

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

CS 122 – Discrete Structures I  
**MIDTERM EXAMINATION**  
2<sup>nd</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** (45 pts, 3 pts each)

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. "Get out." is an example of a proposition.
- \_\_\_\_\_ 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".
- \_\_\_\_\_ 4. In the truth table method, when two propositions have exactly the same or identical end 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 $\vee$ T and p $\wedge$ T are 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 S-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** (20 pts, 2 pts each)

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

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 ( $S \subseteq T$ )?
  - A.  $S = \mathbb{R}$  and  $T = \mathbb{Z}$
  - B.  $S = \{1,2,3\}$  and  $T = \{1,3,5,7\}$
  - C.  $S = \{a, b, c, d, \dots, x, y, z\}$  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  $C = \mathbb{Z}^+$  be sets. Which of the following statements is true?
- $A \subset B$
  - $B \subseteq C$
  - $A \subseteq C$
  - $C \subset A$
13. Let  $X = \{x|x \in \mathbb{Z}\}$ ,  $Y = \{y|y \in \mathbb{R}\}$ , and  $Z = \{z|z \in \mathbb{Z}^+\}$  be sets. Which of the following statements is true?
- $X \subseteq Z$
  - $X \subset Y$
  - $Y \subset X$
  - $Y \subseteq Z$
14. Which of the following pairs of sets are equal?
- $\{1,2,3\}$  and  $\{1^2, 2^2, 3^2\}$
  - $\mathbb{N}$  =set of natural/counting numbers and  $\{1,2,3, \dots\}$
  - $\mathbb{Z}$  =set of integers and  $\{0, 1, 2, 3, \dots\}$
  - None of the above
15. Which of the following follows the De Morgan's Law?
- 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.
16. 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
17. 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  $(a,)$  and  $(c,)$  are equal if and only if  $a=c$  and  $b=d$ .
  - $(x, y) = (y, x)$  for any  $x, y \in \mathbb{R}$
  - None of the above
18. Which of the following is true about the Cartesian products?
- 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.
19. Let  $A = \{x|x \in \mathbb{R}\}$  be the domain and  $B = \{y|y \in \mathbb{R}\}$  be the co-domain. Which of the following relations is a function?
- $y = x + 1$
  - $y = \sqrt{x}$
  - $y^2 = 1 - x^2$
  - $y = \frac{1}{x}$
20. Let  $A = \{2,4,6\}$  and  $B = \{1,3,5\}$ . What are the elements of  $R$  such that  $x \in A$  is greater than  $y \in B$ ?
- $R = \{(2,3), (2,5), (4,5)\}$
  - $R = \{(2,1), (4,1), (4,3), (6,1), (6,3), (6,5)\}$
  - $R = \{(2,1), (2,3), (2,5), (4,1), (4,3), (4,5), (6,1), (6,3), (6,5)\}$
  - $R = \{(1,2), (1,4), (1,6), (3,2), (3,4), (3,6), (5,2), (5,4), (5,6)\}$
21. 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.
22. 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.
- I and II
  - II and III
  - II only
  - I, II, and III

23. 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.  $p \leftrightarrow q$

24. Which of the following conditions is correct?

- A.  $p \wedge q = \max(p, q)$
- B.  $p \vee q = \min(p, q)$
- C.  $p \rightarrow q = 1$  if  $p \leq q$
- D.  $p \leftrightarrow q = 1$  if  $p \neq q$

**Table 1. Truth Table**

1	2	3	4	5	6	7	8	9	10
$p$	$q$	$\neg p$	$p \wedge q$	$p \vee q$	$p \rightarrow q$	$p \leftrightarrow q$	$p \oplus q$	$T$	$F$
1	1	0		0	1	1	0	0	1
1	0	0		0	0	0	1	0	1
0	1	1		0	1	0	1	0	1
0	0	1		1	1	1	0	0	1

25. From Table 1, which of the following completes column 4?

$p \wedge q$
1
0
0
0

$p \wedge q$
0
0
0
1

$p \wedge q$
1
1
1
0

$p \wedge q$
0
1
0
1

26. In Table 1, which column(s) contain incorrect entries?

- A. Column 7
- B. Columns 9 and 10
- C. Columns 5, 9, and 10
- D. Columns 7, 8, 9, and 10

27. Which of the following statements is true about logical equivalence?

- A. Formulas  $p$  and  $q$  are logically equivalent if and only if the truth conditions of  $p$  are exactly the same as the truth conditions of  $p$ .
- B. Formulas  $p$  and  $q$  are logically equivalent if the truth conditions of  $p$  are exactly the same as the truth conditions of  $p$ .
- C. Formulas  $p$  and  $q$  are logically equivalent if and only if the truth conditions of  $p$  are exactly the opposite as the truth conditions of  $p$ .
- D. None of the above

28. 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.  $(p \wedge q) \vee (p \wedge r)$
- D. None of the above

29. Which of the following statements is/are true?

- I. According to the De Morgan's law, the negation of the conjunction is logically equivalent to the disjunction of the individual negations.
  - II. According to the commutative law, order does not matter.
  - III. According to the associative law, grouping matters.
- A. I and II
  - B. II and III
  - C. I and III
  - D. I, II, and III

30. Which of the following propositions is a tautology?

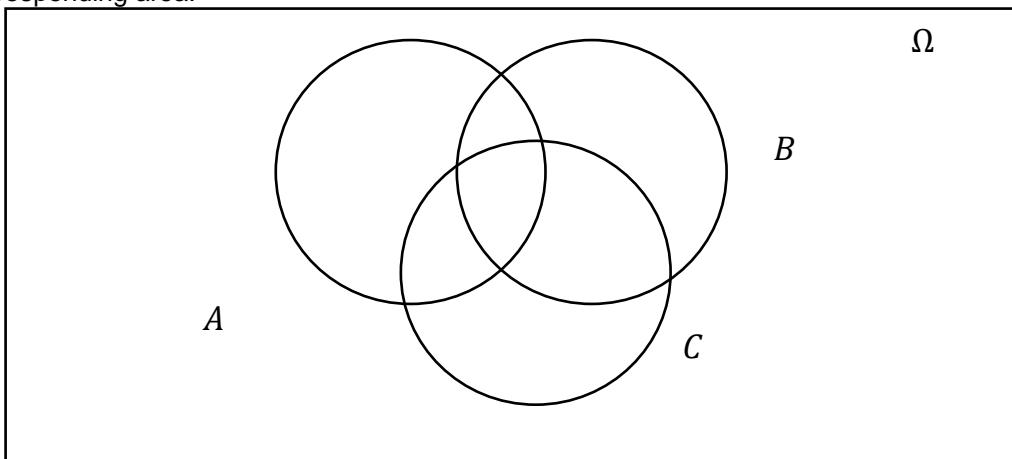
- A.  $p \wedge q$
- B.  $p \wedge \neg p$
- C.  $p \vee q$
- D.  $p \vee \neg p$

**Test IV: Problem Solving** (4 items, 5 pts each)

Instruction: Answer the following problems. Write your answer neatly and legibly in the provided answer sheet.  
Avoid erasures.

31. Let  $A$ ,  $B$ , and  $C$  be two sets. Illustrate the following using a Venn Diagram by shading and labelling (use arrows if area is too small) the corresponding area.

- a.  $(A \cup B \cup C)^c$
- b.  $(A \cap B \cap C)$
- c.  $(A \Delta B \Delta C)$



32. Define your own universal set  $\Omega$  and two sets  $A$  and  $B$  with cardinality  $|\Omega| = 10$ ,  $|A| = 3$ , and  $|B| = 6$ . Determine the elements and the cardinality of the following:

Example (Do not use this example anymore.):  $\Omega = \{1,2,3,4,5, a, b, c, d\}$ ,  $A = \{1,3,5, a\}$ ,  $B = \{3, a, c\}$

- a. set complement  $A^c$
- b. set union ( $A \cup B$ )
- c. set intersection ( $A \cap B$ )

33. Let  $A = \{a, b, c\}$ ,  $B = \{1,2,3\}$ , and  $C = \{<, >\}$ , what are the elements of the following sets?

- a.  $\mathcal{P}(A \cup C)$
- b.  $B \times C$

34. Using the truth table provided below, is  $(p \vee (q \rightarrow r)) \equiv ((p \vee q) \rightarrow (p \vee r))$ ?

Yes  
 No

$p$	$q$	$r$					
1	1	1					
1	1	0					
1	0	1					
1	0	0					
0	1	1					
0	1	0					
0	0	1					
0	0	0					

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Course Number/Description: CS 122 – Discrete Structures I

Term: MIDTERM

Semester: 2<sup>nd</sup> Semester – SY 2024-2025

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Date Submitted: \_\_\_\_\_

**TABLE OF SPECIFICATIONS**

Topics/Content	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	No. of Items	Total Score
Sets and Set Operations	<b>5</b> (28)	<b>6</b> (8, 9)	<b>10</b> (27a-e)	<b>6</b> (12, 14, 16)	<b>5</b> (28)	<b>4</b> (13, 15)	9	<b>36</b>
Relations and Functions	<b>5</b> (29)	<b>5</b> (7, 20)		<b>5</b> (11, 19)	<b>7</b> (18, 29)	<b>5</b> (10, 17)	8	<b>27</b>
Propositional Logic	<b>8</b> (2, 30)	<b>3</b> (6)	<b>3</b> (3)	<b>4</b> (21, 22)	<b>5</b> (30)		6	<b>23</b>
Truth Table and Logical Equivalence	<b>3</b> (5)		<b>4</b> (23, 25)	<b>3</b> (4)	<b>2</b> (24)	<b>2</b> (25)	6	<b>14</b>
<b>Total Score</b>	<b>21</b>	<b>14</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>11</b>	29	<b>100</b>

Summary:

Prepared by:

Reviewed by:

Approved by:

	Item Nos.	No. of Points
Test I: Modified True or False	2 – 11	30
Test II: MCQ	12 – 27	40
Test III: Essay	28 – 30	30
<b>Total Score</b>		<b>100</b>

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