

Republic of the Philippines  
**SULTAN KUDARAT STATE UNIVERSITY**  
College of Computer Studies  
Isulan Campus, Isulan, Sultan Kudarat

IT 111 – Discrete Mathematics  
**MIDTERM EXAMINATION**  
1<sup>st</sup> Semester SY 2024-2025

Name: \_\_\_\_\_ Contact No: \_\_\_\_\_

**General Instructions:**

- 1. Write all your answers in the provided space.
- 2. Write neatly and legibly using a black or a blue pen.
- 3. You may use the blank spaces in your questionnaire for your computation.

**Test I: Modified True or False (30 pts)**

Instruction: Write **TRUE** if the statement is correct or write **FALSE** if the statement is incorrect in the space provided before the number. If the statement is FALSE, change the underlined word or phrase to make the statement correct. Write the **CORRECT AND COMPLETE** statement in the space provided below each item.

- \_\_\_\_\_ 1. A compound proposition is composed of at least two atomic statements and at least one connective.
- \_\_\_\_\_ 2. The English statement "The ball is white and round, therefore, it rolls." can be written as  $(P \vee Q) \rightarrow R$ .
- \_\_\_\_\_ 3. The De Morgan's Law for Logic states that "the negation of a conjunction is equivalent to the disjunction of the negation of the individual propositions", that is  $\neg(p \wedge q) = \neg p \vee \neg q$ .
- \_\_\_\_\_ 4. In the truth table method, when two propositions have exactly the same or identical columns for all possible combinations of truth-values of the individual propositions, they are said to be not logically equivalent.
- \_\_\_\_\_ 5. The general propositions  $p \leftrightarrow q$  and  $\neg(p \oplus q)$  are not logically equivalent.
- \_\_\_\_\_ 6. The ordered pairs  $(x, y)$  and  $(x, z)$ , are equal, that is,  $(x, y) = (x, z)$ , if and only if  $x = z$ .
- \_\_\_\_\_ 7. If  $S = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$  and  $T = \{5, 6, 7, 8, 9\}$ , then  $S \subset T$ .
- \_\_\_\_\_ 8. If  $S = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$  and  $T = \{5, 6, 7, 8, 9\}$ , then  $\neg T = \{1, 2, 3, 4\}$ .
- \_\_\_\_\_ 9. All functions are relations.
- \_\_\_\_\_ 10. The equation  $y = x + 1$  is a relation but not a function.

**Test II: Multiple Choice (30 pts)**

Instruction: Write the letter corresponding to your best choice of answer. Write clearly in **CAPITAL LETTERS**.

- \_\_\_\_\_ 11. Let  $S$  and  $T$  be sets. Which of the following elements of sets  $S$  and  $T$  is appropriate so that  $S$  is a strict/proper subset of  $T$  ( $S \subset T$ )?

A.  $S = \{\text{real numbers}\}$  and  $T = \{\text{integers}\}$

B.  $S = \{1, 2, 3\}$  and  $T = \{1, 3, 5, 7\}$

C.  $S = \{a, b, c, d, \dots, x, y, x\}$  and  $T = \{a, b, c\}$

D. None of the above.
- \_\_\_\_\_ 12. Let  $A = \{\dots, -30, -20, -10, 0, 10, 20, 30, \dots\}$ ,  $B = \{10, 20, 30, \dots\}$ , and  $C = \{\text{positive integers}\}$  be sets. Which of the following statements is true?

A.  $A \subset B$

B.  $B \subseteq C$

C.  $A \subseteq C$

D.  $B \subset A$
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- \_\_\_\_\_ 13. Which of the following pairs of sets are equal?
- $\{1,2,3\}$  and  $\{1,2,3\}$
  - $\mathbb{N}$  = set of natural/counting numbers and  $\{0,1,2,3, \dots\}$
  - $\mathbb{Z}$  = set of integers and  $\{1,2,3, \dots\}$
  - All of the above.
- \_\_\_\_\_ 14. Which of the following follows the De Morgan's Law of Sets?
- The complement of the union is equal to the union of the complements.
  - The complement of the union is equal to the intersection of the complements.
  - The complement of the intersection is equal to the intersection of the complements.
  - None of the above.
- \_\_\_\_\_ 15. Let  $A = \{c, o, m, p, u, t, e, r\}$  and  $B = \{s, c, i, e, n, c, e\}$ . What is the cardinality of  $A \cap B$ ?
- $|\{c, e\}| = 2$
  - $|\{c, e, c, e\}| = 4$
  - $|\{c, o, m, p, u, t, e, r, s, c, i, e, n, c, e\}| = 15$
  - None of the above.
- \_\_\_\_\_ 16. Which of the following is true about an ordered pair?
- An ordered pair is a collection of unordered objects denoted by  $(a, b)$ .
  - Two ordered pairs  $(a, b)$  and  $(c, d)$  are equal if and only if  $a = c$  and  $b = d$ .
  - $(x, y) = (y, x)$  for any  $x, y \in \mathbb{R} = \{\text{real numbers}\}$
  - None of the above.
- \_\_\_\_\_ 17. Which of the following is true about the Cartesian products of sets?
- The Cartesian product of two sets is a set of ordered pairs.
  - The Cartesian products of two sets  $A$  and  $B$  is written as  $A + B$ .
  - Let  $A$  and  $B$  be sets, the Cartesian products  $A \times B$  and  $B \times A$  are always equal.
  - None of the above.
- \_\_\_\_\_ 18. Let  $A = \{2,4,6\}$  and  $B = \{1,3,5\}$ . What are the elements of  $\mathbb{R}$  such that  $x \in A$  is greater than  $y \in B$ ?
- $\mathbb{R} = \{(2,3), (2,5), (4,5)\}$
  - $\mathbb{R} = \{(2,1), (4,1), (4,3), (6,1), (6,3), (6,5)\}$
  - $\mathbb{R} = \{(2,1), (2,3), (2,5), (4,1), (4,3), (4,5), (6,1), (6,3), (6,5)\}$
  - $\mathbb{R} = \{(1,2), (1,4), (1,6), (3,2), (3,4), (3,6), (5,2), (5,4), (5,6)\}$
- \_\_\_\_\_ 19. Which of the following statements about functions is true?
- The elements of the domain can have one or more pairs with elements of the co-domain.
  - Every element of the domain must have a unique pair with any element of the co-domain.
  - There exists an element in the domain which does not have a pair with any element in the co-domain.
  - The domain and co-domain must always have the same cardinality.
- \_\_\_\_\_ 20. Which of the following is/are true about compound propositions?
- Compound propositions must end with a question mark.
  - Compound propositions are consisted of one or more atomic statements and one or more connectives.
  - Compound propositions can be evaluated as either true or false.
  - Compound propositions are joined by connectives such as conjunction, disjunction, negation, and conditional.
- I only.
  - II and III only
  - II, III, and IV only
  - All of the above

- \_\_\_\_\_ 21. Which of the following symbolic logic represents the statement “I think, therefore, I am.”?
- A.  $p \wedge q$
  - B.  $p \vee q$
  - C.  $p \rightarrow q$
  - D.  $p \leftrightarrow q$

Table 1. Truth Table.

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
$p$	$q$	$\neg p$	$p \wedge q$	$p \vee q$	$p \rightarrow q$	$T$	$F$
T	T	F		F	T	F	T
T	F	F		F	F	F	T
F	T	T		F	T	F	T
F	F	T		T	F	F	T

Note:  $T$  = **Tautology**, a proposition that is always true, and  $F$  = **Fallacy**, a proposition that is always false.

- \_\_\_\_\_ 22. In Table 1, which of the following is the correct entry in Column 4?

A.	B.	C.	D.
$p \wedge q$	$p \wedge q$	$p \wedge q$	$p \wedge q$
T	F	T	T
F	F	T	F
F	F	T	T
F	T	F	F

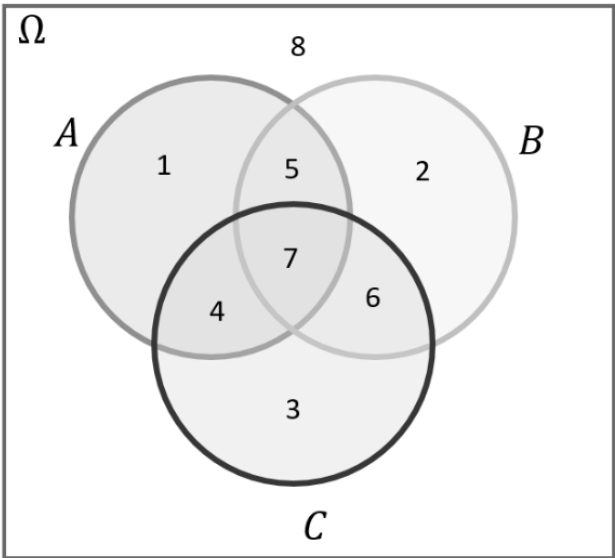
- \_\_\_\_\_ 23. In Table 1, which column(s) contain incorrect entries
- A. Column 3
  - B. Columns 5 and 7
  - C. Columns 5, 6, and 7
  - D. Columns 5, 7, and 8
- \_\_\_\_\_ 24. Which of the following statements is true about logical equivalence?
- A. Propositions  $P$  and  $Q$  are logically equivalent if and only if the truth conditions of  $P$  are exactly the same as the truth conditions of  $Q$ .
  - B. Propositions  $P$  and  $Q$  are logically equivalent if the truth conditions of  $P$  are exactly the same as the truth conditions of  $Q$ .
  - C. Propositions  $P$  and  $Q$  are logically equivalent if and only if the truth conditions of  $P$  are exactly the opposite as the truth conditions of  $Q$ .
  - D. None of the above.
- \_\_\_\_\_ 25. Which of the following propositions is logically equivalent to  $p \wedge (q \vee r)$ ?
- A.  $T$
  - B.  $(p \vee q) \wedge (p \vee r)$
  - C.  $p \wedge q) \vee (p \wedge q)$
  - D. None of the above

**Test III: Problem Solving:** (30 pts)

26. Let A, B, and C be three sets. Illustrate the following using a Venn Diagram by selecting the number corresponding to the area that is included in the following sets: (2 pts each)

Example:  $A \cap B$  : {5,7}

- a.  $B - C$  :
- b.  $B - (A \cap C)$  :
- c.  $B - (A \cup C)$  :
- d.  $A \cap B \cap C$  :
- e.  $\Omega - (B \cap C)$  :



27. What is a set? Explain in your own words and give examples to illustrate. (5 pts)

28. What is a function? Explain in your own words and give examples to illustrate. (5 pts)

29. What is a propositional logic? Explain in your own words and give examples to illustrate. (5 pts)

30. Using the truth table, show that the propositions  $P \vee Q$  and  $Q \vee P$  are equivalent. (15 pts).

\*\*\*\*\*END OF EXAM\*\*\*\*\*

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Course Number/Description: IT 111 – Discrete Mathematics      Term: MIDTERM      Semester: 1<sup>st</sup> Semester – SY 2024-2025  
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**TABLE OF SPECIFICATIONS**

Topics/Content	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	No. of Items	Total Score
Sets and Set Operations	2 (27)	8 (7, 8, 12)	10 (26 a-e)	6 (11, 14, 16)	3 (27)	4 (13, 15)	9	33
Relations and Functions	2 (28)	5 (6, 20)	2 (19)	5 (10)	5 (18, 28)	5 (9, 17)	8	22
Propositional Logic	5 (1, 29)	3 (5)	3 (2)	4 (21, 22)	3 (29)		6	18
Truth Table and Logical Equivalence	3 (4)		9 (23, 25, 30)	8 (3, 30)	2 (24)	5 (30)	6	27
<b>Total Score</b>	<b>12</b>	<b>16</b>	<b>24</b>	<b>23</b>	<b>13</b>	<b>14</b>	29	<b>100</b>

Summary:

Reviewed by:

	Item Nos.	No. of Points
Test I: Modified True or False	1 – 10	30
Test II: MCQ	11– 25	30
Test III: Essay	26 – 30	40
Total Score		100

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