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Reg. No. :

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B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2021.

First Semester

Computer Science / Software Engineering — Allied

DISCRETE MATHEMATICS

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. A relation R on a set A is _____ if whenever aRb and bRa then $a=b$.
 - (a) Reflexive
 - (b) Symmetric
 - (c) Antisymmetric
 - (d) Transitive

2. The relation $R=\{(1,2),(2,1),(2,3)\}$ on $A=\{1,2,3\}$ having the property.
- (a) R is both symmetric and antisymmetric
 - (b) R is neither symmetric nor antisymmetric
 - (c) R is transitive but RVR^{-1} is not transitive
 - (d) None of the above
3. The function from each element of a set to itself is called the _____.
- (a) identity function
 - (b) surjective function
 - (c) injective function
 - (d) None of the above
4. $INT(x)$ means
- (a) absolute value of x
 - (b) Modular Arithmetic
 - (c) integer value of x
 - (d) None of the above
5. $p \wedge q \equiv q \wedge p$ is _____ law.
- (a) Idem potent
 - (b) Associative
 - (c) Commutative
 - (d) None of the above.
6. Write the symbolic form of "It is not true that Erik reads Newsweek but not Time".
- (a) $\sim (p \wedge \sim q)$
 - (b) $\sim (p \vee \sim q)$
 - (c) $p \wedge \sim q$
 - (d) $\sim p \wedge \sim q$

7. Any $m \times n$ matrix that only one column is called a _____ matrix.
- (a) row (b) column
(c) scalar (d) unit
8. Inverse matrix exists only when the given matrix is _____.
- (a) singular (b) non singular
(c) scalar (d) none of the above
9. The path that begins and ends at the same vertex is called _____.
- (a) walk (b) circuit
(c) Bridge (d) None of the above
10. How many vertices do the graph have 16 edges and all vertices of degree 2?
- (a) 16 (b) 8
(c) 32 (d) 4

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Let $A = \{1,2,3,4\}$, $B = \{a,b,c,d\}$, $C = \{x,y,z\}$ and the relations $R = \{(1,a),(2,d),(3,a),(3,b),(3,d)\}$ and $S = \{(b,x),(b,z),(c,y),(d,z)\}$. Write the matrix representation of M_R, M_S and $M_{R \circ S}$.

Or

- (b) Explain the properties of relation.

12. (a) Define one-to-one and onto function give examples.

Or

- (b) Let $f: R \rightarrow R$, $g: R \rightarrow R$ be defined by
 $f(x) = x + 1$, $g(x) = 2x^2 + 3$, then find
 $g \circ f, f \circ g$.

13. (a) Write a short note on basic logical connectives.

Or

- (b) Explain conditional and biconditional statements.

14. (a) If $A = \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix}$ then find $2A^2 - 3A + 5$ and A^3

Or

- (b) Find x, y, z, t when
$$3 \begin{bmatrix} x & y \\ z & t \end{bmatrix} = \begin{bmatrix} x & 6 \\ -1 & 2t \end{bmatrix} + \begin{bmatrix} 4 & x+y \\ z+t & 3 \end{bmatrix}$$

15. (a) Define regular graph and Bipartite graph.

Or

- (b) P.T. the number of odd degree vertices in a graph is always even.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b)

Each answer should not exceed 600 words.

16. (a) Let $A = \{1, 2, \dots, 7\}$ and $R = \{(x, y) : x - y \text{ is divisible by } 3\}$. Show that R is an equivalence relation.

Or

- (b) If R and S are relations from A to B prove that

(i) $R^{-1} \leq S^{-1}$ when $R \leq S$

(ii) $(R \cap S)^{-1} = R^{-1} \cap S^{-1}$

(iii) $(R \cup S)^{-1} = R^{-1} \cup S^{-1}$

17. (a) Write in details of types of functions.

Or

- (b) Let x and y be two non empty sets and let $f : x \rightarrow y$ is an into mapping and also $A \leq X$, $B \leq X$ then prove that

(i) $f(A \cap B) \leq f(A) \cap f(B)$ and

(ii) $f^{-1}(A \cap B) = f^{-1}(A) \cap f^{-1}(B)$

18. (a) Construct the truth table for the statement.
 $(p \Rightarrow (q \Rightarrow r)) \Rightarrow ((p \Rightarrow q) \Rightarrow (p \Rightarrow r))$.

Or

(b) Establish the validity of the argument

$$p \Rightarrow r$$

$$\sim p \Rightarrow q$$

$$\underline{q \Rightarrow s}$$

$$\therefore \sim r \Rightarrow s$$

19. (a) Solve the system $x + 2y + z = 3$,
 $2x + 5y - z = -4$, $3x - 2y - z = 5$.

Or

- (b) Find the inverse of $A = \begin{bmatrix} 1 & 0 & 2 \\ 2 & -1 & 3 \\ 4 & 1 & 8 \end{bmatrix}$

20. (a) Draw a diagram for the graph $G(V, E)$
 $V = \{v_1, v_2, v_3, v_4, v_5, v_6\}$ and $E = \{(v_1, v_6), (v_1, v_4),$
 $(v_3, v_4), (v_3, v_4)(v_3, v_5), (v_4, v_4), (v_6, v_6)\}$ and also
find the degree of all the vertices.

Or

- (b) Explain the Adjacency matrix and incidence matrix of a graph and give an example.
