

Applied Math 40S

NOT FOR HAND-IN

Logical Reasoning Practice Test

Part I: Multiple Choice – Circle the correct answer for each question below. Circle only one answer. There is no penalty for guessing.

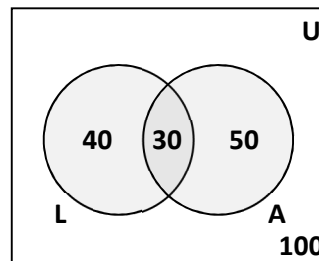
1. Consider the following two sets: $V = \{A, E, I, O, U\}$ and $C = \{\text{all consonants in alphabet}\}$. (Consonants are not vowels – not A, E, I, O or U). Which of the following statements is true?

- a) $V \subset C$
- b) $C \subset V$
- c) V and C are disjoint
- d) $n(V \cap C) = 5$

2. The Venn diagram below represents the number of people in the following three sets:

- $U = \{\text{people who like pie}\}$
- $L = \{\text{people who like lemon pie}\}$
- $A = \{\text{people who like apple pie}\}$.

What is the value of $n(L \cap A)$?



- a) 120
- b) 30
- c) 100
- d) 90

3. Consider the truth table fragment shown. What are the correct values for the missing spaces?

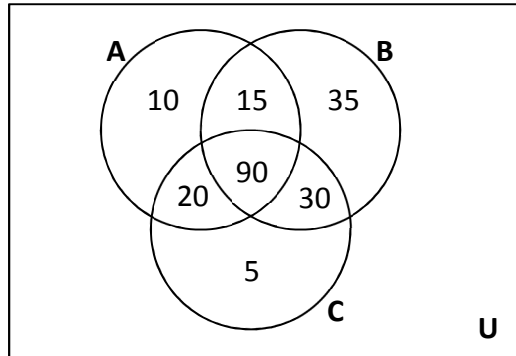
- a) $\sim p = T, \sim p \Leftrightarrow q = T$
- b) $\sim p = T, \sim p \Leftrightarrow q = F$
- c) $\sim p = F, \sim p \Leftrightarrow q = T$
- d) $\sim p = F, \sim p \Leftrightarrow q = F$

p	q	$\sim p$	$\sim p \Leftrightarrow q$
T	F		

4. Gord's book club consists of 8 people who have read 'The Life of Pi', and 12 people who have read 'The Hobbit'. 5 people have read both books. How many people are in Gord's book club?
- a) 15
 - b) 20
 - c) 10
 - d) 25
5. Consider the following conditional statement: "If you are in Winnipeg, then you are in Canada". What is the **inverse** of this conditional statement? (Don't worry if the inverse is true or not.)
- a) "If you are not in Canada, then you are not in Winnipeg."
 - b) "You are in Canada if and only if you are in Winnipeg."
 - c) "If you are in Canada, then you are in Winnipeg."
 - d) "If you are not in Winnipeg, then you are not in Canada."
6. Consider the following conditional statement: "If it is a Monday, then it is a weekday." Which of the following answers is accurate:
- a) The conditional statement is **true** and the converse is also **true** – the statement is biconditional.
 - b) The conditional statement is **true** and the converse is **false**.
 - c) The conditional statement is **false** and the converse is **true**.
 - d) None of the above answers are accurate.

Part II: Numerical Response – Your answers in this section do not need work shown.

7. Consider the following Venn diagram (which has the number of items in each region filled in) and give the requested values.

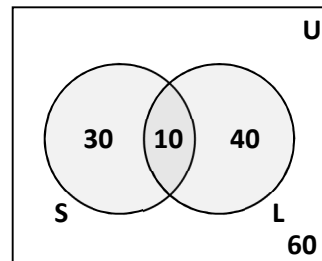


- a) $n(A \cap B \cap C) =$ _____
- b) $n(A \cup B) =$ _____
- c) $n(A \cap B) =$ _____
- d) $n(B \setminus C) =$ _____
- e) $n(B \cup C \setminus A) =$ _____
- f) $n(A \cup B \cup C) =$ _____

8. The following Venn diagram represents the following three sets (the number of people in each region is given in the diagram):

- $U = \{\text{people in a restaurant}\}$
- $S = \{\text{people who ordered steak}\}$
- $L = \{\text{people who ordered lobster}\}$

Give the requested values for this Venn diagram.



- a) How many people ordered both steak and lobster? _____
- b) How many people ordered steak or lobster? _____
- c) How many people ordered steak? _____
- d) How many people ordered only lobster? _____
- e) How many people are in the restaurant? _____
- f) How many people did not order steak or lobster? _____
- g) Are the people who did not order steak or lobster vegetarians? Explain your reasoning.

Part III: Long Answer – Show all work in this section for full marks. (A Venn diagram counts as ‘showing work’). Part marks may be awarded for work shown.

9. Carly, Jason, and Bodie have several videogames in their collections. Their collections have been organized into sets, as shown below:

- $U = \{\text{All videogames}\}$
- $C = \{\text{Far Cry 3, Halo 4, Lego Star Wars}\}$
- $J = \{\text{Far Cry 3, Halo 4, Lego Star Wars, GTA IV}\}$
- $B = \{\text{Skylanders, Kung Fu Panda}\}$

Organize these sets into a Venn diagram. You do **not** have to write each element into its correct region in the diagram. (Make sure to label your circles with the letter that represents the set.)

10. 80 fans of the Winnipeg Jets were asked who their favourite player is. The results were as follows:

- 50 people liked Dustin Byfuglien.
- 40 people liked Toby Enstrom.
- 20 people liked some other player.

a) Model this situation with sets. Identify the universal set, and explain which subsets you will use. Be sure to use proper set notation.

b) Draw a Venn diagram to model this situation. Put the correct numbers of people in the appropriate regions in your diagram. (Make sure every region has a number).

11. 2000 people were asked which of three popular American vacation destinations (New York, Las Vegas, Miami Beach) they had traveled to in the past. The results are as follows:

- 105 have been to New York.
 - 70 have been to Las Vegas only.
 - 30 have been to New York and Las Vegas.
 - 40 have been to Las Vegas and Miami Beach.
 - 25 have been to New York and Miami Beach only.
 - 10 have been to all three destinations.
 - 235 have been to Las Vegas or Miami.
- a) Draw a Venn diagram below to represent this information. Put the appropriate number of people in each region in your diagram.

b) How many people have been to Miami Beach only?

c) What percentage of people have not been to any of the three destinations?

12. Consider the following conditional statement:

“If I am breathing, then I am alive.”

Is the statement **biconditional**? Justify your answer.

13. The statement “If a polygon is a pentagon, then it has 5 sides of equal length” is biconditional. Re-write this statement in biconditional form.

14. Give a counterexample for the following conditional statement:

“If I am eating a McDonald’s Big Mac sandwich, then I am in a McDonald’s restaurant.”

15. Consider the following conditional statement:

“If a number is an integer, then it is also a whole number.”

Verify the truth of this conditional statement below. Then **write** the *converse*, the *inverse* and the *contrapositive* of this statement and verify the truth of each of those as well. For each statement that is false, provide a number that is a counter-example.

Type	Statement	True or False?	Counter-Example
Original Statement	If a number is an integer, then it is also a whole number.		
Converse			
Inverse			
Contrapositive			

16. Fill in the blank spaces in the truth tables shown below with the appropriate values.

a)

p	q	$\neg p$	$\neg q$	$\neg p \wedge \neg q$
T	T			
T	F			
F	T			
F	F			

b)

p	q	p'	$q \Rightarrow p'$
T	T		
T	F		
F	T		
F	F		

c)

p	q	$\neg q$	$p \leftrightarrow \neg q$
T	T		
T	F		
F	T		
F	F		

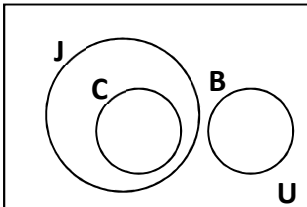
17. SUPER FUN BONUS QUESTION WHICH IS NOT WORTH MARKS ON THIS PRACTICE TEST WHICH IS ALSO NOT WORTH MARKS SO THIS QUESTION IS, LIKE, **DOUBLE** NOT WORTH MARKS AND YOU SHOULD NOT WORRY ABOUT IT BUT JUST HAVE FUN WITH IT BECAUSE WHAT IS LIFE WITHOUT A LITTLE FUN IN IT, AM I RIGHT, OR AM I RIGHT?

p	q	$\sim p$	$\sim q$	$\sim p \cap q$	$(\sim p \cap q) \cup \sim q$
T	T				
T	F				
F	T				
F	F				

Answers

1. c) 2. b) 3. c) 4. a) 5. d) 6. b)
 7. a) 90 b) 200 c) 105 d) 50 e) 70 f) 205
 8. a) 10 b) 80 c) 40 d) 40 e) 140 f) 60
 g) not necessarily – they may have ordered chicken!

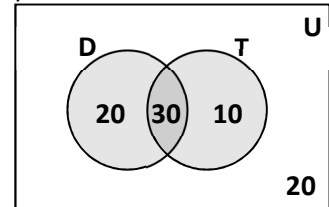
9.



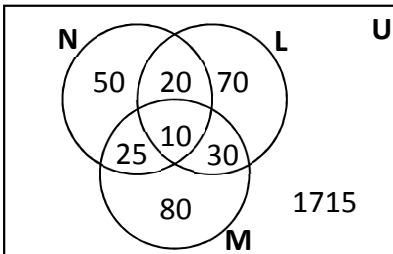
10. a) Possible:

U = {all people surveyed}
 D = {people who liked Dustin Byfuglien}
 T = {people who liked Toby Enstrom}

b)



11. a)



b) 80 people

c) 85.75%

12. Answers can vary, but if original statement is correct and converse is incorrect, then statement is not biconditional.

13. A polygon is a pentagon if and only if it has 5 sides of equal length.

14. You could be eating a Big Mac in the car, at home, etc.

15.

Type	Statement	True or False?	Counter-Example
Original Statement	If a number is an integer, then it is also a whole number.	False	-6
Converse	If a number is a whole number, then it is also an integer.	True	
Inverse	If a number is NOT an integer, then it is NOT a whole number.	True	
Contrapositive	If a number is NOT a whole number, then it is NOT an integer.	False	-6

16. a)

p	q	$\neg p$	$\neg q$	$\neg p \wedge \neg q$
T	T	F	F	F
T	F	F	T	F
F	T	T	F	F
F	F	T	T	T

(#16 continues on back...)

b)

p	q	p'	$q \Rightarrow p'$
T	T	F	F
T	F	F	T
F	T	T	T
F	F	T	T

c)

p	q	$\neg q$	$p \leftrightarrow \neg q$
T	T	F	F
T	F	T	T
F	T	F	T
F	F	T	F

17.

p	q	$\sim p$	$\sim q$	$\sim p \cap q$	$(\sim p \cap q) \cup \sim q$
T	T	F	F	F	F
T	F	F	T	F	T
F	T	T	F	T	T
F	F	T	T	F	T