

Code No. : 20675 E Sub. Code : EECA 11

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

First Semester

Computer Application

Elective — DISCRETE MATHEMATICS

(For those who joined in July 2023 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

- A binary relation on a set A is a subset of
 - Set A
 - Set $A \times \text{Set } A$
 - Set $B - \text{Set } B$
 - Set $A \cup \text{Set } A$
- A relation represented by "A set of ordered pairs where each element is related to itself" is represented in
 - Symmetric relation
 - Reflexive relation
 - Transitive relation
 - Antisymmetric relation

- The transpose of a matrix is obtained by
 - Changing all elements to ones
 - Changing all elements to zeros
 - Interchanging its row and columns
 - Negating all elements
- What is the determinant of a 2×2 matrix with elements a, b, c and d ?
 - $ad - bc$
 - $ac - bd$
 - $a + b + c + d$
 - $(a + b)(c + d)$
- A collection of vertices and edges is known as a
 - Circuit
 - Tree
 - Graph
 - Cycle
- Which representation of a graph is suitable for dense graphs with many edges?
 - List representation
 - Adjacency matrix representation
 - Incidence matrix representation
 - Edge list representation

- The composition of two functions is
 - Commutative
 - Associative
 - Distributive
 - None of the above
- When multiplying two functions, $f(x)$ and $g(x)$, the result is
 - $f(x) * g(x)$
 - $f(x) + g(x)$
 - $f(x) - g(x)$
 - $f(x)/g(x)$
- Which of the following is a binary logical operator?
 - \neg (Negation)
 - \wedge (Conjunction)
 - \vee (Disjunction)
 - \rightarrow (Implication)
- Two propositions are said to be logically equivalent if
 - They are identical in terms of syntax
 - They have the same truth values for all possible combinations of truth values of their atomic propositions
 - They have the same atomic propositions
 - They are both tautologies

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

- (a) If $A = \{a, b, c\}$ and $M_R = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$, find the relation R defined on A .
Or
(b) Find the Composition of the Relations.
 $R_1 = \{(1, 2), (1, 6), (2, 4), (3, 4), (3, 6), (3, 8)\}$ and
 $R_2 = \{(2, x), (4, y), (4, z), (6, z), (8, x)\}$
- (a) Examine the function $f(x) = x^2$ from the set of integers to the set of integers for one to one.
Or
(b) Let $A = \{1, 2, 3, 4\}$, $B = \{a, b, c\}$ and $f = \{(1, a), (2, a), (3, b)\}$. Check whether f is a function or not?
- (a) Find the negation of the following statements :
 - Kolkata is in India
 - $4 + 4 = 9$.
 Or
(b) Construct truth tables for the propositions.
 $\sim (p \vee q) \vee (\sim p \wedge \sim q)$

14. (a) Show that $\begin{pmatrix} \cos\theta & 0 & \sin\theta \\ 0 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{pmatrix}$ is orthogonal.

Determine the value of $|A|$.

Or

- (b) Show that the matrix $A = \begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$ satisfies the equation $A^2 - 4A + I = 0$.
15. (a) Prove that, In a graph, total number of odd-degree vertices is even.

Or

- (b) Show that the degree of a vertex of a simple graph G on n vertices cannot exceed $n-1$.

PART C — ($5 \times 8 = 40$ marks)

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

Each answer should not exceed 600 words.

16. (a) Let $A = \{1, 2, 3\}$, $B = \{a, b\}$ and $R = \{(1, a), (2, b), (3, a)\}$. Determine M_R in tabular form and in matrix forms.

Or

- (b) Explain the classification of relations with example.

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17. (a) Let $f: R \rightarrow R$ be defined by $f(x) = x+1$ and $g: R \rightarrow R$ be defined as $g(x) = 2x^2 + 3$. Find $f \circ g$ and $g \circ f$. Is $f \circ g = g \circ f$?

Or

- (b) Let $f: R \rightarrow R$ be defined by $f(x) = 3x - 4$. Find a formula for f^{-1} . Solution :

18. (a) Show that $p \rightarrow (q \rightarrow r) \Leftrightarrow p \rightarrow (\sim q \vee r) \Leftrightarrow (\sim p \wedge q) \vee r$.

Or

- (b) Write a brief note on disjunctive and conjunctive normal forms.

19. (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) Show that $A = \begin{pmatrix} -5 & -8 & 0 \\ 3 & 5 & 0 \\ 1 & 2 & -1 \end{pmatrix}$ is involutory.

20. (a) Explain the operations on graphs.

Or

- (b) Show that maximum number of edges in a simple undirected graph with ' n ' vertices is $n(n-1)/2$.

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