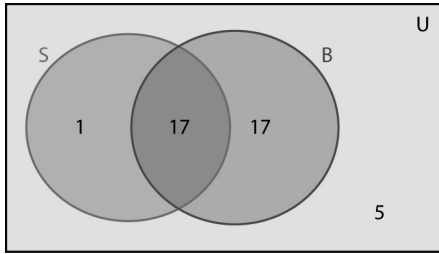


c)

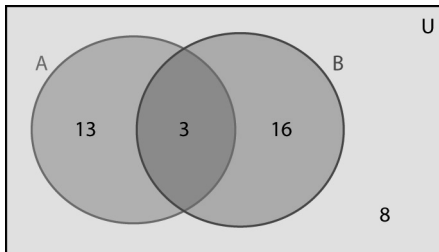


5. a) sunglasses or hat: $20 - 5 = 15$
 sunglasses and hat: $13 + 6 = 19$
 overlap: $19 - 15 = 4$
 4 students are wearing sunglasses and a hat.
 b) only sunglasses: $13 - 4 = 9$
 9 students are wearing sunglasses but not a hat.
 c) only hat: $6 - 4 = 2$
 2 students are wearing a hat but not sunglasses.

6. a) e.g., Tanya did not put any elements in the intersection of A and B.

$$\begin{aligned} n(A \cup B) &= n(U) - n((A \cup B)') \\ n(A \cup B) &= 40 - 8 \\ n(A \cup B) &= 32 \\ n(A \cap B) &= n(A) + n(B) - n(A \cup B) \\ n(A \cap B) &= 16 + 19 - 32 \\ n(A \cap B) &= 3 \\ n(A|B) &= n(A) - n(A \cap B) \\ n(A|B) &= 16 - 3 \\ n(A|B) &= 13 \\ n(B|A) &= n(B) - n(A \cap B) \\ n(B|A) &= 19 - 3 \\ n(B|A) &= 16 \end{aligned}$$

b)



7. Let U represent the universal set. Let D represent the set of students who have a dog. Let C represent the set of students who have a cat.

$$\begin{aligned} n(C \cup D) &= n(U) - n((C \cup D)') \\ n(C \cup D) &= 20 - 4 \\ n(C \cup D) &= 16 \\ n(C \cap D) &= n(C) + n(D) - n(C \cup D) \\ n(C \cap D) &= 8 + 8 - 16 \\ n(C \cap D) &= 0 \end{aligned}$$

No students have a cat and a dog.

Lesson 3.4: Applications of Set Theory, page 191

1. $n(P) = p + 16$, $n(Q) = q + 21$, $n(R) = r + 18$
 e.g., p Can be any number. Suppose $p = 14$. Then $n(P) = 30$.

$$\begin{aligned} n(Q) &= 30, \text{ so } q = 30 - 21 \text{ or } 9 \\ n(R) &= 30, \text{ so } r = 30 - 18 \text{ or } 12 \end{aligned}$$

2. a) $n((F \cup M) \setminus A) = 9 + 15 + 8$
 $n((F \cup M) \setminus A) = 32$

b) $n((A \cup F) \setminus M) = 9 + 11 + 7$
 $n((A \cup F) \setminus M) = 27$

c) $n((F \cup A) \cup (F \cup M))$
 $= (9 + 11 + 7 + 9) + (15 + 8 + 4)$
 $= 36 + 27$
 $= 63$

d) $n(A \setminus F \setminus M) = 7$

3. e.g., Staff could look at how many David Smiths were on that bus route or they could look at the books in the bag and see how many David Smiths are taking courses that use those books.

4. $P = \{\text{population surveyed}\}$
 $n(P) = 641$
 $L = \{\text{people wearing corrective lenses}\}$
 $L' = \{\text{people not wearing corrective lenses}\}$
 $n(L') = 167$
 $G = \{\text{people wearing glasses}\}$
 $C = \{\text{people wearing contact lenses}\}$
 $n(L) = n(P) - n(L')$
 $n(L) = 641 - 167$
 $n(L) = 474$
 $n(G \cup C) = n(L)$
 $n(G \cup C) = n(G) + n(C) - n(G \cap C)$
 $474 = 442 + 83 - n(G \cap C)$
 $51 = n(G \cap C)$

51 people might make use of a package deal. This is $\frac{51}{574} = 10.759\ldots\%$ or about 10.8% of all potential customers.

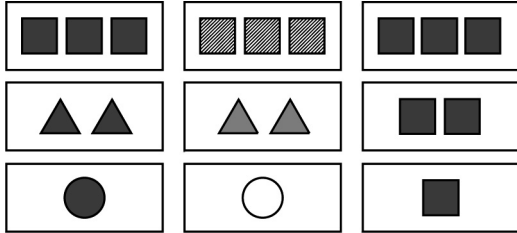
5. e.g., "Canadian Rockies," "ski accommodations," "weather forecast," "Whistler." By combining two or more of these terms, Jacques can search for the intersection of web pages related to these terms. For example, "ski accommodations" and "Canadian Rockies" is more likely to give him useful information for his trip than either of those terms on its own.

6. Using the principle of inclusion and exclusion for three sets:

$$\begin{aligned}
 32 + 35 + 38 - (9 + x) - (11 + x) - (13 + x) + x &= 58 \\
 105 - 9 - x - 11 - x - 13 - x + x &= 58 \\
 72 - 2x &= 58 \\
 -2x &= 58 - 72 \\
 -2x &= -14 \\
 x &= 7
 \end{aligned}$$

7 teens are training for the upcoming triathlon.

- same numbers, same shapes, different shadings
- same numbers, different shape, different shading
- same numbers, different shape, different shading



8. a) e.g., The dealer might use exterior colour, interior colour, or year.

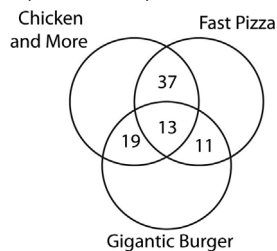
b) e.g., The dealer might prioritize the search according to options Travis wants or by distance from where Travis lives.

9. e.g., John assumed that 90 people ate at only one restaurant for each of the 3 restaurants. He did not calculate the correct number of people eating at only one of each of the 3 restaurants. I defined these sets.

- $C = \{\text{students who like only Chicken and More}\}$
- $F = \{\text{students who like only Fast Pizza}\}$
- $G = \{\text{students who like only Gigantic Burger}\}$

I listed the values I knew and entered them in a Venn diagram.

$$\begin{aligned}
 n(C \cap P \setminus B) &= 37; n(C \cap B \setminus P) = 19; n(P \cap B \setminus C) = 11 \\
 n(C \cap B \cap P) &= 13
 \end{aligned}$$

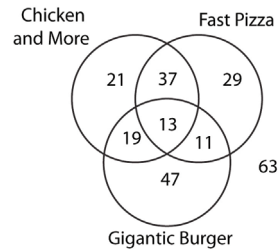


I used these figures and diagram to determine the unknown values.

$$\begin{aligned}
 n(C \setminus B \setminus P) &= 90 - n(C \cap P \setminus B) - n(C \cap B \setminus P) \\
 &\quad - n(C \cap B \cap P) \\
 &= 90 - 37 - 19 - 13 \\
 &= 21
 \end{aligned}$$

$$\begin{aligned}
 n(B \setminus P \setminus C) &= 90 - n(C \cap B \setminus P) - n(P \cap B \setminus C) \\
 &\quad - n(C \cap B \cap P) \\
 &= 90 - 19 - 11 - 13 \\
 &= 47
 \end{aligned}$$

$$\begin{aligned}
 n(P \setminus B \setminus C) &= 90 - n(P \cap B \setminus C) - n(C \cap P \setminus B) \\
 &\quad - n(C \cap B \cap P) \\
 &= 90 - 11 - 37 - 13 \\
 &= 29
 \end{aligned}$$



$$n(R) = 21 + 29 + 47 + 37 + 19 + 11 + 13$$

$$n(R) = 177$$

177 students like at least one of these restaurants.

$$240 - 177 = 63$$

So, 63 students do not like any of the restaurants.

10. a) e.g., He can search for *colleges and (Calgary or Edmonton)*.

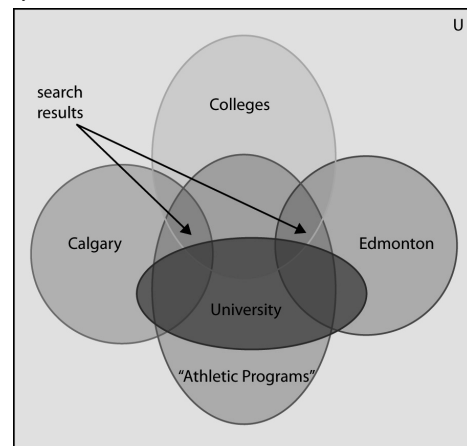
b) He should use "and" to connect the words.

c) He should use "or" to search for one or the other city.

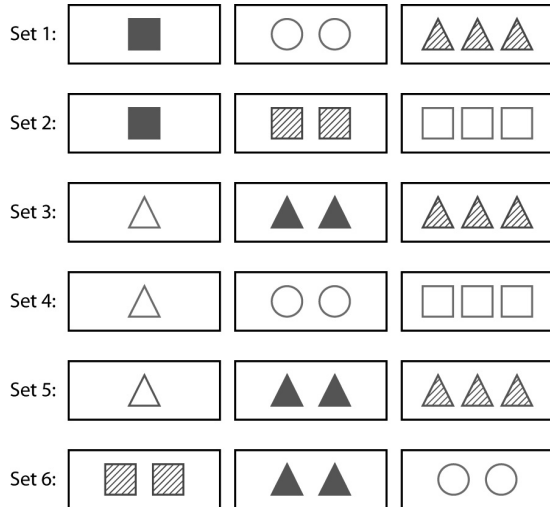
d) e.g., *colleges and (Calgary or Edmonton) and "athletics programs" - university*

e) e.g., about 1500

f)



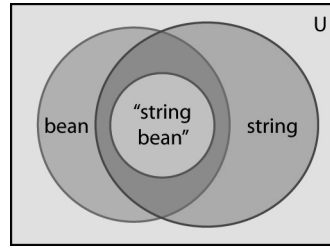
11. Set 1: different numbers, different colours, different shading, different shape
 Set 2: different numbers, different colours, different shading, same shape
 Set 3: different numbers, different colours, different shading, same shape
 Set 4: different numbers, same colour, same shading, different shape
 Set 5: different numbers, same colour, different shading, same shape
 Set 6: same number, different colours, different shading, different shape



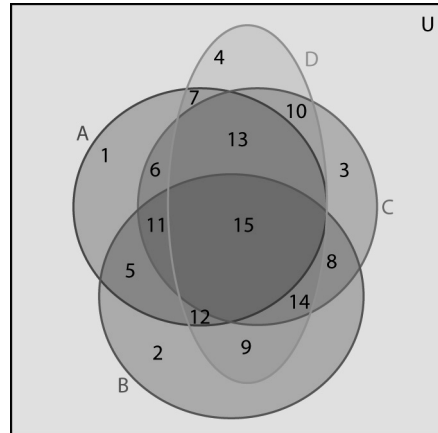
12. a) $n(D)$, the total number of cards in the deck: there are 3 shapes, 3 colours, 3 numbers, and 3 shadings, so in total there are $3 \cdot 3 \cdot 3 \cdot 3$ or 81 cards.
 b) $n(T)$, the total number of triangle cards in the deck: there are 3 colours, 3 numbers, and 3 shadings, so in total there are $3 \cdot 3 \cdot 3$ or 27 triangle cards.
 c) $n(G)$, the total number of green cards in the deck: 3 shapes, 3 numbers, and 3 shadings, so in total, there are $3 \cdot 3 \cdot 3$ or 27 green cards.
 d) $n(S)$, the total number of cards with shading: there are 27 cards with striped shading and 27 cards with solid shading, so there are $27 + 27$ or 54 cards with shading.
 e) $n(T \cup G)$: there are 27 triangle cards and 27 green cards, but 9 triangle cards are also green, so there are $54 - 9$ or 45 cards that have triangles or are green.
 f) $n(G \cap S)$: there are 27 green cards. Since $2/3$ of the cards have either striped shading or solid shading, 18 cards are both green and have shading.

13. a) 36 sites would appear in a search for fishing boats. There are 35 sites that involve boats, 20 of which deal with fishing boats. 21 sites involve fishing, but these sites include the 20 sites that deal with fishing boats.
 b) e.g., Because *fishing* and *boats* will turn up sites that deal with boats and fishing, but not just fishing boats.
 c) 20 of the 21 fishing sites deal with fishing boats, so 1 site would not have boats.

14. e.g., No, they did not get the same results. Elinor got all of James' results, plus others dealing with either string or bean, but not both.



15. a) and b) e.g.,



- c) e.g., $1 = A \setminus (B \cup C \cup D)$
 $2 = B \setminus (A \cup C \cup D)$
 $3 = C \setminus (A \cup B \cup D)$
 $4 = D \setminus (A \cup B \cup C)$
 $5 = (A \cap B) \setminus (C \cup D)$
 $6 = (A \cap C) \setminus (B \cup D)$
 $7 = (A \cap D) \setminus (B \cup C)$
 $8 = (B \cap C) \setminus (A \cup D)$
 $9 = (B \cap D) \setminus (A \cup C)$
 $10 = (C \cap D) \setminus (A \cup B)$
 $11 = (A \cap B \cap C) \setminus D$
 $12 = (A \cap B \cap D) \setminus C$
 $13 = (A \cap C \cap D) \setminus B$
 $14 = (B \cap C \cap D) \setminus A$
 $15 = A \cap B \cap C \cap D$
 16. e.g., Let $B = \{\text{blue}\}$, $Y = \{\text{yellow}\}$, $R = \{\text{red}\}$, and $G = \{\text{green}\}$. There is no area representing $(B \cap R) \setminus (G \cup Y)$ or $(G \cap T) \setminus (B \cup R)$.

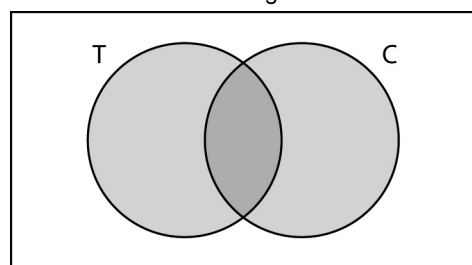
Math in Action, page 194

e.g.,

- I decided to research texting in relation to driving safely.

Search Words	Number of Hits
texting and driving	3 830 000
texting while driving	976 000
“texting while driving”	599 000
“texting while driving in Canada”	8

• I had way too many hits for texting and driving. I figured out that the issue is texting while driving, so I tried that combination. Putting quotes around it netted even fewer results. Since I live in Canada, I was interested in what’s happening here, so I added Canada to my search. Then I tried “texting while driving in Canada”. That really cut down the hits to a manageable number.



Let T represent “texting while driving” sites, and C represent Canada sites. The overlap of the two circles represents the sites that contain both “texting while driving” and Canada.

- The search engine’s Advanced Search feature allows you to exclude any sites that contain certain hits from your search.

Lesson 3.5: Conditional Statements and Their Converse, page 203

- a)** Hypothesis, $p =$ I am swimming in the ocean. Conclusion, $q =$ I am swimming in salt water.
 - b)** Yes, the conditional statement is true, because all oceans contain salt water.
 - c)** Converse: If I am swimming in salt water, then I am swimming in the ocean. The converse is false, because I could be swimming in a salt-water pool, or a salt-water lake.
- a)** Yes, the conditional statement is true. Four is divisible by 2, so any number that is divisible by 4 is also divisible by 2.
 - b)** Converse: If a number is divisible by 2, then it is divisible by 4. The converse is false.
 - c)** e.g., A counterexample of the converse is the number 2, which is divisible by 2, but not 4.
- a)** If a triangle is equilateral, then it has 3 equal sides.
 - b)** If a triangle has 3 equal sides, then it is equilateral.
 - c)** Both statements are true, because the definition of an equilateral triangle is a triangle that has 3 equal sides.
 - d)** Yes, the statement is biconditional, because both the conditional statement and its converse are true.

4. a) If we cannot get what we like, then let us like what we get.

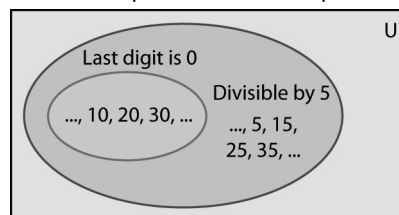
b) Hypothesis: We cannot get what we like.

Conclusion: Let us like what we get.

5. a) The statement is false. A counterexample is the number 25. It is divisible by 5, but it does not end in a 0.

b) If a number ends in a 0, then it is divisible by 5.

c) The converse is true. The Venn diagram shows that all multiples of ten are also multiples of 5, but not all multiples of 5 are multiples of 10.



6. a) The conditional statement is true, because Canada is in North America. The converse is false. Counterexample: You might live in Mexico and still be in North America. The statement is not biconditional.

b) The statement is true, because Ottawa is the capital of Canada. The converse is also true. Biconditional statement: You live in the capital of Canada if and only if you live in Ottawa.

7. Biconditional. e.g.,

$\sqrt{x^2} = x$	x is not negative	$\sqrt{x^2} = x \Rightarrow x$ is not negative
true	true	true
false	false	true
false	true	true
true	false	false

Both the conditional statement and its converse are always true, so the statement is biconditional.

The statement can be written as: $\sqrt{x^2} = x$ if and only if x is non-negative.

8. a) Conditional statement: If a glass is half-empty, then it is half full. This statement is true.

Converse: If a glass is half full, then it is half-empty. The converse is true. The statement is biconditional, because both the conditional statement and its converse are true.

Biconditional statement: A glass is half-empty if and only if it is half full.

b) Conditional statement: If a polygon is a rhombus, then it has equal opposite angles. The statement is true.

Converse: If a polygon has equal opposite angles, then it is a rhombus. The converse is false.

Counterexample: A rectangle has equal opposite angles. The statement is not biconditional.