(8 pages)

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Code No. : 8376 **Sub. Code : WCAM 11/ VCAC 11**

M.C.A. (CBCS) DEGREE EXAMINATION, NOVEMBER 2024.

First Semester

Master of Computer Application — Core

DISCRETE MATHEMATICS

(For those who joined in July 2023 onwards)

Time : Three hours Maximum : 75 marks

PART A — (15 × 1 = 15 marks)

Answer ALL questions.

Choose the correct answer :

1. Which of the following is/are the type(s) of relation?

   (a) Reflexive relation (b) Irreflexive relation

   (c) Symmetric relation (d) All of the above

2. If for every $(a,b) \in R$, (b,a) does not belong to R, then R is an/the ———— relation.

   (a) Symmetric (b) Antisymmetric

   (c) Asymmetric (d) None

3. Set A is called the ———— of a function, and set B is called the co-domain?

   (a) Domain (b) Co-domain

   (c) Both (a) and (b) (d) None of the above

4. $(P \vee Q) \wedge (P \to R) \wedge (Q \to R)$ is equivalent to

   (a) P (b) Q

   (c) R (d) T

5. Which of the following well-formed formula(s) are valid?

   (a) $((P \to Q) \wedge (Q \to R)) \to (P \to R)$

   (b) $(P \to Q) \to (\neg P \to \neg Q)$

   (c) $(P \vee (\neg P \vee \neg Q)) \to P$

   (d) $((P \to R) \vee (Q \to R)) \to (P \vee Q\} \to R)$

6. Consider the statements P : mark is rich, and Q : mark if happy. Then they symbolic form of the statement "Mark is poor but happy" is ————

   (a) $P \wedge Q$ (b) $\neg P \wedge Q$

   (c) $\neg P \vee Q$ (d) $P \vee Q$

7. The solution to the recurrence relation $a = a + 2n$, with initial term $a = 2$ are ————

(a) $4n + 7$ (b) $2(1 + n)$

(c) $3n$ (d) $5 * (n + 1)/2$

8. The process of arranging n objects in a particular order is known as ———— of objects?

(a) Permutation (b) Combination

(c) Both (a) and (b) (d) None of the above

9. $P(n,r)$ means -?

(a) $n!/r!$ (b) $n!/(n!-r!)$

(c) $n!/(n-r)!$ (d) $r!/n!$

10. A matrix having one row and many columns is known as?

(a) Row matrix

(b) Column matrix

(c) Diagonal matrix

(d) None of the mentioned

11. For matrix A if $AA = I, I$ is identity matrix then A is?

(a) orthogonal matrix

(b) nilpotent matrix

(c) idempotent matrix

(d) none of the mentioned

12. Which of the following property of matrix multiplication is correct?

(a) Multiplication is not commutative in general

(b) Multiplication is associative

(c) Multiplication is distributive over addition

(d) All of the mentioned

13. Vertex degrees are calculated based on the number of ———— that are incident on the vertex.

(a) Points (b) Edges

(c) Vertex (d) Point

14. Vertex degrees are represented by ————?

(a) $v(d)$ (b) v

(c) d (d) $d(v)$

15. ———— are paths with the same vertex at both ends?

(a) Circuit paths (b) Closed paths

(c) Both (a) and (b) (d) None of the above

PART B — ($5 \times 4 = 20$ marks)

Answer ALL questions, choosing either (a) or (b).
Each answer should not exceed 250 words.

16. (a) Let $A = \{1,2,3,4\}$, $B = \{p,q,r,5\}$, and $R = \{(1,p),(1,q),(1,r),(2,q),(2,r),(2,i)\}$. Find MR.

Or

(b) Let $f : R \to R$ be defined by $f(x) = x + 1$ and $g : R \to R$ be define as $g(x) = 2x^2 + 3$. Find *fog* and *gof*. If *fog* = *gof* ?

17. (a) Construct the truth table of $p \wedge (q \vee r)$.

Or

(b) Verify that the proposition $p \vee \sim (p \wedge q)$ is a tautology.

18. (a) How many numbers are there between 99 and 1000, having at least one of their digits 7?

Or

(b) Determine the number of 5 card combinations out of a deck of 52 cards, if there is exactly one ace in each combination.

19. (a) The matrix is given by, $A = \begin{bmatrix} 4 & -3 & 5 \\ 1 & 0 & 3 \\ -1 & 5 & 2 \end{bmatrix}$ find $|A|$.

Or

(b) Explain operations on matrices.

20. (a) Prove that, the sum of degrees of the vertices of G is always even.

Or

(b) Explain incidence matrix representation of graph.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b)
Each answer should not exceed 600 words.

21. (a) Let Z denote the set of integers and the relation R in Z be defined by aRb iff $a - b$ is an even integer. Then show that R is an equivalence relation.

Or

(b) Explain classifications of function.

22. (a) State and prove De-Morgan's law.

Or

(b) Find the conjunctive normal form for the formula $(p \wedge q) \vee (p \wedge r)$.

23. (a) Solve the recurrence relation $a_n = a_{n-1} - n$ with the initial term $a_0 = 4$.

Or

(b) In a small village, there are 87 families, of which 52 families have at most 2 children. In a rural development programme 20 families are to be chosen for assistance, of which at least 18 families must have at most 2 children. In how many ways can the choice be made?

24. (a) Explain any six types of matrices with examples.

Or

(b) Find the inverse of the matrix

$$\begin{pmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{pmatrix}$$

25. (a) Explain adjacency matrix representation of graph with example.

Or

(b) Write notes on :

(i) Connected graph

(ii) Hyper cube graph.

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