Chapter 4

Probability and Counting Rules

Chapter 4
4-1 Sample Spaces and Probability
Exercises 4-1

10. A probability experiment is conducted. Which of these cannot be considered a probability outcome?

a.	$\frac{2}{3}$	*d.*	1.65 ⟸	*g.*	1
b.	0.63	*e.*	−0.44 ⟸	*h.*	125% ⟸
c.	$-\frac{3}{5}$ ⟸	*f.*	0	*i.*	24%

11. Classify each statement as an example of classical probability, empirical probability, or subjective probability.

a. The probability that a person will watch the 6 o'clock evening news is 0.15. Empirical

b. The probability of winning at a Chuck-a-Luck game is $\frac{5}{36}$. Classical

c. The probability that a bus will be in an accident on a specific run is about 6%. Empirical

d. The probability of getting a royal flush when five cards are selected at random is $\frac{1}{649,740}$. Classical

Chapter 4
4-1 Sample Spaces and Probability
Exercises 4-1

12. Classify each statement as an example of classical probability, empirical probability, or subjective probability.

a. The probability that a student will get a C or better in a statistics course is about 70%.

Empirical

b. The probability that a new fast-food restaurant will be a success in Chicago is 35%.

Empirical

c. The probability that interest rates will rise in the next 6 months is 0.50.

Subjective

d. The probability that the unemployment rate will fall next month is 0.03.

Subjective

Chapter 4
4-1 Sample Spaces and Probability
Exercises 4-1

13. **Rolling a Die** If a die is rolled one time, find these probabilities.
    a. Getting a 2
    b. Getting a number greater than 6
    c. Getting an odd number
    d. Getting an odd or even number

a. $\frac{1}{6}$ c. $\frac{1}{2}$

b. 0 d. 1

Chapter 4
4-1 Sample Spaces and Probability
Exercises 4-1

14. Rolling a Die If a die is rolled one time, find these probabilities:

a. Getting a number less than 7

b. Getting a number greater than or equal to 3

c. Getting a number greater than 2 and an even number

d. Getting a number less than 1

a. 1
b. $\frac{2}{3}$
c. $\frac{1}{3}$
d. 0

Chapter 4
4-1 Sample Spaces and Probability
Exercises 4-1

15. Rolling Two Dice If two dice are rolled one time, find the probability of getting these results.

a. A sum of 9

b. A sum of 7 or 11

c. Doubles

There are 6^2 or 36 outcomes.

a. There are 4 ways to get a sum of 9. They are (6,3), (5,4), (4,5), and (3,6). The probability then is $\frac{4}{36}$

b. There are 6 ways to get a sum of 7 and 2 ways to get a sum of 11. They are (6,1), (5,2), (4,3), (3,4), (2,5), (1,6), (6,5) and (5,6). The probability then is $\frac{8}{36}$

c. There are 6 ways to get doubles. They are (1,1), (2,2), (3,3), (4,4), (5,5), and (6,6). The probability then is $\frac{6}{36}$

Chapter 4
4-1 Sample Spaces and Probability
Exercises 4-1

16. Rolling Two Dice If two dice are rolled one time, find the probability of getting these results:

a. A sum less than 9

b. A sum greater than or equal to 10

c. A 3 on one die or on both dice.

a. To get a sum less than nine, one must roll a 2, 3, 4, 5, 6, 7, or 8. There are 26 ways to get a sum less than 9. The probability then is $\frac{26}{36}$

b. To get a sum greater than or equal to 10, one must roll a 10, 11, or 12. There are six ways to do this. They are (6,4), (5,5), (4,6), (6,5), (5,6), and (6,6). The probability is $\frac{6}{36}$

c. There are 11 ways to get a 3 on one or both die. The probability is $\frac{11}{36}$.

Chapter 4
4-1 Sample Spaces and Probability
Exercises 4-1

21. Human Blood Types Human blood is grouped into four types. The percentages of Americans with each type are listed below.

O 43% A 40% B 12% AB 5%

Choose one American at random. Find the probability that this person

a. Has type O blood

b. Has type A or B

c. Does not have type O or A

Source: www.infoplease.com

a. P(type O) = 0.43

b. P(type A or B) = 0.40 + 0.12 = 0.52

c. P(not type A or O) = 1 − 0.83 = 0.17

Chapter 4
4-1 Sample Spaces and Probability
Exercises 4-1

22. Murder Victims Of all the murder victims in 2010 whose relation to the offender was known, 24.8% were killed by a family member and 53% by an acquaintance. The rest were killed by a stranger. What is the probability that a randomly selected murder victim was killed by a stranger?

Source: *World Almanac 2012.*

$$P(\text{stranger}) = 1 - P(\text{family or acquaintance})$$
$$P(\text{stranger}) = 1 - (0.248 + 0.53) = 0.222$$

Chapter 4
4-1 Sample Spaces and Probability
Exercises 4-1

25. Gender of Children A couple has three children. Find each probability.

a. All boys

b. All girls or all boys

c. Exactly two boys or two girls

d. At least one child of each gender

The sample space is BBB, BBG, BGB, GBB, GGB, GBG, BGG, and GGG.

a. All boys is the outcome BBB; hence P(all boys) $= \frac{1}{8}$.

b. All girls or all boys would be BBB and GGG; hence, P(all girls or all boys) $= \frac{1}{4}$.

c. Exactly two boys or two girls would be BBG, BGB, GBB, BBG, GBG, or BGG. The probability then is $\frac{6}{8}$

d. At least one child of each gender means at least one boy or at least one girl. The outcomes are the same as those of part c, hence the probability is the same, $\frac{3}{4}$.

Chapter 4
4-1 Sample Spaces and Probability
Exercises 4-1

26. Sources of Energy Uses in the United States A breakdown of the sources of energy used in the United States is shown below. Choose one energy source at random. Find the probability that it is

a. Not oil

b. Natural gas or oil

c. Nuclear

Oil 39%	Natural gas 24%	Coal 23%
Nuclear 8%	Hydropower 3%	Other 3%

Source: www.infoplease.com

a. $P(\text{not oil}) = 1 - 0.39 = 0.61$

b. $P(\text{natural gas or oil}) = 0.39 + 0.24 = 0.63$

c. $P(\text{nuclear}) = 0.08$

Chapter 4
4-1 Sample Spaces and Probability
Exercises 4-1

41. Distribution of CEO Ages The distribution of ages of CEOs is as follows:

Age	Frequency
21–30	1
31–40	8
41–50	27
51–60	29
61–70	24
71–up	11

Source: Information based on *USA TODAY* Snapshot.

If a CEO is selected at random, find the probability that his or her age is

a. Between 31 and 40
b. Under 31
c. Over 30 and under 51
d. Under 31 or over 60

a. 0.08
b. 0.01
c. $0.08 + 0.27 = 0.35$
d. $0.01 + 0.24 + 0.11 = 0.36$

Chapter 4
4-2 The Addition Rules for Probability
Exercises 4-2

3. Determine whether these events are mutually exclusive.

a. Roll a die: Get an even number and get a number less than 3. No

b. Roll a die: Get a prime number (2, 3, 5) and get an odd number. No

c. Roll a die: Get a number greater than 3 and get a number less than 3. Yes

d. Select a student in your class: The student has blond hair and the student has blue eyes. No

Chapter 4
4-2 The Addition Rules for Probability
Exercises 4-2

4. Determine whether these events are mutually exclusive.

   a. Roll two dice: Get a sum of 7 or get doubles. Yes

   b. Select a student in your college: The student is a sophomore and the student is a business major. No

   c. Select any course: It is a calculus course and it is an English course. Yes

   d. Select a registered voter: The voter is a Republican and the voter is a Democrat. Yes

Chapter 4
4-2 The Addition Rules for Probability
Exercises 4-2

5. College Degrees Awarded The table below represents the college degrees awarded in a recent academic year by gender.

	Bachelor's	Master's	Doctorate
Men	573,079	211,381	24,341
Women	775,424	301,264	21,683

Choose a degree at random. Find the probability that it is

a. A bachelor's degree
b. A doctorate or a degree awarded to a woman
c. A doctorate awarded to a woman
d. Not a master's degree

Source: www.nces.ed.gov

a. $\frac{1,348,503}{1,907,172} = 0.707$

b. $\frac{46,024}{1,907,172} + \frac{1,098,371}{1,907,172} - \frac{21,683}{1,907,172} = 0.589$

c. $\frac{21,683}{1,907,172} = 0.011$

d. $\frac{1,394,527}{1,907,172} = 0.731$

Chapter 4
4-2 The Addition Rules for Probability
Exercises 4-2

7. Medical Specialities The following doctors were observed on staff at a local hospital.

	MD	Doctor of Osteopathy
Pathology	6	1
Pediatrics	7	2
Orthopedics	20	2

Choose one doctor at random; what is the probability that

a. She is a pathologist?

b. He is an orthopedist or an MD?

a. $P(\text{pathologist}) = \frac{7}{38}$

b. $P(\text{orthopedist or MD}) = \frac{22}{38} + \frac{33}{38} - \frac{20}{38} = \frac{35}{38}$

Chapter 4
4-2 The Addition Rules for Probability
Exercises 4-2

9. Selecting an Instructor At a convention there are 7 mathematics instructors, 5 computer science instructors, 3 statistics instructors, and 4 science instructors. If an instructor is selected, find the probability of getting a science instructor or a math instructor.

$$\frac{4}{19} + \frac{7}{19} = \frac{11}{19}$$

Chapter 4
4-2 The Addition Rules for Probability
Exercises 4-2

11. Selecting a Student In a statistics class there are 18 juniors and 10 seniors; 6 of the seniors are females, and 12 of the juniors are males. If a student is selected at random, find the probability of selecting the following.

a. A junior or a female

b. A senior or a female

c. A junior or a senior

	Junior	Senior	Total
Female	6	6	12
Male	12	4	16
Total	18	10	28

a. $\frac{18}{28} + \frac{12}{28} - \frac{6}{28} = \frac{24}{28}$

b. $\frac{10}{28} + \frac{12}{28} - \frac{6}{28} = \frac{16}{28}$

c. $\frac{18}{28} + \frac{10}{28} = 1$

Chapter 4
4-2 The Addition Rules for Probability
Exercises 4-2

12. Selecting a Book At a used-book sale, 100 books are adult books and 160 are children's books. Of the adult books, 70 are nonfiction while 60 of the children's books are nonfiction. If a book is selected at random, find the probability that it is

a. Fiction

b. Not a children's nonfiction book

c. An adult book or a children's nonfiction book

a. $P(\text{fiction}) = \frac{130}{260}$

b. $P(\text{children's nonfiction}) = \frac{60}{260}$

$P(\text{not a children's nonfiction}) = 1 - \frac{60}{260} = \frac{10}{13}$

c. $P(\text{adult book or children's nonfiction}) = \frac{100}{260} + \frac{60}{260} = \frac{160}{260}$

Chapter 4
4-2 The Addition Rules for Probability
Exercises 4-2

13. **Young Adult Residences** According to the Bureau of the Census, the following statistics describe the number (in thousands) of young adults living at home or in a dormitory in the year 2004.

	Ages 18–24	Ages 25–34
Male	7922	2534
Female	5779	995

Source: *World Almanac*.

Choose one student at random. Find the probability that the student is

a. A female student aged 25–34 years
b. Male or aged 18–24 years
c. Under 25 years of age and not male

	18 - 24	25 - 34	Total
Male	7922	2534	10,456
Female	5779	995	6,774
Total	13,701	3529	17,230

a. P(female aged 25 - 34) $= \frac{995}{17,230} = 0.058$

b. P(male or aged 18 - 24) $= \frac{10,456}{17,230} + \frac{13,701}{17,230} - \frac{7922}{17,230} = 0.942$

c. P(under 25 years and not male) $= \frac{5779}{17,230} = 0.335$

Chapter 4
4-2 The Addition Rules for Probability
Exercises 4-2

17. Student Survey In a recent survey, the following data were obtained in response to the question, "If the number of summer classes were increased, would you be more likely to enroll in one or more of them?"

Class	Yes	No	No opinion
Freshmen	15	8	5
Sophomores	24	4	2

If a student is selected at random, find the probability that the student

a. Has no opinion

b. Is a freshman or is against the issue

c. Is a sophomore and favors the issue

a. P(no opinion) $= \frac{7}{58}$

b. P(is a freshman or is against the issue) $=$ P(freshman) $+$ P(against) $-$ P(both) $=$ $\frac{28}{58} + \frac{12}{58} - \frac{8}{58} = \frac{32}{58}$

c. P(sophomore and in favor) $= \frac{24}{58}$

Chapter 4
4-2 The Addition Rules for Probability
Exercises 4-2

21. Door-to-Door Sales A sales representative who visits customers at home finds she sells 0, 1, 2, 3, or 4 items according to the following frequency distribution.

Items sold	Frequency
0	8
1	10
2	3
3	2
4	1

Find the probability that she sells the following.

a. Exactly 1 item

b. More than 2 items

c. At least 1 item

d. At most 3 items

The total of the frequencies is 24.

a. $\frac{10}{24} = \frac{5}{12}$

b. $\frac{2+1}{24} = \frac{3}{24}$

c. $\frac{10+3+2+1}{24} = \frac{16}{24}$

d. $\frac{8+10+3+2}{24} = \frac{23}{24}$

Chapter 4
4-2 The Addition Rules for Probability
Exercises 4-2

24. Rolling Die Two dice are rolled. Find the probability of getting

a. A sum of 8, 9, or 10

b. Doubles or a sum of 7

c. A sum greater than 9 or less than 4

a. $P(\text{sum of } 8) + P(\text{sum of } 9) + P(\text{sum of } 10) = \frac{5}{36} + \frac{4}{36} + \frac{3}{36} = \frac{12}{36}$

b. $P(\text{doubles}) + P(\text{sum of } 7) = \frac{6}{36} + \frac{6}{36} = \frac{12}{36}$

c. $P(\text{sum} > 9) + P(\text{sum} < 4) = \frac{6}{36} + \frac{3}{36} = \frac{9}{36}$

Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

1. State which events are independent and which are dependent.

a. Tossing a coin and drawing a card from a deck — Independent

b. Drawing a ball from an urn, not replacing it, and then drawing a second ball — Dependent

c. Getting a raise in salary and purchasing a new car — Dependent

d. Driving on ice and having an accident — Dependent

Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

2. State which events are independent and which are dependent.

a. Having a large shoe size and having a high IQ — Independent

b. A father being left-handed and a daughter being left-handed — Dependent

c. Smoking excessively and having lung cancer — Dependent

d. Eating an excessive amount of ice cream and smoking an excessive amount of cigarettes — Independent

Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

3. Video and Computer Games Sixty-nine percent of U.S. heads of household play video or computer games. Choose 4 heads of household at random. Find the probability that

a. None play video or computer games.

b. All four do.

Source: www.theesa.com

a. P(none play video or computer games) =
$(0.31)^4 = 0.009$

b. P(all four play video or computer games) =
$(0.69)^4 = 0.227$

Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

6. **Prison Populations** If 25% of U.S. federal prison inmates are not U.S. citizens, find the probability that 2 randomly selected federal prison inmates will not be U.S. citizens.

Source: *Harper's Index*

P(two inmates are not citizens) $= (0.25)^2$
$= 0.0625$

Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

8. Working Women and Computer Use It is reported that 72% of working women use computers at work. Choose 5 working women at random. Find

a. The probability that at least 1 doesn't use a computer at work

b. The probability that all 5 use a computer in their jobs

Source: www.infoplease.com

a. P(at least one doesn't use a computer at work)
$= 1 - P(\text{none of the women don't use a computer at work}) =$

P(at least one doesn't use a computer) $= 1 - (0.72)^5 = 0.807$

b. P(all 5 use a computer) $= (0.72)^5 = 0.193$

Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

16. Winning a Door Prize At a gathering consisting of 10 men and 20 women, two door prizes are awarded. Find the probability that both prizes are won by men. The winning ticket is not replaced. Would you consider this event likely or unlikely to occur?

P(both prizes are won by men) =
$\frac{10}{30} \cdot \frac{9}{29} = \frac{90}{870}$ unlikely

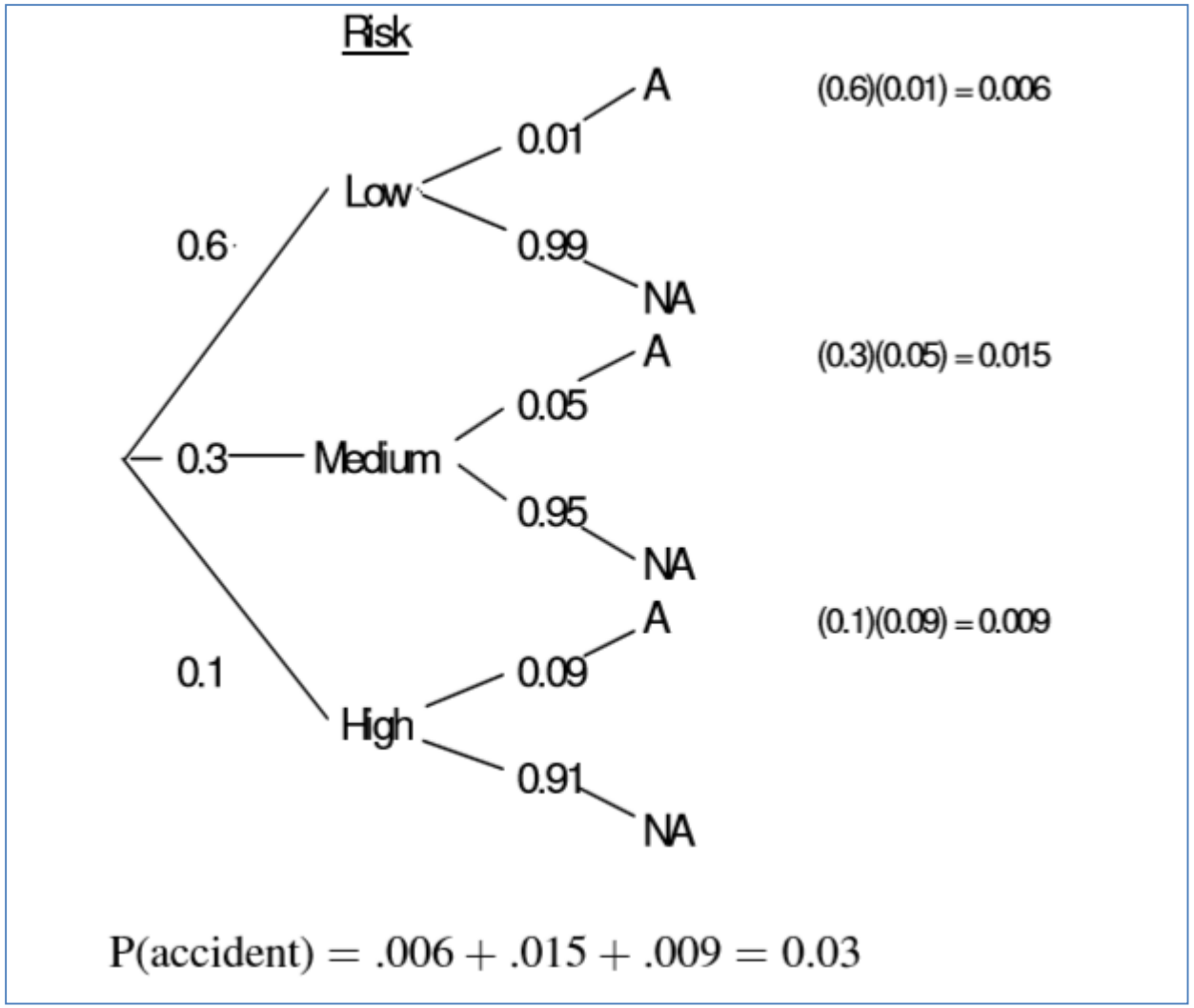
Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

20. Selecting Colored Balls Urn 1 contains 5 red balls and 3 black balls. Urn 2 contains 3 red balls and 1 black ball. Urn 3 contains 4 red balls and 2 black balls. If an urn is selected at random and a ball is drawn, find the probability it will be red.

$$P(\text{red}) = \frac{1}{3} \cdot \frac{5}{8} + \frac{1}{3} \cdot \frac{3}{4} + \frac{1}{3} \cdot \frac{4}{6} = \frac{49}{72}$$

Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

21. Automobile Insurance An insurance company classifies drivers as low-risk, medium-risk, and high-risk. Of those insured, 60% are low-risk, 30% are medium-risk, and 10% are high-risk. After a study, the company finds that during a 1-year period, 1% of the low-risk drivers had an accident, 5% of the medium-risk drivers had an accident, and 9% of the high-risk drivers had an accident. If a driver is selected at random, find the probability that the driver will have had an accident during the year.



$$\text{P(accident)} = .006 + .015 + .009 = 0.03$$

Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

27. College Courses At a large university, the probability that a student takes calculus and is on the dean's list is 0.042. The probability that a student is on the dean's list is 0.21. Find the probability that the student is taking calculus, given that he or she is on the dean's list.

$$P(\text{calculus} \mid \text{dean's list}) = \frac{0.042}{0.21} = 0.2$$

Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

30. Gift Baskets The Gift Basket Store had the following premade gift baskets containing the following combinations in stock.

	Cookies	Mugs	Candy
Coffee	20	13	10
Tea	12	10	12

Choose 1 basket at random. Find the probability that it contains

a. Coffee or candy
b. Tea given that it contains mugs
c. Tea and cookies

Source: www.infoplease.com

a. $P(\text{coffee or candy}) = \frac{43}{77} + \frac{22}{77} - \frac{10}{77} = 0.714$

b. $P(\text{tea} \mid \text{contains mugs}) = \frac{10/77}{23/77} = 0.435$

c. $P(\text{tea and cookies}) = \frac{12}{77} = 0.156$

Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

35. Leisure Time Exercise Only 27% of U.S. adults get enough leisure time exercise to achieve cardiovascular fitness. Choose 3 adults at random. Find the probability that

a. All 3 get enough daily exercise

b. At least 1 of the 3 gets enough exercise

Source: www.infoplease.com

a. P(all 3 get enough exercise) $= (0.27)^3 = 0.0197$

b. P(at least one gets enough exercise) $= 1 - (0.73)^3 = 0.611$

Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

37. Marital Status of Women According to the *Statistical Abstract of the United States*, 70.3% of females ages 20 to 24 have never been married. Choose 5 young women in this age category at random. Find the probability that

a. None has ever been married

b. At least 1 has been married

Source: *New York Times Almanac*.

a. P(none have been married) $= (0.703)^5 = 0.172$

b. P(at least one has been married) $=$
$1 - $ P(none have been married)
$= 1 - 0.1717 = 0.828$

Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

41. Reading to Children Fifty-eight percent of American children (ages 3 to 5) are read to every day by someone at home. Suppose 5 children are randomly selected. What is the probability that at least 1 is read to every day by someone at home?

Source: Federal Interagency Forum on Child and Family Statistics.

If P(read to) = 0.58, then
P(not being read to) = 1 − 0.58 = 0.42

P(at least one is read to) = 1 − P(none are read to)
= 1 − P(all five are not read to)
= $1 - (0.42)^5 = 0.987$

Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

45. Family and Children's Computer Games It was reported that 19.8% of computer games sold in 2005 were classified as "family and children's." Choose 5 purchased computer games at random. Find the probability that

a. None of the 5 was family and children's

b. At least 1 of the 5 was family and children's

Source: www.theesa.com

a. P(not a family and children's game) $= 1 - 0.198 = 0.802$

P(none of five are family and children's games) $=$
$(0.802)^5 = 0.332$

b. P(at least one is family and children's game) $=$
$1 - 0.332 = 0.668$

Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

47. Tossing a Coin A coin is tossed 5 times; find the probability of getting at least 1 tail. Would you consider this event likely to happen? Explain your answer.

P(at least one tail) $= 1 -$ P(no tails)
$1 - (\frac{1}{2})^5 = 1 - \frac{1}{32} = \frac{31}{32}$
The event is likely to occur since the probability is high.

Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

49. Rolling a Die A die is rolled 6 times. Find the probability of getting at least one 4.

$P(\text{rolling a 4}) = \frac{1}{6}$

$P(\text{at least one 4}) = 1 - P(\text{no fours})$

$P(\text{at least one 4}) = 1 - P(\text{all 6 are not 4's})$

$P(\text{at least one 4}) = 1 - (\frac{5}{6})^6 = 0.665$

Chapter 4
4-3 The Multiplication Rules and Conditional Probability
Exercises 4-3

51. Rolling a Die If a die is rolled 3 times, find the probability of getting at least 1 even number.

$$P(\text{at least one even}) = 1 - P(\text{no evens})$$
$$1 - \left(\frac{1}{2}\right)^3 = 1 - \frac{1}{8} = \frac{7}{8}$$

Chapter 4
4-4 Counting Rules
Exercises 4-4

1. **Zip Codes** How many 5-digit zip codes are possible if digits can be repeated? If there cannot be repetitions?

$10^5 = 100{,}000$
$10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 = 30{,}240$

2. **Letter Permutations** List all the permutations of the letters in the word *MATH*.

$4 \cdot 3 \cdot 2 \cdot 1$

3. **Video Games** How many different ways can 6 different video game cartridges be arranged on a shelf?

$6! = 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 720$

Chapter 4
4-4 Counting Rules
Exercises 4-4

12. Automobile Trips There are 2 major roads from city X to city Y and 4 major roads from city Y to city Z. How many different trips can be made from city X to city Z, passing through city Y?

$$2 \cdot 4 = 8$$

17. Threatened Species of Reptiles There are 22 threatened species of reptiles in the United States. In how many ways can you choose 4 to write about? (Order is not important.)

Source: www.infoplease.com

$$_{22}C_4 = \frac{22!}{(22-4)!\,4!} = 7315$$

Chapter 4
4-4 Counting Rules
Exercises 4-4

19. How many different 4-letter permutations can be formed from the letters in the word *decagon*?

$$_7P_4 = \frac{7!}{(7-4)!} = 840$$

21. ID Cards How many different ID cards can be made if there are 6 digits on a card and no digit can be used more than once?

$$_{10}P_6 = \frac{10!}{(10-6)!} = 151{,}200$$

Chapter 4
4-4 Counting Rules
Exercises 4-4

23. Ticket Selection How many different ways can 4 tickets be selected from 50 tickets if each ticket wins a different prize?

$$_{50}P_4 = \frac{50!}{(50-4)!} = 5{,}527{,}200$$

Chapter 4
4-4 Counting Rules
Exercises 4-4

42. Freight Train Cars In a train yard there are 4 tank cars, 12 boxcars, and 7 flatcars. How many ways can a train be made up consisting of 2 tank cars, 5 boxcars, and 3 flatcars? (In this case, order is not important.)

$${}_4C_2 \cdot {}_{12}C_5 \cdot {}_7C_3 = 166{,}320$$

Chapter 4
4-4 Counting Rules
Exercises 4-4

43. Selecting a Committee There are 7 women and 5 men in a department. How many ways can a committee of 4 people be selected? How many ways can this committee be selected if there must be 2 men and 2 women on the committee? How many ways can this committee be selected if there must be at least 2 women on the committee?

$${}_{12}C_4 = 495$$

$${}_7C_2 \cdot {}_5C_2 = 21 \cdot 10 = 210$$

$${}_7C_2 \cdot {}_5C_2 + {}_7C_3 \cdot {}_5C_1 + {}_7C_4 =$$
$$21 \cdot 10 + 35 \cdot 5 + 35 =$$
$$210 + 175 + 35 = 420$$

Chapter 4
4-4 Counting Rules
Exercises 4-4

59. Textbook Selection How many different ways can an instructor select 2 textbooks from a possible 17?

$$_{17}C_2 = 136$$

63. Dinner Selections How many ways can a dinner patron select 3 appetizers and 2 vegetables if there are 6 appetizers and 5 vegetables on the menu?

$$_6C_3 \cdot {}_5C_2 = 200$$

Chapter 4
4-5 Probability and Counting Rules
Exercises 4-5

3. Management Seminar In a company there are 7 executives: 4 women and 3 men. Three are selected to attend a management seminar. Find these probabilities.

a. All 3 selected will be women.

b. All 3 selected will be men.

c. 2 men and 1 woman will be selected.

d. 1 man and 2 women will be selected.

a. There are ${}_4C_3$ ways of selecting 3 women and ${}_7C_3$ total ways to select 3 people; hence, $P(\text{all women}) = \frac{{}_4C_3}{{}_7C_3} = \frac{4}{35}$.

b. There are ${}_3C_3$ ways of selecting 3 men; hence, $P(\text{all men}) = \frac{{}_3C_3}{{}_7C_3} = \frac{1}{35}$.

c. There are ${}_3C_2$ ways of selecting 2 men and ${}_4C_1$ ways of selecting one woman; hence, $P(\text{2 men and 1 woman}) = \frac{{}_3C_2 \cdot {}_4C_1}{{}_7C_3} = \frac{12}{35}$.

d. There are ${}_3C_1$ ways to select one man and ${}_4C_2$ ways of selecting two women; hence, $P(\text{1 man and 2 women}) = \frac{{}_3C_1 \cdot {}_4C_2}{{}_7C_3} = \frac{18}{35}$.

Chapter 4
4-5 Probability and Counting Rules
Exercises 4-5

6. Defective Resistors A package contains 12 resistors, 3 of which are defective. If 4 are selected, find the probability of getting

a. 0 defective resistors

b. 1 defective resistor

c. 3 defective resistors

a.P(no defective resistors) $= \frac{{}_9C_4}{{}_{12}C_4} = \frac{126}{495}$

b.P(1 defective resistor) $= \frac{{}_3C_1 \cdot {}_9C_3}{{}_{12}C_4} = \frac{252}{495}$

c.P(3 defective resistors) $= \frac{{}_3C_3 \cdot {}_9C_1}{{}_{12}C_4} = \frac{1}{55}$

Chapter 4
4-5 Probability and Counting Rules
Exercises 4-5

7. **Winning Tickets** If 50 tickets are sold and 2 prizes are to be awarded, find the probability that one person will win 2 prizes if that person buys 2 tickets.

$$\frac{2}{50} \cdot \frac{1}{49} = \frac{1}{1225}$$

Chapter 4
4-5 Probability and Counting Rules
Exercises 4-5

11. Socks in a Drawer A drawer contains 11 identical red socks and 8 identical black socks. Suppose that you choose 2 socks at random in the dark.

a. What is the probability that you get a pair of red socks?

b. What is the probability that you get a pair of black socks?

c. What is the probability that you get 2 unmatched socks?

a. $P(\text{red}) = \frac{{}_{11}C_2}{{}_{19}C_2} = \frac{55}{171}$

b. $P(\text{black}) = \frac{{}_{8}C_2}{{}_{19}C_2} = \frac{28}{171}$

c. $P(\text{unmatched}) = \frac{{}_{11}C_1 \cdot {}_{8}C_1}{{}_{19}C_2} = \frac{88}{171}$

Chapter 4
4-5 Probability and Counting Rules
Exercises 4-5

12. Selecting Books Find the probability of selecting 3 science books and 4 math books from 8 science books and 9 math books. The books are selected at random.

$$\frac{{}_8C_3 \cdot {}_9C_4}{{}_{17}C_7} = \frac{882}{2431}$$

Chapter 4
4-5 Probability and Counting Rules
Exercises 4-5

14. Football Team Selection A football team consists of 20 freshmen and 20 sophomores, 15 juniors, and 10 seniors. Four players are selected at random to serve as captains. Find the probability that

a. All 4 are seniors

b. There is 1 each: freshman, sophomore, junior, and senior

c. There are 2 sophomores and 2 freshmen

d. At least 1 of the students is a senior

a. P(all 4 seniors) $= \frac{{}_{10}C_4 \cdot {}_{20}C_0 \cdot {}_{20}C_0 \cdot {}_{15}C_0}{{}_{65}C_4} = 0.0003$

b. P(one of each) $= \frac{{}_{20}C_1 \cdot {}_{20}C_1 \cdot {}_{15}C_1 \cdot {}_{10}C_1}{{}_{65}C_4} = 0.089$

c. P(2 sophomores and 2 freshmen) $= \frac{{}_{20}C_2 \cdot {}_{20}C_2 \cdot {}_{15}C_0 \cdot {}_{10}C_0}{{}_{65}C_4} = 0.053$

d. P(at least 1 senior) $= 1 -$ P(none are seniors) $= 1 - \frac{{}_{55}C_4}{{}_{65}C_4} = 0.496$

Chapter 4
Review Exercises

1. When a standard die is rolled, find the probability of getting

a. A 5
b. A number larger than 2
c. An odd number

a. $\frac{1}{6}$ b. $\frac{2}{3}$ c. $\frac{3}{6} = \frac{1}{2}$

Chapter 4
Review Exercises

6. Rolling Two Dice When two dice are rolled, find the probability of getting

a. A sum of 5 or 6

b. A sum greater than 9

c. A sum less than 4 or greater than 9

d. A sum that is divisible by 4

e. A sum of 14

f. A sum less than 13

a. There are 4 ways to roll a 5 and 5 ways to roll a 6; hence, $P(5 \text{ or } 6) = \frac{4}{36} + \frac{5}{36} = \frac{1}{4}$

b. There are 3 ways to get a 10, 2 ways to get an 11 and 1 way to get a 12; hence, $P(\text{sum greater than } 9) = \frac{3}{36} + \frac{2}{26} + \frac{1}{36} = \frac{1}{6}$

c. A sum less than 4 means 3 or 2, and greater than 9 means 10, 11, 12; hence, the probability is $\frac{2+1+3+2+1}{36} = \frac{9}{36}$

d. Four, 8, and 12 are divisible by 4; hence, the probability of rolling a 4, 8, or 12 is $\frac{3+5+1}{36} = \frac{9}{36}$

e. Since this is impossible, the answer is 0.

f. Since this is the entire sample space, the probability is $\frac{36}{36} = 1$.

Chapter 4
Review Exercises

7. Budget Rental Cars Cheap Rentals has nothing but budget cars for rental. The probability that a car has air conditioning is 0.5, and the probability that a car has a CD player is 0.37. The probability that a car has both air conditioning and a CD player is 0.06. What is the probability that a randomly selected car has neither air conditioning nor a CD player?

P(either air-conditioning or CD player)
$= 0.5 + 0.37 - 0.06 = 0.81$
P(neither air-conditioning nor CD)
$= 1 - 0.81 = 0.19$

Chapter 4
Review Exercises

9. Car and Boat Ownership The probability that a person owns a car is 0.80, that a person owns a boat is 0.30, and that a person owns both a car and a boat is 0.12. Find the probability that a person owns either a boat or a car.

$$0.80 + 0.30 - 0.12 = 0.98$$

Chapter 4
Review Exercises

12. Purchasing Sweaters During a sale at a men's store, 16 white sweaters, 3 red sweaters, 9 blue sweaters, and 7 yellow sweaters were purchased. If a customer is selected at random, find the probability that he bought

a. A blue sweater
b. A yellow or a white sweater
c. A red, a blue, or a yellow sweater
d. A sweater that was not white

a. $P(\text{blue}) = \frac{9}{35}$

b. $P(\text{yellow or white}) = \frac{7}{35} + \frac{16}{35} = \frac{23}{35}$

c. $P(\text{red, blue, or yellow}) = \frac{3}{35} + \frac{9}{35} + \frac{7}{35} = \frac{19}{35}$

d. $P(\text{not white}) = 1 - P(\text{white})$
$P(\text{not white}) = 1 - \frac{16}{35} = \frac{19}{35}$

Chapter 4
Review Exercises

15. Movie Releases The top five countries for movie releases for a specific year are the United States with 471 releases, United Kingdom with 386, Japan with 79, Germany with 316, and France with 132. Choose 1 new release at random. Find the probability that it is

a. European
b. From the United States
c. German or French
d. German given that it is European

Source: www.showbizdata.com

Total number of movie releases = 1384

a. $P(\text{European}) = \frac{834}{1384}$

b. $P(\text{US}) = \frac{471}{1384}$

c. $P(\text{German or French}) = \frac{316}{1384} + \frac{132}{1384} = \frac{448}{1384}$

d. $P(\text{German} \mid \text{European})$

$$= \frac{P(\text{European and German})}{P(\text{European})} = \frac{\frac{316}{1384}}{\frac{834}{1384}} = 0.379$$

Chapter 4
Review Exercises

16. Factory Output A manufacturing company has three factories: X, Y, and Z. The daily output of each is shown here.

Product	Factory X	Factory Y	Factory Z
TVs	18	32	15
Stereos	6	20	13

If 1 item is selected at random, find these probabilities.

a. It was manufactured at factory X or is a stereo.

b. It was manufactured at factory Y or factory Z.

c. It is a TV or was manufactured at factory Z.

	X	Y	Z	Total
TV	18	32	15	65
Stereo	6	20	13	39
Total	24	52	28	104

a. $\frac{24}{104} + \frac{39}{104} - \frac{6}{104} = \frac{57}{104}$

b. $\frac{52}{104} + \frac{28}{104} = \frac{80}{104} = \frac{10}{13}$

c. $\frac{65}{104} + \frac{28}{104} - \frac{15}{104} = \frac{78}{104} = \frac{3}{4}$

Chapter 4
Review Exercises

25. DVD Players Eighty-one percent of U.S. households have DVD players. Choose 6 households at random. What is the probability that at least 1 does not have a DVD player?

Source: www.infoplease.com

P(at least one household has no DVD player)

$= 1 - P(\text{none have no DVD player})$

$= 1 - P(\text{all 6 have DVD players})$

$= 1 - (0.81)^6 = 0.718$

Chapter 4
Review Exercises

28. Types of Copy Paper White copy paper is offered in 5 different strengths and 11 different degrees of brightness, recycled or not, and acid-free or not. How many different types of paper are available for order?

$5 \cdot 11 \cdot 2 \cdot 2 = 220$ different types of paper

Work Sheet

1- A chance process that leads to well-defined results called outcomes

A. Sample space
B. Outcome
C. probability experiment ⟸
D. tree diagram

2- Probability uses a frequency distribution to compute probabilities

A. Empirical probability ⟸
B. Subjective probability
C. Classical probability
D. A sample space

3- If there is a 20% chance that it will rain tomorrow, what is the probability that it will not rain tomorrow ?

A. 0
B. 0.20
C. 0.08
D. 0.80 ⟸

4- Number of sample space for the children gender (B for boy and G for girl) in a family with three children is

A. S={BBG,BGB,BGG,GBB,GBG,GGB}
B. S={BBB,BBG,BGB,BGG,GBB,GBG,GGB,GGG}
C. 3
D. 8 ⟸

5- "The probability that is storm(عاصفة)will happen next week is 50% " This is an example:

A. Empirical probability
B. Subjective probability ⟵
C. Classical probability
D. A sample space

6- A die is rolled one time, find the probability of getting number less than or equal 2 or an even number.

A.1 B. 2/3 ⟵ C. 5/3 D. 4/8

7- Which of these numbers cannot be a probability:

A. 0.01 B. 2% C. - 0.01 ⟵ D. 1

8- The probability that a student has a car is 0.8, and the probability that he has an I-Phone is 0.7, while the probability that he either car or I-Phone is 0.6. Find the probability that he has both.

A. 0.9 ⟵ B. 0.6 C. 0.8

1- **If P(A) = 0.4 , P(B) = 0.3, and P(A and B) = 0.12, then the events A and B are said to be:**

A. Not mutually exclusive events
B. Dependent events
C. Independent events ⟸
D. Mutually exclusive events

2- **The probabilities of the events A and B are** $P(A \text{ and } B) = 0.2$, and $P(B \mid A) = 0.3$. **Find** $P(\overline{A})$.

A. 0.4
B. 0.5
C. 0.6
D. 0.3 ⟸

3- **It is known that 10% of men are heavy smokers. If 3 men are selected at random, find the probability that all of them are heavy smokers**

A. 0.271
B. 0.729
C. 0.999
D. 0.001 ⟸

The table below shows the number of the students in the classroom who studies Biology or Physics at King Abdul-Aziz University . Answer the following questions(4-5-6)

	Biology	Physics
Female	15	12
Male	15	8

4- **Find the probability that a student chosen at random is a male or takes Biology?**

A. 0.3

B. 0.16

C. 0.76 ⟸

D. 0.84

5- **Find the probability that a student chosen at random is a female and takes Physics?**

A. 0.6

B. 0.24 ⟸

C. 0.44

D. 0.16

6- **Find the probability that a student chosen at random is a female given that, she takes Physics?**

A. 0.6 ⟸

B. 0.24

C. 0.44

D. 0.7

7- **Box A contains 4 red balls and 2 white balls. Box B contains 2 red balls, 2 white balls. A die is rolled first and if the outcome is an even number a ball is chosen at random from Box A, and if the outcome is an odd number a ball is randomly chosen from Box B. Find the probability that a red ball is chosen?**

A. $\frac{2}{9}$ B. $\frac{6}{24}$ C. $\frac{7}{12}$ ⟸ D. $\frac{2}{12}$

1- **A box contains apple and orange fruits, a person selects two fruits without replacement . if the probability of selecting an apple and orange is $\frac{17}{38}$, and the probability of selecting an orange on the first draw is $\frac{5}{10}$,then the probability of selecting an apple on the second draw, given that the first fruit selected was an orange is**

A. 1.1
B. 0.89 ⟸
C. 0.1
D. -1

2- **A box of fruits contains 3 apples and 7 oranges. If two fruits are drawn from the box at random, what is the probability that both of them are orange?**

A. 1/15 B. 7/15 ⟸ C. 49/100 D. 9/100

3- **How many ways can a person select 4 science books and 3 math's books from 9 science books and 5 math's books**

A. $C_4^9 + C_3^5$
B. C_4^9 / C_3^5
C. C_7^{14}
D. $C_4^9 \times C_3^5$ ⟸

It is reported that 72% of working women use computer at work. Choose 5 working women at random. Answer the following two questions (4-5):

4- The probability that none of them use a computer in their jobs is:

A. 0.193

B. 0.807

C. 0.002 ⟸

D. 0.998

5- The probability that at least 1 doesn't use a computer at work is:

A. **0.193**

B. **0.807** ⟸

C. **0.002**

D. **0.998**

6- A box contains 9 apples, 3 of which are defective . if 4 were sold at random, the probability that exactly 2 are defective is …..

A. 0.476

B. 0.143

C. 0.357 ⟸

D. 0.789

7- One company's ID cards consist of 2 letters followed by 2 digits. How many cards be made if repetition are not allowed?

A. 4

B. 58500 ⟸

C. 60

D. 67600

8- **A JARIR store has 5 HP laptops and 4 SONEY laptops on the counter .if two customers purchased a laptop, Find the probability that one of each laptop was purchased.**

A. $\frac{7}{36}$

B. $\frac{4}{9}$

C. $\frac{48}{91}$

D. $\frac{5}{9}$ ⟸

9- **How many different ways can 2 tickets be selected from 6 tickets if each ticket wins a different prize?**

A. 15 B. 27 C.12 D. 30 ⟸

10- **If 4 different-sized washers (غسالات) are arranged in a row, then the probability that they will be arranged in order of size is:**

A) 4!

B) 1/24

C) 1/12 ⟸

D) ¼

11- **If a menu has a choice of 7 appetizers (6 ,(مقبلات main courses(رئيسية اطباق) , and 5 desserts (تحلية اطباق), then the sample space for all possible dinners can be determined by using.....**

A) the fundamental counting rule. ⟸

B) the permutation rule.

C) the combination rule.

D) the addition rule.