(7 pages)

Reg. No. : ....

Code No.: 8076   Sub. Code: WCAM 11

M.C.A (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023

First Semester

Computer Applications – 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. When $(a,b) \in R$ and $(b,c) \in R \Leftrightarrow (a,c) \in R$ on set A, it is said that R is ————
    (a) Transitive   (b) Identity
    (c) Void   (d) Universal

2. When $(a,b) \in R$ and $(b,a) \in R$ then ————, a relation R is antisymmetric
    (a) $a = b$ (b) $a \neq b$
    (c) $a * b$ (d) $a - b$

3. Whenever f is a function from P to Q, ———— is referred to as it Co-domain?
    (a) P (b) Q
    (c) f (d) None

4. $P \rightarrow (Q \rightarrow R)$ is equivalent to
    (a) $(P \wedge Q) \rightarrow R$ (b) $(P \vee Q) \rightarrow R$
    (c) $(P \vee Q) \rightarrow \neg R$ (d) None of these

5. A statement formula is an expression which is a string consisting of ————
    (a) variables
    (b) parenthesis
    (c) connective symbols
    (d) all of above

6. If truth values of statement P is true and Q is false, then the truth value of $P \wedge Q$ (conjunction of P and Q) is ————
    (a) T (b) F
    (c) T or F (d) T and F

7. What is the solution to the recurrence relation $a = 5a + 6a$?
    (a) $2n$ (b) $6n$
    (c) $(3/2)n$ (d) $n! * 3$

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8. The order of the objects in a ———— does not matter, since it may contain some or all of the objects from a given set?
    (a) Permutation   (b) Combination
    (c) Binomial   (d) Boolean

9. $^5P_2$ is ————
    (a) 5   (b) 10
    (c) 20   (d) 120

10. A matrix having many rows and one column is known as ?
    (a) Row matrix
    (b) Column matrix
    (c) Diagonal matrix
    (d) None of the mentioned

11. The determinant of identity matrix is?
    (a) 1
    (b) 0
    (c) Depends on the matrix
    (d) None of the mentioned

12. Let A be a nilpotent matrix of order n then?
    (a) $A = O$
    (b) $nA = O$
    (c) $A = nI$, I is identity matrix
    (d) None of the mentioned

13. Self – loops are counted ————?
    (a) Once
    (b) Twice
    (c) Thrice
    (d) Multiple times

14. Pendant vertex is a vertex with degree ————?
    (a) Zero   (b) One
    (c) Two   (d) Three

15. Number of edges incident with the vertex V is called?
    (a) Degree of a Graph
    (b) Handshaking Lemma
    (c) Degree of a Vertex
    (d) None of the above

PART B — (5 × 4 = 20 marks)

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

16. (a) Draw the directed graph or digraph of the relation
    $R = \{(1,2),(1,3),(2,2),(2,4),(3,2),(3,4),(4,1),(4,3)\}$
    on the set $A = \{1,2,3,4\}$

Or

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[P.T.O.]

(b) Let $A = \{1,2,3,4\}$ and $B = \{3,4,5,6\}$

Find the elements of each relation R stated below. Also, find the domain and range of R.

(i) aRb if and only if $a < b$

(ii) aRb if an only if a and b are both odd numbers

17. (a) Construct the truth table for $(p \to q) \leftrightarrow (\sim p \lor q)$

Or

(b) Construct the truth table for $(p \to q) \leftrightarrow (q \to p)$

18. (a) Find the number of permutations of the letters of the word ALLAHABAD.

Or

(b) Find the sum of all the 4 digit numbers that can be formed with the digits 3,4,5 and 6.

19. (a) Find the determinant of the Matrix $A = \begin{bmatrix} 2 & 3 & 1 \\ 6 & 5 & 2 \\ 1 & 4 & 7 \end{bmatrix}$

Or

(b) Explain Cayley-Hamilton Theorem.

20. (a) Prove that, total number of odd-degree vertices is even in a graph.

Or

(b) Write notes on Bipartite Graph with example.

PART C — (5 × 8 = 40 marks)

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

21. (a) Explain Classification of Relation.

Or

(b) Let Z^* be the set of all non-zero integers and R be the relation of Z^* such that $(a,b) \in R$ if a is the factor of b i.e., a/b. Investigate R for reflexive, symmetric, anti-symmetric or transitive.

22. (a) Show that $p \land (q \lor r)$ is equivalent to $(p \land q) \lor (p \land r)$

Or

(b) Find the Principal Disjunctive Normal Form for the formula $(p \land q) \lor (p \land r)$.

23. (a) A group consists of four girls and seven boys. In how many ways can a team of five members be selected if the team has

(i) no girls

(ii) at least one boy and one girl

(iii) at least three girls

Or

(b) How many numbers greater than 1000000 can be formed using the digits 1, 2, 0, 2, 4, 2, 4?

24. (a) Prove that $A^3 - 4A^2 - 3A + 11I = 0$ where A is given by $A = \begin{pmatrix} 1 & 3 & 2 \\ 2 & 0 & -1 \\ 1 & 2 & 3 \end{pmatrix}$ And I is the unit matrix of order 3.

Or

(b) Find the adjoint of the matrix $\begin{pmatrix} 1 & 2 & 3 \\ 2 & -4 & 5 \\ 6 & 1 & 0 \end{pmatrix}$

25. (a) Explain in detail about Hamiltonian Circuits and path.

Or

(b) Write notes on

(i) Complete Graph

(ii) Planar Graph

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