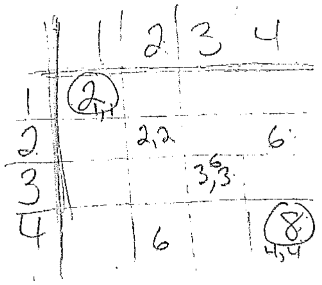
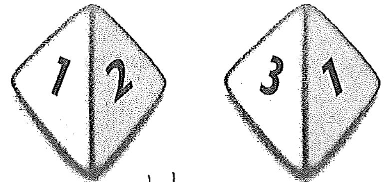
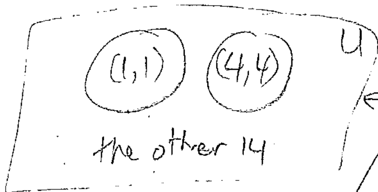
5.4

CHECK Your Understanding

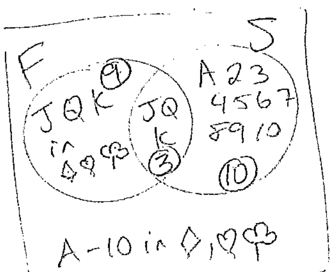


1. Zach is playing a board game. He must roll two four-sided dice, numbered 1 to 4. He can move if he rolls a sum of 2 or a sum of 8.

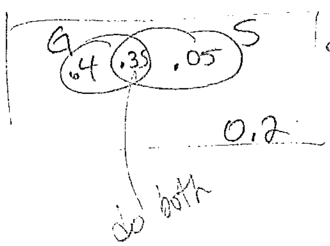




a) Use A and B to represent the two events that will allow Zach to move. Then draw a Venn diagram to illustrate A and B. 1,1 4,4
b) Are A and B mutually exclusive or not mutually exclusive?
c) Determine the probability that Zach will roll a sum of 2 or a sum of 8. $\frac{2 \text{ chances}}{16 \text{ possibilities}} = 0.125$
d) Determine the probability that Zach will roll doubles or a sum of 6. $\frac{6}{16} = 0.375$ (don't count overlap twice)



2. Pearl is about to draw a card at random from a standard deck of 52 playing cards. If she draws a face card or a spade, she will win a point.
a) Draw a Venn diagram to represent the two events.
b) Are the events mutually exclusive? no, JQK overlap
c) Determine the probability of drawing a face card or a spade. $\frac{9+3+10}{52} = 0.4$

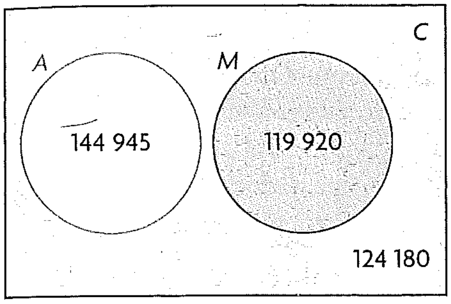


3. The probability that Maria will go to the gym on Saturday is 0.75. The probability that she will go shopping on Saturday is 0.4. The probability that she will do neither is 0.2. $0.75 + 0.4 + 0.2 = 1.35$
a) Draw a Venn diagram to represent the two events. .35 overlap
b) Are the two events mutually exclusive? no, overlap
c) Determine the probability that Maria will do at least one of these activities on Saturday. $.4+.35+.05 \rightarrow \frac{.8}{1} = 0.8$

PRACTISING

4. For each of the following, state whether the events are mutually exclusive. Explain your reasoning.
a) Selecting a prime number or selecting an even number from a set of 15 balls, numbered 1 to 15 no, 2 is even and prime
b) Rolling a sum of 10 or a sum of 7 with a pair of six-sided dice, numbered 1 to 6 yes $7 \neq 10$, never get these at the same time
c) Walking to school or getting a ride to school
yes - can't do both at the same time

5. The following Venn diagram shows the declared population of Métis in Canada, where
A = {Métis in Alberta and British Columbia},
M = {Métis in Manitoba and Saskatchewan}, and
C = {Métis in Canada}. — not including BC, AB, SK, MB Métis



a) Determine the probability that a person who is Métis lives in Alberta or British Columbia. P(A) $= \frac{144945}{144945 + 119920 + 124180} = 0.373$
b) Determine the probability that a person who is Métis lives in Manitoba or Saskatchewan. P(M) $= \frac{119920}{389045} = 0.308$
c) Does $P(A \cup M) = P(A) + P(M)$ in this situation? Explain. yes, since no overlap ✓
d) Determine the odds in favour of a person who is Métis living in one of the four Western provinces. (B, A, S, M)
144945 + 119920 : 124180 elsewhere in Canada
→ 264865 : 124180

6. Tanya plays the balloon pop game at a carnival. There are 40 balloons, with the name of a prize inside each balloon. The prizes are 8 stuffed bears, 5 toy trucks, 16 decks of cards, 7 yo-yos, and 4 giant stuffed dogs. Tanya pops a balloon with a dart. Determine the odds in favour of her winning either a stuffed dog or a stuffed bear.
8+4 : 5+16+7
12 : 28 → 3:7 ✓

7. Edward rolls two regular six-sided dice. Determine the odds against each event below.
a) The sum is 5 or 9.
b) Both dice are even numbers, or the sum is 8.

8. The probability that John will study on Friday night is 0.4.
The probability that he will play video games on Friday night is 0.6.
The probability that he will do at least one of these activities is 0.8.
a) Determine the probability that he will do both activities.
b) Are these events mutually exclusive? Explain how you know.

5.5

In Summary

Key Ideas

- If the probability of one event depends on the probability of another event, then these events are called **dependent events**. For example, drawing a heart from a standard deck of 52 playing cards and then drawing another heart from the same deck without replacing the first card are dependent events.
- If event B depends on event A occurring, then the **conditional probability** that event B will occur, given that event A has occurred, can be represented as follows:

intersection

Prob that B occurs (if A has already happened)

$$P(B \mid A) = \frac{P(A \cap B)}{P(A)}$$

Need to Know

- If event B depends on event A occurring, then the probability that both events will occur can be represented as follows:

prob that both occur

$$P(A \cap B) = P(A) \cdot P(B \mid A)$$

- A tree diagram is often useful for modelling problems that involve dependent events.
- Drawing an item and then drawing another item, without replacing the first item, results in a pair of dependent events.

CHECK Your Understanding

1. Austin rolls a regular six-sided red die and a regular six-sided black die. If the red die lands on 4 and the sum of the two dice is greater than 7, Austin wins a point.

a) Are the two events dependent or independent?

one die doesn't influence the other but need a 4 for sum to be over 7

b) Determine the probability that Austin will win a point.

1b) sum >7: $P\left(\begin{smallmatrix}\text{red}\\4\end{smallmatrix}\right) \cdot P\left(\begin{smallmatrix}\text{Black}\\4,5,6\end{smallmatrix} \middle| \begin{smallmatrix}\text{red}\\4\end{smallmatrix}\right)$

$\frac{1}{6} \cdot \frac{3}{6} = \frac{3}{36} = \frac{1}{12}$ ✓

2. Valeria draws a card from a well-shuffled standard deck of 52 playing cards. Then she draws another card from the deck without replacing the first card.

a) Are these two events dependent or independent?

b) Determine the probability that both cards are diamonds.

$P\left(\begin{smallmatrix}1^{st}\\\text{card}\\\diamondsuit\end{smallmatrix}\right) \cdot P\left(\begin{smallmatrix}2^{nd}\\\text{card}\\\diamondsuit\end{smallmatrix} \middle| \begin{smallmatrix}1^{st}\\\text{card}\\\diamondsuit\end{smallmatrix}\right)$

$\frac{13}{52} \cdot \frac{12}{51} = \frac{156}{2654} = 0.059$ ✓

3. Valeria draws a card from a well-shuffled standard deck of 52 playing cards. Then she puts the card back in the deck, shuffles again, and draws another card from the deck.

a) Are these two events dependent or independent?

b) Determine the probability that both cards are diamonds.

$\frac{13}{52} \times \frac{13}{52} = \frac{169}{2704} = 0.0625$ ✓

PRACTISING

4. Lexie has six identical black socks and eight identical white socks loose in her drawer. She pulls out one sock at random and then another sock, without replacing the first sock. 14 socks
   a) Determine the probability of each event below.
      i) She pulls out a pair of black socks. $\frac{6}{14} \times \frac{5}{13} = \frac{30}{182} = 0.165$ ✓
      ii) She pulls out a pair of white socks. $\frac{8}{14} \times \frac{7}{13} = \frac{56}{182} = 0.308$ ✓
      iii) She pulls out a matched pair of socks; that is, either both are black or both are white. add prob : $0.165 + 0.308 = 0.473$ ✓
   b) If Lexie randomly pulled out both socks at the same time, would your answers for part a) change? Explain. NO – can't be 14 socks for both hands to choose from 14 for one hand, 13 for other

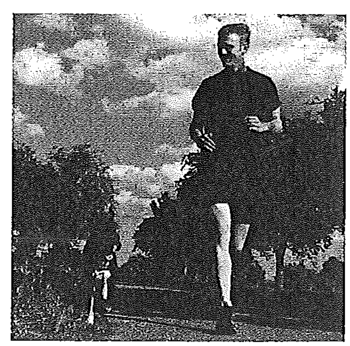
5. There are 80 males and 110 females in the graduating class in a Kelowna school. Of these students, 30 males and 50 females plan to attend the University of British Columbia (UBC) next year.
   a) Determine the probability that a randomly selected student plans to attend UBC. $\frac{80}{190} = 0.421$ ✓
   b) A randomly selected student plans to attend UBC. Determine the probability that the selected student is female. $\frac{50}{80} = 0.625$ ✓

6. Each day, Melissa's math teacher gives the class a warm-up question. It is a true-false question 30% of the time and a multiple-choice question 70% of the time. Melissa gets 60% of the true-false questions correct, and 80% of the multiple-choice questions correct. Melissa answers today's question correctly. What is the probability that it was a multiple-choice question?

7. Skye has four loonies, three toonies, and five quarters in his pocket. He needs two loonies for a parking meter. He reaches into his pocket and pulls out two coins at random. Determine the probability that both coins are loonies.

   12 coins
   $\frac{4}{12} \times \frac{3}{11} = \frac{12}{132} = 0.091$ ✓
   dependent

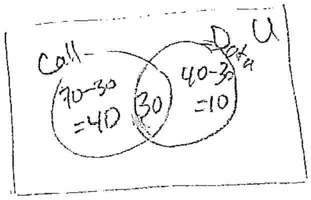
8. Anita remembers to set her alarm clock 62% of the time. When she does remember to set her alarm clock, the probability that she will be late for school is 0.20. When she does not remember to set it, the probability that she will be late for school is 0.70. Anita was late today. What is the probability that she remembered to set her alarm clock?



9. Ian likes to go for daily jogs with his dog, Oliver. If the weather is nice, he is 85% likely to jog for 8 km. If the weather is rainy, he is only 40% likely to jog for 8 km. The weather forecast for tomorrow indicates a 30% chance of rain. Determine the probability that Ian will jog for 8 km.

set 0.62 — late 0.20 → $0.62 \times 0.20 = 0.124$ late
set 0.62 — not late 0.80 → $0.62 \times 0.80 = 0.496$ not late
not set 0.38 — late 0.70 → $0.38 \times 0.70 = 0.266$ late
not set 0.38 — not late 0.30 → $0.38 \times 0.30 = 0.114$ not late
adds to 1 ✓

$P(\text{rem to set alarm}) = \frac{P(\text{rem set alarm late})}{P(\text{all times of being late})} = \frac{0.124}{(0.124 + 0.266)} = 0.318$ ✓



10. Cellphone users only in Mapletown were surveyed about their phone plan, with these results:

- 70% of all users have call display.
- 40% of users have a data plan.
- 75% users with a data plan also have call display. 75% of 40 = 30 only

A cellphone user in Mapletown, who is selected at random, has call display. Determine the probability that this person also has a data plan. $\frac{30}{70}$ to have data as well. = 0.429 ✓

11. Cole surveyed 10 students in his Grade 12 class about their lunch break on school days. He asked them to base their answers to the following questions on a period of 1 month.

- How often do you have 1 h or less for lunch?
- How often do you have more than 1 h for lunch?
- How often do you go to your local fast-food outlet for lunch, if you only have 1 h or less for lunch?
- How often do you go to your local fast-food outlet for lunch, if you have more than 1 h for lunch?

His results are given below:

A = {1 h or less for lunch}
B = {more than 1 h for lunch}
C = {go to fast food outlet if less than 1 h for lunch}
D = {go to fast food outlet if more than 1 h for lunch}

Event	Number
A	120
B	80
C	40
D	60

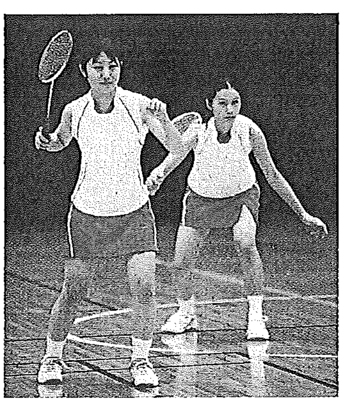
Create a conditional probability problem for Cole's data.

12. Decide on a topic that interests you.

a) Create and conduct a short survey, similar to Cole's survey in the previous question. Tabulate your results.

b) Create a conditional probability problem for your data.

13. The probability that a car tire will last for 5 years is 0.8. The probability that a tire will last for 6 years is 0.5. Suppose that your parents' tires have lasted for 5 years. Determine the probability that the tires will last for 6 years.



14. The probability that the windshield wipers on a particular model of car will last for 2 years is 0.7. The probability that they will last for 3 years is 0.6. The wipers on your parents' car have lasted for 2 years. Determine the probability that the wipers will last for 3 years.

15. The probability that a particular pair of badminton shoes will last for 6 months is 0.9. The probability that the shoes will last for 1 year is 0.2. Natalie's shoes have lasted for 6 months. Determine the probability that they will last for 1 year.

5: 20, 25, 35, 40, 50 | 30, 45 | 3: 21, 24, 27, 33, 36, 39, 42, 48

22, 23, 26, 28, 29, 31, 32, 34, 37, 38, 41, 43, 44, 46, 47, 49

16. Morgan asks Jasmine to choose a number between 20 and 50 and then say one fact about the number. Jasmine says that the number she chose is a multiple of 5. Determine the probability that the number is also a multiple of 3, using each method below.

30 overlap

a) A Venn diagram $\frac{2}{7}$ ✓

b) The formula for conditional probability $P(3|5) = \frac{P(3 \cap 5)}{P(5)} = \frac{\frac{2}{15}}{\frac{7}{15}} = \frac{2}{7}$ ✓

17. Recall the opening problem in this lesson:
A computer manufacturer knows that, in a box of 100 chips, 3 will be defective. Jocelyn will draw 2 chips, at random, from a box of 100 chips.

a) Draw a tree diagram to represent this situation.

b) Determine the probability that exactly 1 chip will be defective. Explain what you did.

18. A computer manufacturer knows that, in a box of 150 computer chips, 3 will be defective. Samuel will draw 2 chips, at random, from a box of 150 chips. Determine the probability that Samuel will draw the following:

a) 2 defective chips $\frac{3}{150} \times \frac{2}{149} = 0.000268$ ✓

b) 2 non-defective chips $\frac{147}{150} \times \frac{146}{149} = 0.960$ ✓

c) Exactly 1 defective chip $\frac{3}{150} \times \frac{147}{149}$ + or $\frac{147}{150} + \frac{3}{149} = 0.0395$ ✓ (could pull defective 1st or 2nd so must count both ways)

19. Savannah's soccer team is playing a game tomorrow. Based on the team's record, it has a 50% chance of winning on rainy days and a 60% chance of winning on sunny days. Tomorrow, there is a 30% chance of rain. Savannah's soccer league does not allow ties.

a) Determine the probability that Savannah's team will win tomorrow.

b) Determine the probability that her team will lose tomorrow.

20. Think of two situations in your life in which the probability of one event happening depends on another event happening. Write two problems, one for each of these situations. Also, write the solutions to your problems. Exchange your problems with a classmate. Solve, and then correct, each other's problems. Adjust your problems, if necessary.

Closing

21. Explain the meaning of the formula $P(A \text{ and } B) = P(A) \cdot P(B \mid A)$. Give an example to illustrate your explanation.

Extending

22. A computer manufacturer knows that, in a box of 100 computer chips, 4 will be defective. Caleb will draw 3 chips, at random, from a box of 100 chips. Determine the probability that Caleb will draw the following:

a) 3 defective chips

b) 3 non-defective chips

c) More defective chips than non-defective chips

5.6

CHECK Your Understanding

1. For each situation, classify the events as either independent or dependent. Justify your classification.
   a) A four-colour spinner is spun, and a die is rolled. The first event is spinning red, and the second event is rolling a 2. Independent
   b) A red die and a green die are rolled. The first event is rolling a 1 on the red die, and the second event is rolling a 5 on the green die. indep.
   c) Two cards are drawn, without being replaced, from a standard deck of 52 playing cards. The first event is drawing a king, and the second event is drawing an ace. dependent
   d) There are 30 cards, numbered 1 to 30, in a box. Two cards are drawn, one at a time, with replacement. The first event is drawing a prime number, and the second event is drawing a number that is a multiple of 5. independent

2. Celeste goes to the gym five days a week. Each day, she does a cardio workout using either a treadmill, an elliptical walker, or a stationary bike. She follows this with a strength workout using either free weights or the weight machines. Celeste randomly chooses which cardio workout and which strength workout to do each day.
   a) Are choosing a cardio workout and choosing a strength workout dependent or independent events? Explain. indep. Since random, diff
   b) Determine the probability that Celeste will use a stationary bike and free weights the next day she goes to the gym. $\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$

3. Ian also goes to the gym five days a week, but he does two different cardio workouts each day. His choices include using a treadmill, a stepper, or an elliptical walker, and running the track.
   bad wording
   a) Are the two cardio workouts that Ian chooses dependent or independent events? ?
   b) Determine the probability that the next time Ian goes to the gym he will use the elliptical walker and then run the track.

PRACTISING

4. For each situation described in question 1, determine the probability that both events will occur. $P(A \cap B) = .35 \times .4 = 0.14$ and $\neq 0.12$

5. a) Suppose that $P(A) = 0.35$, $P(B) = 0.4$, and $P(A \cap B) = 0.12$. Are A and B independent events? Explain. No
   b) Suppose that $P(Q) = 0.720$, $P(R) = 0.650$, and $P(Q \cap R) = 0.468$. Are Q and R independent events? Explain. Yes

$P(Q \cap R) = P(Q) \cdot P(R) = 0.468$

$P(B) = 0.4$ $P(A|B) = 0.3429$

for dependent
$P(A \cap B) = P(A) \cdot P(B|A)$ $\neq .4$
$P(B|A) = \frac{P(A \cap B)}{P(A)} = \frac{.12}{.35} = 0.3429$

6. There are two children in the Angel family.
   a) Draw a tree diagram that shows all the possible gender combinations for the two children.
   b) Determine the probability that both children are boys.
   c) Determine the probability that one child is a boy and the other child is a girl. $0.25 + 0.25 = 0.5$

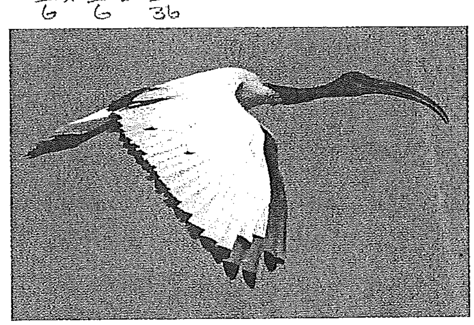
Child 1 Child 2 both B

$$B \xrightarrow{0.5} B \to (0.5)(0.5) = 0.25$$
$$B \xrightarrow{0.5} G \to 0.25$$
$$G \xrightarrow{0.5} B \to 0.25$$
$$G \xrightarrow{0.5} G \to 0.5$$

7. A particular game uses 40 cards from a standard deck of 52 playing cards: the ace to the 10 from the four suits. One card is dealt to each of two players. Determine the probability that the first card dealt is a club and the second card dealt is a heart. Are these events independent or dependent?

$\frac{10}{40} \times \frac{10}{39} = \frac{100}{1560} = 0.0641$

8. A die is rolled twice. Determine the probability for the following:
   a) The first roll is a 1, and the second roll is a 6. $\frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$
   b) The first roll is greater than 3, and the second roll is even. $\frac{3}{6} \times \frac{3}{6} = \frac{9}{36} = \frac{1}{4} = 0.25$
   c) The first roll is greater than 1, and the second roll is less than 6. $\frac{5}{6} \times \frac{5}{6} = \frac{25}{36}$



9. Jeremiah is going on a cruise up the Nile. According to the travel brochure, the probability that he will see a camel is $\frac{4}{5}$, and the probability that he will see an ibis is $\frac{3}{4}$. Determine the probability that Jeremiah will see the following:
   a) A camel and an ibis $\frac{4}{5} \times \frac{3}{4} = \frac{12}{20} = \frac{3}{5} = 0.6$
   b) Neither a camel nor an ibis $\frac{1}{5} \times \frac{1}{4} = \frac{1}{20} = 0.05$
   c) Only one of these sights $\underbrace{\frac{4}{5} \times \frac{1}{4}}_{C\,NI} + \underbrace{\frac{1}{5} \times \frac{3}{4}}_{NC\,I} = 0.35$

10. a) Design a spinner so that when you toss a coin and spin the spinner, the probability of getting heads and spinning a 6 is $\frac{1}{12}$.
    b) Repeat part a) with a probability of $\frac{1}{20}$.

11. Recall Anne and Abby, from the beginning of this lesson. They each have 19 marbles: 11 red and 8 blue. Anne places 7 red marbles and 3 blue marbles in bag 1. She places the rest of her marbles in bag 2. Abby places all of her marbles in bag 3. Anne then draws one marble from bag 1 and one marble from bag 2. Abby draws two marbles from bag 3.
    a) Are Anne and Abby equally likely to draw two blue marbles from their bags? Explain.
    b) Determine the probability Anne and Abby will both draw one red marble and one blue marble. Explain what you did.
    c) Suppose that Anne now has 5 red marbles and 5 blue marbles in each of her two bags, while Abby has 10 red marbles and 10 blue marbles in her one bag. Will Abby still be more likely to draw two red marbles? Explain.

20 items ⇐ **(12.)** A paper bag contains a mixture of three types of treats: 10 granola bars, 7 fruit bars, and 3 cheese strips. Suppose that you play a game in which a treat is randomly taken from the bag and replaced, and then a second treat is drawn from the bag. You are allowed to keep the second treat only if it was the same type as the treat that was drawn the first time. Determine the probability of each of the following:

✓

a) You will be able to keep a granola bar. $\frac{10}{20} \times \frac{10}{20} = 0.25$

b) You will be able to keep any treat. $\frac{10}{20} \times \frac{10}{20} + \frac{7}{20} \times \frac{7}{20} + \frac{3}{20} + \frac{3}{20} = 0.395$

c) You will not be able to keep any treat. $1 - 0.395 = 0.605$
(rest of the time)

13. Tiegan's school is holding a chocolate bar sale. For every case of chocolate bars sold, the seller receives a ticket for a prize draw. Tiegan has sold five cases, so she has five tickets for the draw. At the time of the draw, 100 tickets have been entered. There are two prizes, and the ticket that is drawn for the first prize is returned so it can be drawn for the second prize.

a) Determine the probability that Tiegan will win both prizes.

b) Determine the probability that she will win no prizes.

14. a) Create a problem that involves determining the probability of two independent events. Give your problem to a classmate to solve.

b) Modify the problem you created in part a) so that it now involves two dependent events. Give your problem to a classmate to solve.

15. Two single-digit random numbers (0 to 9 inclusive) are selected independently. Determine the probability that their sum is 10.

Closing

16. a) Explain why the formula you would use to calculate $P(A \cap B)$ would depend on whether A and B are dependent or independent events.

b) Give an example of how you would calculate $P(A \cap B)$ if A and B were independent events.

c) Give an example of how you would calculate $P(A \cap B)$ if A and B were dependent events.

Extending

17. A particular machine has 100 parts. Over a year, the probability that each part of the machine will fail is 1%. If any part fails, the machine will stop.

a) Determine the probability that the machine will operate continuously for 1 year.

b) Suppose that the probability of each part failing within one year dropped to 0.5%. Determine the probability that the machine will operate continuously for 1 year.

c) Suppose that the probability of the machine operating continuously for 1 year must be 90%. What would the probability of not failing need to be for each part?

5 Chapter Self-Test

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

1. Cassie and Jacob are playing a game. Six tiles, numbered 1 to 6, are placed face down. Each player selects a tile. If the sum of their two tiles is even, Jacob wins. If the sum is odd, Cassie wins. Is this game fair? Explain. yes ✓ odds are even.
2. The odds in favour of an Inuit person being able to converse in more than one Aboriginal language are 7 : 3. Determine the probability that an Inuit person can converse in at least two Aboriginal languages. $\frac{7}{10}$ ✓
3. A credit card company randomly generates a temporary three-digit pass code for cardholders. Braydon is expecting his credit card to arrive in the mail. Determine the probability that her pass code is made up of three different even digits. 0 is even here $\frac{5 \cdot 4 \cdot 3}{10 \cdot 10 \cdot 10} = 0.06$ ✓
4. In the card game called Crazy Eights, players are dealt 8 cards from a standard deck of 52 playing cards. Determine the probability that a hand will consist of 4 hearts and 4 spades. $\frac{{}_{13}C_4 \cdot {}_{13}C_4}{{}_{52}C_8}$ ✓
5. Kaylee plays the balloon pop game at a carnival. There are 50 balloons, with the name of a prize inside each balloon. The prizes are 10 stuffed bears, 4 toy trucks, 20 stuffed rabbits, 6 yo-yos, and 10 giant stuffed cats. Kaylee pops a balloon with a dart. Determine the probability that she will win either a toy truck or a yo-yo. $\frac{10}{50} = 0.2$ ✓
6. Hans tosses a coin and then draws a card from a standard deck of 52 playing cards. Determine the probability that he will toss a head and draw an 8. $\frac{1}{2} \times \frac{4}{52} = 0.0385$ ✓
7. Jarrod likes to play basketball. Based on past games, the probability that he will make a free throw is 70%. If he has been awarded two free throws, what is the probability of each of the following?
   a) He will make both shots. .7 · .7
   b) He will miss both shots. .3 · .3
   c) He will make one shot. 0.7 × .3 + .3 × .7
   d) He will make at least one shot. 0.7 · 0.3 + 0.3 × 0.7 + 0.7 · 0.7
8. A euchre deck consists of 24 cards: the 9, 10, jack, queen, king, and ace of all four suits. George draws two cards from a well-shuffled euchre deck. Determine the probability that both cards are hearts. 6 hearts in deck

   $P(♡) \cdot P(♡|♡)$

   $\frac{6}{24} \cdot \frac{5}{23} = 0.0543$ ✓

   or

   $\frac{{}_6C_2}{{}_{24}C_2} = 0.0543$ ✓
9. Miguel remembers to set his alarm clock 72% of the time. When he does remember to set his alarm clock, the probability that he will be late for school is 0.10. When he does not remember to set it, the probability that he will be late for school is 0.70. Miguel was late today. Determine the probability that he remembered to set his alarm clock.

   alarm — set 0.72 — late 0.10 = (0.072); on time 0.9 = 0.648

   not 0.28 — late 0.7 = (0.196); on time 0.3 = 0.084

   $\frac{\text{specific } 0.072}{\text{total } 0.072 + 0.196} = 0.269$ ✓

WHAT DO You Think Now? Revisit **What Do You Think?** on page 301. How have your answers and explanations changed?

Ch 5 Review

PRACTISING

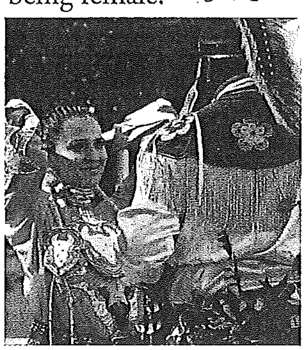
Lesson 5.1

1. Is each game fair or not fair? Explain.
   a) Chloe and Camila each toss two coins. If all four coins land heads or tails, Chloe wins. If two coins are heads and two coins are tails, Camila wins. Otherwise, it is a tie. Not fair
   better chance
   b) Cooper and Alyssa take turns rolling three four-sided dice. If a 1 or a 2 is rolled at least once, then Cooper gets a point. If a 3 or a 4 is rolled at least once, then Alyssa gets a point. (Note that both could get a point on the same roll.) fair
   equal chances

2. In spinning classes, the tension of a bike is said to be 100% when the pedal can no longer be turned. Bob's spinning instructor asks him to turn the tension up to 130%. Determine the probability that Bob can do this. Explain.
   0%, impossible, can't be more than 100%

Lesson 5.2

3. On National Aboriginal Day (NAD), celebrated on June 21 every year, cultural events and demonstrations take place across Canada. At a traditional Pow Wow held in Edmonton, Alberta, for NAD, 60% of the people in attendance were female. At the conclusion of the Pow Wow, everyone in attendance receives a gift from the hosts. If the first person receiving a gift is chosen at random:
   a) Determine the odds in favour of this person being female. 60 : 40, 3 : 2
   b) Determine the odds against this person being female. 2 : 3



4. The forecaster predicts a 70% probability of rain tomorrow. What are the odds against rain?
   for 70 : 30 → against 3 : 7

5. Serenity is watching Keir surf. The last seven times that Serenity watched Keir, he fell twice.
   a) Determine the odds in favour of Keir falling this time. 2 : 5
   b) Determine the odds against Keir falling this time. 5 : 2

6. Ariana plays sponge hockey. She has scored 6 goals in 30 shots on goal. She says that the odds against her scoring a goal are 4 : 5. Is she correct? Explain. No
   for 6 : 24, 1 : 4; against 4 : 1

7. Averill is planning her university schedule. She is trying to decide between two different mathematics courses. She has been told that the odds against getting an A in the first course are 8 : 3, and the odds in favour of getting an A in the second course are 6 : 11, based on the results from previous years. Averill wants to get as high a mark as possible. Which course should ~~she take~~? Second
   1st 3 : 8 → 33 : 88, $\frac{3}{11}$; 2nd 6 : 11 → 48 : 88, $\frac{6}{17}$ =

Lesson 5.3

8. Two people are randomly chosen from a committee of nine people to be president and secretary. Cameron and Wyatt are on the committee. Determine the probability that they will be chosen for these roles. $= 0.0278$
   $\frac{{}_2C_2}{{}_9C_2} = \frac{\frac{2!}{2!0!}}{\frac{9!}{2!7!}}$

9. There are 11 students, including Marina and MacKenzie, on the school swim team. The upcoming swim tournament includes a relay race. The coach has decided to choose the four positions on the relay team (first, second, third, and anchor) randomly. Determine the probability that Marina and MacKenzie will be chosen to be on the relay team. 0.109
   $\frac{{}_4C_2}{{}_{11}C_2} = \frac{\frac{4!}{2!2!}}{\frac{11!}{2!9!}} = \frac{6}{55}$

10. Access to a particular online game is password protected. Every player must create a password that consists of three capital letters followed by four digits. For each condition below, determine the probability that a password chosen at random will contain the letters A, R, and T.
    a) Repetitions are not allowed in a password.
    b) Repetitions are allowed in a password.

a) all possibilities $26 \times 25 \times 24 \times 10 \times 9 \times 8 \times 7$
with ART $3 \times 2 \times 1 \times 10 \times 9 \times 8 \times 7$
$P = \frac{3 \times 2 \times 1}{26 \times 25 \times 24} = 0.000385$
b) all possibilities $26 \times 26 \times 26 \times 10^4$
with ART $3 \times 2 \times 1 \times 10^4$
$P = \frac{6}{26^3} = 0.000341$

Lesson 5.4

11. For each of the following, state whether the two events are mutually exclusive or not mutually exclusive. Explain your reasoning.

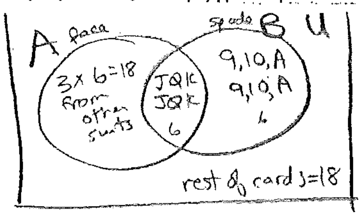
a) Selecting a prime number or selecting an odd number from a set of 15 balls, numbered 1 to 15 not → 3 is prime and odd

b) Rolling a sum of 8 or a sum of 6 with a pair of six-sided dice, numbered 1 to 6 is mutually exclusive 6 ≠ 8

c) Eating a peach or eating an apple
Mut. exclusive peach ≠ apple

12.

12a)

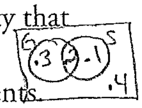


b) not mutually exclusive

c) $P(A \cup B) = \frac{18+6+6}{48}$ (or)

$= \frac{30}{48} = 0.625$ ✓

13. The probability that Mya will exercise on Sunday is 0.5. The probability that she will go shopping on Sunday is 0.3. The probability that she will do both is 0.2. ← overlap



a) Use G and S to represent these two events. Draw a Venn diagram to illustrate G and S.

b) Are G and S mutually exclusive or not mutually exclusive? Not

c) Determine the probability that Mya will do at least one of these activities on Sunday.
.3 + .2 + .1 = 0.6

14. There are 24 students in Sergio's Grade 5 class. Based on a survey he conducted, he knows that 19 of these students can swim and 8 can ski. Create a probability problem using Sergio's data. Then solve your problem, using a Venn diagram or a tree diagram. create own

15. Collect data on a topic that interests you. Create a probability problem using this data. Then solve your problem, using a Venn diagram or a tree diagram. create own

Lesson 5.5

16. Parker has eight identical black socks and 10 identical white socks loose in his drawer. He pulls out two socks at random. Determine the probability that he pulls out a pair of mismatched socks; that is, one is black and the other is white. → 18 socks

$\frac{8}{18} \times \frac{10}{17} + \frac{10}{18} \times \frac{8}{17} = 0.523$

17. The probability that a plane will leave Winnipeg on time is 0.70. The probability that a plane will leave Winnipeg on time and arrive in Calgary on time is 0.56. Determine the probability that a plane will arrive in Calgary on time, given that it left Winnipeg on time. See sticky

18. A deck of 40 cards consists of the ace to the 10 from the four suits. A card is dealt to each of two players. Determine the probability that the first card is red and the second card is black.

$\frac{20}{40} \times \frac{20}{39} = 0.256$ ✓

Lesson 5.6

19. Peyton goes to the gym four days a week. She does a cardio workout each day, using a stair machine or a running machine or taking a salsa class. She also does a strength workout each day, using a weight machine or taking a body sculpt class. Peyton randomly chooses which cardio workout and which strength workout to do each day. Determine the probability that she will use a stair machine and take a body sculpt class the next day she goes to the gym. $\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$ ✓

20. Suppose that $P(A) = 0.5$, $P(B) = 0.6$, and $P(A \cap B) = 0.3$. Are events A and B independent? Explain. if indep. then $P(A \cap B) = P(A) \cdot P(B)$
$0.3 \stackrel{?}{=} 0.5 \times 0.6$ yes

21. Tanya estimates that her probability of passing French is 0.7 and her probability of passing chemistry is 0.6. Determine the probability that Tanya will:

a) Pass both French and chemistry $0.7 \cdot 0.6 = 0.42$

b) Pass French but fail chemistry $0.7 \cdot 0.4 = 0.28$

c) Fail both French and chemistry $0.3 \cdot 0.4 = 0.12$

Games and Probability

You can sometimes use probability to increase your chances of winning a game

For c... cards ... or se... show... hand ... win by grouping your ... consecutive order) ... nple, the card hand ... ıd 6 of diamonds, the

#17 | pg 368

Win

Cal

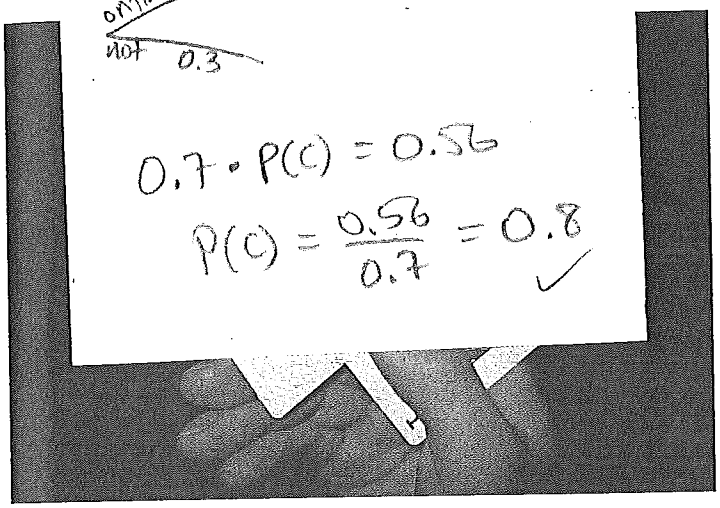
ontime $P(C) \rightarrow 0.56$

ontime 0.7

not 0.3

$$0.7 \cdot P(C) = 0.56$$

$$P(C) = \frac{0.56}{0.7} = 0.8 \checkmark$$



By carefully watching and remembering the cards that your opponent collects or discards during play, you can often determine your probability of getting a particular card that you want.

? How can you apply your knowledge of probability to increase your odds of winning a game?

A. Choose a game, such as Gin Rummy or cribbage, that has many options and variables.

B. Play the game with a friend. As you play, keep track of situations in which you used probability to decide what card to play. These situations should include, where possible, probabilities or odds, and independent, dependent, or mutually exclusive events.

C. Describe these situations mathematically, indicating the type of probability involved. Explain how you used probability to help you make decisions.

D. Present your results. Your presentation should include at least two helpful strategies to improve a player's chance of winning the game.

Task | ***Checklist***

- ✔ Did you describe each situation and event clearly?
- ✔ Did you justify the decisions you made?
- ✔ Did you use appropriate mathematical language?