Italian?

A) 0.625 B) 0.333 C) 0.030 D) 0.180

18) Suppose that the probability that Sue will pass her statistics test is 0.64, the probability that she will pass her physics test is 0.51, and the probability that she will pass both tests is 0.310. What is the probability that she passes her physics test given that she passed her statistics test?

A) 0.484 B) 0.608 C) 0.200 D) 0.840

19) The table below describes the exercise habits of a group of people suffering from high blood pressure. If a woman is selected at random from the group, find the probability that she does not exercise.

	No exercise	Occasional exercise	Regular exercise	Total
Men	363	89	63	515
Women	312	68	69	449
Total	675	157	132	964

A) 0.695 B) 0.324 C) 0.462 D) 0.466

20) The table below describes the exercise habits of a group of people suffering from high blood pressure. If one of the 1096 subjects is randomly selected, find the probability that the person selected is female given that they exercise occasionally.

	No exercise	Occasional exercise	Regular exercise	Total
Men	400	82	85	567
Women	374	78	77	529
Total	774	160	162	1096

A) 0.488 B) 0.071 C) 0.147 D) 0.146

21) 390 voters are classified by income and political party. The results are shown in the table. If a person is selected at random from the sample, find the probability that the person has high income.

	Democrat	Republican	Total
Low Income	101	79	180
Medium Income	96	64	160
High Income	19	17	36
Super High Income	9	5	14
Total	225	165	390

A) 0.092 B) 0.049 C) 0.084 D) 0.528

22) 390 voters are classified by income and political party. The results are shown in the table. If a person is selected at random from the sample, find the probability that the person has medium income and votes Democrat.

	Democrat	Republican	Total
Low Income	101	76	177
Medium Income	94	66	160
High Income	19	16	35
Super High Income	11	7	18
Total	225	165	390

A) 0.241 B) 0.418 C) 0.588 D) 0.746

23) 390 voters are classified by income and political party. The results are shown in the table. If a person is selected at random from the sample, find the probability that the person has medium income or votes Democrat.

	Democrat	Republican	Total
Low Income	107	68	175
Medium Income	89	71	160
High Income	19	18	37
Super High Income	10	8	18
Total	225	165	390

A) 0.759 B) 0.396 C) 0.556 D) 0.987

2 Determine the appropriate counting technique to use.

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

Evaluate.

24) ${}_8P_5$

A) 6720 B) 336 C) 8064 D) 40,320

25) ${}_{10}C_7$

A) 120 B) 720 C) 302,400 D) 12

26) $\frac{5!}{3!}$

A) 20 B) 2! C) $\frac{5}{3}$ D) 5

Solve the problem.

27) In how many ways can Iris choose 4 of 8 books to bring on vacation?

A) 70 B) 1680 C) 24 D) 4096

28) In how many ways can a board of supervisors choose a president, a treasurer, and a secretary from its 6 members ?

A) 120 B) 216 C) 720 D) 20

29) Karen is completing a fitness circuit. There are 10 fitness stations. At each station she can choose from 4 different activities. If she chooses one activity at each fitness station, in how many ways can she complete the circuit?

A) 1,048,576 B) 40 C) 10,000 D) 14

30) A company makes skirts in 5 different styles. Each style comes in two different fabrics and 4 different colors. How many skirts are available from this company?

A) 40 B) 20 C) 9 D) 11

31) License plates are made using 2 letters followed by 2 digits. How many plates can be made if repetition of letters and digits is allowed?

A) 67,600 B) 10,000 C) 456,976 D) 6760

32) If a coin is tossed 11 times, how many head–tail sequences are possible?

A) 2048 B) 22 C) 39,916,800 D) 121

33) A pool of possible candidates for a student council consists of 12 freshmen and 8 sophomores. How many different councils consisting of 5 freshmen and 7 sophomores are possible?
A) 6336 B) 125,970 C) 214,617,600 D) 11,404,800

34) How many arrangement are there of the letters DISAPPOINT?
A) 907,200 B) 3,628,800 C) 1,814,400 D) 1024

35) How many different arrangements are possible using 4 letters from the word PAYMENT?
A) 840 B) 420 C) 210 D) 28

36) There are 11 runners in a race. In how many ways can the first, second, and third place finishes occur? (Assume there are no ties.)
A) 990 B) 165 C) 994 D) 163

37) A poet will read 5 of her poems at an award ceremony. How many ways can she choose the 5 poems from 8 poems given that the sequence is important?
A) 6720 B) 336 C) 56 D) 672

38) A license plate is to consist of 3 letters followed by 5 digits. Determine the number of different license plates possible if the first letter must be an K , L , or M and repetition of letters and numbers is not permitted.
A) 54,432,000 B) 9,072,000 C) 272,160,000 D) 54,522,000

39) In how many ways can 6 women and 3 men be seated in a row of 9 seats at a movie theater assuming that all the women must sit together and all the men must sit together?
A) 8640 B) 4320 C) 362,880 D) 512

40) In how many ways can a club choose a president, a treasurer, a secretary, and three other committee members (with identical duties) from a group of 13 candidates?
A) 205,920 B) 1,235,520 C) 4,826,809 D) 1716

5.7 Bayes's Rule (online)

1 Use the rule of total probability.

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

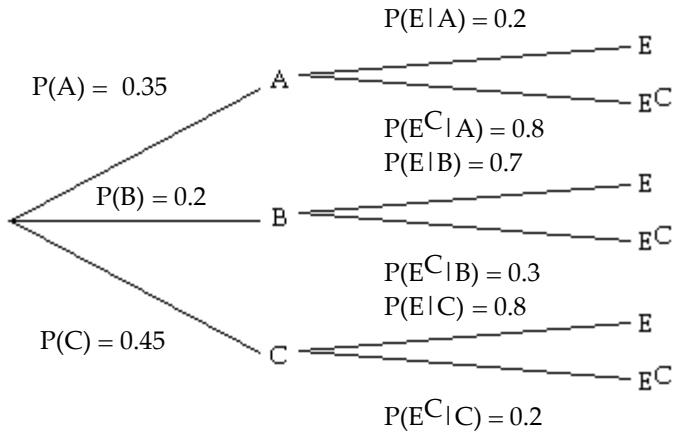
Provide an appropriate response.

1) One of the conditions for a sample space S to be portioned into n subsets is that
A) Each of the subsets is mutually exclusive.
B) Each of the subsets is independent of the other subsets.
C) At least one subset must be empty.
D) Each subset is orthogonal to the other subsets.

2) One of the conditions for a sample space S to be portioned into n subsets is that
A) Each of the subsets must contain at least one element of S.
B) The subsets are independent of each other.
C) Each subset is orthogonal to the other subsets.
D) The elements in the subsets are randomly selected for inclusion.

Use the rule of total probability to find the indicated probability.

3) Use the tree diagram below to find P(E). Round to the nearest thousandth when necessary.



A) 0.57 B) 0.07 C) 0.561 D) 0.21

4) Suppose that events A_1 and A_2 form a partition of the sample space S with $P(A_1) = 0.75$ and $P(A_2) = 0.25$. If B is an event that is a subset of S and $P(B|A_1) = 0.09$ and $P(B|A_2) = 0.21$, find P(B). Round to the nearest ten–thousandth when necessary.

A) 0.12 B) 0.0675 C) 0.15 D) 0.0525

5) Suppose that events A_1, A_2, and A_3 form a partition of the sample space S with $P(A_1) = 0.45$, $P(A_2) = 0.3$, and $P(A_3) = 0.25$. If B is an event that is a subset of S and $P(B|A_1) = 0.18$, $P(B|A_2) = 0.23$, and $P(B|A_3) = 0.13$, find P(B). Round to the nearest ten–thousandth when necessary.

A) 0.1825 B) 0.081 C) 0.1782 D) 0.15

6) Suppose that there are two buckets. Bucket 1 contains 3 tennis balls and 5 ping–pong balls. Bucket 2 contains 4 tennis balls, 3 ping–pong balls, and 5 baseballs. An unfair coin will decide from which bucket we draw. Heads implies we draw from Bucket 1 and tails implies we draw from Bucket 2. The probability of heads is $\frac{1}{3}$ and the probability of tails is $\frac{2}{3}$. What is the probability of drawing a baseball? Round to the nearest thousandth when necessary.

A) 0.277 B) 0.723 C) 0.25 D) 0.417

7) Two stores sell a certain product. Store A has 36% of the sales, 2% of which are of defective items, and store B has 64% of the sales, 4% of which are of defective items. The difference in defective rates is due to different levels of pre–sale checking of the product. A person receives one of this product as a gift. What is the probability it is defective? Round to the nearest thousandth when necessary.

A) 0.033 B) 0.03 C) 0.017 D) 0.38

8) A teacher designs a test so a student who studies will pass 89% of the time, but a student who does not study will pass 6% of the time. A certain student studies for 91% of the tests taken. On a given test, what is the probability that student passes? Round to the nearest thousandth when necessary.

A) 0.815 B) 0.81 C) 0.475 D) 0.054

9) In one town, 8% of 18–29 year olds own a house, as do 21% of 30–50 year olds and 52% of those over 50. According to a recent census taken in the town, 27.0% of adults in the town are 18–29 years old, 38.7% are 30–50 years old, and 34.3% are over 50. What is the probability that a randomly selected adult owns a house? Round to the nearest thousandth when necessary.
A) 0.281 B) 0.27 C) 0.028 D) 0.2

10) A company manufactures shoes in three different factories. Factory Omaha Produces 25% of the company's shoes, Factory Chicago produces 60%, and factory Seattle produces 15%. One percent of the shoes produced in Omaha are mislabeled, 0.5 % of the Chicago shoes are mislabeled, and 2% of the Seattle shoes are mislabeled. If you purchase one pair of shoes manufactured by this company what is the probability that the shoes are mislabeled? Round to the nearest thousandth.
A) 0.009 B) 0.036 C) 0.043 D) 0.020

11) A survey conducted in one U.S. city together with information from the census bureau yielded the following table. The first two columns give a percentage distribution of adults in the city by ethnic group. The third column gives the percentage of people in each ethnic group who have health insurance. Round to the nearest thousandth.

Ethnic Group	Percentage of adults	Percentage with health insurance
Caucasian	49.0	75
African American	12.1	46
Hispanic	18.7	51
Asian	10.8	61
Other	9.4	49

Determine the probability that a randomly selected adult has health insurance.
A) 0.630 B) 0.564 C) 0.063 D) 0.584

2 Use Bayes's Rule to compute probabilities.

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

Provide an appropriate response.

12) Suppose that there are two buckets. Bucket 1 contains 3 tennis balls and 5 ping–pong balls. Bucket 2 contains 4 tennis balls, 3 ping–pong balls, and 5 baseballs. An unfair coin will decide from which bucket we draw. Heads implies we draw from Bucket 1 and tails implies we draw from Bucket 2. The probability of a heads is $\frac{1}{3}$ and the probability of a tails is $\frac{2}{3}$. Given that a ping–pong ball was selected what is the probability that it came from Bucket 2?
A) 0.444 B) 0.555 C) 0.625 D) 0.250

13) A company manufactures shoes in three different factories. Factory Omaha Produces 25% of the company's shoes, Factory Chicago produces 60%, and factory Seattle produces 15%. One percent of the shoes produced in Omaha are mislabeled, 0.5 % of the Chicago shoes are mislabeled, and 2% of the Seattle shoes are mislabeled. If you purchase one pair of shoes manufactured by this company and you determine they are mislabeled what is the probability they were made in Omaha?
A) 0.294 B) 0.353 C) 0.333 D) 0.070

14) A company manufactures shoes in three different factories. Factory Omaha Produces 25% of the company's shoes, Factory Chicago produces 60%, and factory Seattle produces 15%. One percent of the shoes produced in Omaha are mislabeled, 0.5 % of the Chicago shoes are mislabeled, and 2% of the Seattle shoes are mislabeled. If you purchase one pair of shoes manufactured by this company what is the probability that it was labeled correctly?

A) 0.991 B) 0.035 C) 0.9 D) 0.08

Ch. 5 Probability
Answer Key

5.1 Probability Rules

1 Apply the rules of probabilities.

1) (head, tail)
2) (true, false)
3) (0, 1, 2, 3, 4)
4) (A, B, C, D, E)
5) (MMM), (MMF), (MFM), (FMM), (MFF), (FMF), (FFM), (FFF)
6) A
7) A
8) A
9) A
10) A
11) A
12) A
13) A
14) A
15) A
16) A

2 Compute and interpret probabilities using the empirical method.

17) A
18) A
19) A
20) A
21) A

3 Compute and interpret probabilities using the classical method.

22) A
23) A
24) A
25) A
26) A
27) A
28) A
29) A
30) A
31) A
32) A
33) A
34) A
35) A
36) A

4 Recognize and interpret subjective probabilities.

37) A
38) A
39) A
40) A
41) A
42) A
43) A
44) A

5 Know Concepts: Probability Rules

45) Answers to parts (a) and (b) will vary. Using the classical method, the probability of getting a sum of 8 is $\frac{5}{36}$.

In general, as the number of repetitions of a probability experiment increases, the closer the empirical probability should get to the classical probability.

46) Answers to parts (a) and (b) will vary.

The answer in part (b) is likely to be closer to the classical probability of $\frac{1}{4}$.

In general, as the number of repetitions of a probability experiment increases, the closer the empirical probability should get to the classical probability.

47) Answers to parts (a) and (b) will vary.

The answer in part (b) is likely to be closer to the classical probability of $\frac{1}{4}$.

In general, as the number of repetitions of a probability experiment increases, the closer the empirical probability should get to the classical probability.

5.2 The Addition Rule and Complements

1 Use the Addition Rule for Disjoint Events.

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) A
11) A
12) A
13) A
14) A
15) A

2 Use the General Addition Rule.

16) A
17) A
18) A
19) A
20) A
21) A
22) A
23) A
24) A
25) A
26) A
27) A
28) A
29) A

3 Compute the probability of an event using the Complement Rule.

30) A
31) A
32) A
33) A

34) A
35) A
36) A
37) A
38) A
39) A
40) A
41) A
42) A
43) A
44) A
45) A

5.3 Independence and the Multiplication Rule

1 Identify independent events.

1) A
2) A
3) A
4) A
5) A
6) A

2 Use the Multiplication Rule for independent events.

7) A
8) A
9) A
10) A
11) A
12) A
13) A
14) A
15) A
16) A

3 Compute at–least probabilities.

17) A
18) A
19) A
20) A
21) A
22) A
23) A
24) A
25) A
26) A

5.4 Conditional Probability and the General Multiplication Rule

1 Compute conditional probabilities.

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) A

11) A
12) A
13) A
14) A
15) A
16) A
17) A
18) A
19) A
20) A

2 Compute probabilities using the General Multiplication Rule.

21) A
22) A
23) A
24) A
25) A
26) A
27) A
28) A
29) A
30) A
31) A
32) A
33) A
34) A
35) A
36) A
37) A
38) A
39) A
40) A
41) A
42) A
43) A
44) A
45) A
46) A
47) A
48) A
49) A
50) A
51) A
52) A
53) A

5.5 Counting Techniques

1 Solve counting problems using the Multiplication Rule.

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A

9) A
10) A
11) A
12) A

2 Solve counting problems using permutations.

13) A
14) A
15) A
16) A
17) A
18) A
19) A
20) A
21) A
22) A
23) A
24) A

3 Solve counting problems using combinations.

25) A
26) A
27) A
28) A
29) A
30) A
31) A
32) A
33) A
34) A
35) A
36) A

4 Solve counting problems involving permutations with nondistinct items.

37) A
38) A
39) A
40) A
41) A
42) A

5 Compute probabilities involving permutations and combinations.

43) A
44) A
45) A
46) A
47) A
48) A
49) A
50) A
51) A
52) A
53) A
54) A
55) A
56) A

5.6 Putting It Together: Which Method Do I Use?

1 Determine the appropriate probability rule to use.

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A
10) A
11) A
12) A
13) A
14) A
15) A
16) A
17) A
18) A
19) A
20) A
21) A
22) A
23) A

2 Determine the appropriate counting technique to use.

24) A
25) A
26) A
27) A
28) A
29) A
30) A
31) A
32) A
33) A
34) A
35) A
36) A
37) A
38) A
39) A
40) A

5.7 Bayes's Rule (online)

1 Use the rule of total probability.

1) A
2) A
3) A
4) A
5) A
6) A
7) A
8) A
9) A

10) A
11) A

2 Use Bayes's Rule to compute probabilities.

12) A
13) A
14) A