14960

BRAINWARE UNIVERSITY

Term End Examination 2025-2026
Programme – M.Sc.(MATH)-2024
Course Name – Discrete Structures
Course Code - MSCME302D
(Semester III)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) If ${}^{2n}C_3 : {}^{n}C_2 = 44:33$ then determine the value of n

a) 6
b) 5
c) 2
d) 7

(ii) Calculate the number of numbers which are chosen from 1 to 7 so that two of them will add up to 8.

a) 3
b) 4
c) 5
d) 9

(iii) Write the first step in a proof by induction

a) Inductive step
b) Base case
c) Hypothesis
d) Conclusion

(iv) Select from the following that is used to prove program correctness

a) Hoare Logic
b) Godel's Theorem
c) Fermat's Last Theorem
d) None of these

(v) A connected graph with 70 vertices and 69 edges can be defined as

a) Not a minimally connected graph
b) Euler graph
c) Binary tree
d) Tree

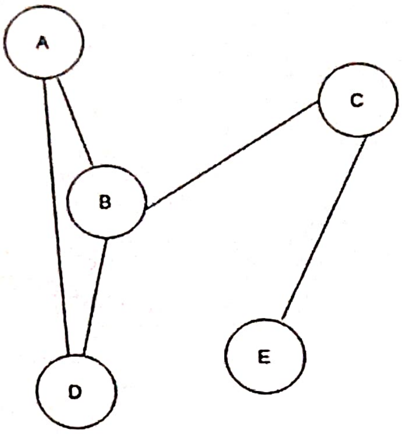
(vi) A connected graph with 150 vertices and 149 edges can be defined as

a) Not a minimally connected graph
b) Euler graph
c) Binary tree
d) Tree

(vii) A minimally connected graph can be defined as

a) Binary tree
b) Hamiltonian graph
c) Tree
d) Regular graph

(viii) In the given graph identify the cut vertices.



a) B and E
b) C and D
c) A and E
d) C and B

(ix) Let N be the set of natural numbers and R be the relation in N defined as $R = \{(a, b): a = b - 2, b > 6\}$. Then identify the correct answer.

a) $(2, 4) \in R$
b) $(8, 7) \in R$
c) $(3, 8) \in R$
d) $(6, 8) \in R$

(x) Illustrate that Kuratowski's theorem helps in identifying:

a) Eulerian circuits
b) Planarity of graphs
c) Minimum spanning trees
d) Graph isomorphism

(xi) Choose the correct algorithm from the following that is used to find a minimum spanning tree

a) Dijkstra's Algorithm
b) Bellman-Ford Algorithm
c) Kruskal's Algorithm
d) Floyd-Warshall Algorithm

(xii) Choose the correct answer. A rooted tree is:

a) A tree with one designated root node
b) A tree where each node has exactly two children
c) A tree with no leaves
d) A tree with a cycle

(xiii) Write the name of connected graph with no articulation points

a) Eulerian
b) Hamiltonian
c) Biconnected
d) Planar

(xiv) Calculate the total number of ways to arrange 5 distinct objects in a line.

a) 5
b) 10
c) 60
d) 120

(xv) Calculate total number of ways 3 objects can be selected from a set of 8 objects.

a) 24
b) 56
c) 336
d) 512

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Define vertex connectivity of a graph. (3)

3. Explain spanning tree. (3)

4. Solve the following recurrence relation using generating function: (3)

$$a_n - 2a_{n-1} + a_{n-2} = 2^{n-2} \quad \textit{for } n \geq 2 \textit{ and } a_0 = 1, a_1 = 5$$

5. Give an example of a divide-and-conquer recurrence relation. (3)

6. Conclude the applications Dijkstra's algorithm. (3)

OR

Justify whether the following two graphs are isomorphic or not: (3)

Group-C

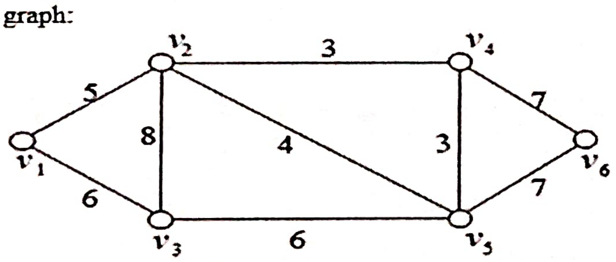
(Long Answer Type Questions) 5 x 6=30

7. Express the recurrence relation by characteristic root method (5)

$$a_n - 6a_{n-1} + 8a_{n-2} = 7^n$$

8. Explain the applications of recurrence relations in algorithm analysis. (5)

9. Apply Prim's algorithm to calculate a shortest spanning tree of the following graph: (5)



10. Describe structural induction and conclude its applications. (5)

11. Illustrate the process of constructing a Hasse diagram for a poset. (5)

12. Evaluate the minimum spanning tree and its usefulness. (5)

OR