25P104 (Pages: 2) Name: .....

Reg.No: .....

FIRST SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2025

(CBCSS - PG)

(Regular/Supplementary/Improvement)

CC19PMTH1C04 - DISCRETE MATHEMATICS

(Mathematics)

(2019 Admission onwards)

Time : 3 Hours Maximum : 30 Weightage

Part A

Answer any ***all*** questions. Each question carries 1 weightage.

1. Show that intersection of two chains is again a chain.
2. Define complimented lattice. Also justfy the statement that, compliment need not be unique with an example.
3. If u and v are nonadjacent vertices of a tree T, then $T + (uv)$ contains a unique cycle.
4. Define the planarity and plane representation of graph G with an example.
5. If the grith k of a connected plae graph G is at least 3, then $m \leq \frac{k(n-2)}{(k-2)}$.
6. Define concadination of two strings with an example.
7. Define a grammer G.
8. Find the grammer $L = \{a^n b^{n+1} : n \geq 0\}$.

(8 × 1 = 8 Weightage)

Part B

Answer any ***two*** questions from each unit. Each question carries 2 weightage.

UNIT - I

9. Let Y be the set of subsets of N, which are either finite or cofinite. Prove that Y is a subalgebra of the powerset boolean algebra $P(N)$.
10. Check whether the boolean function is symmetric; $x_1x_2x_3x_4' + x_2x_3x_4x_1' + x_3x_4x_2x_1' + x_4x_1x_2x_3'$.
11. Write the DNF of $g(a, b, c) = (a + b + c)(a' + b + c')(a + b' + c')(a' + b' + c')(a + b + c')$.

UNIT - II

12. In any group of n persons $(n \geq 2)$, there are at least two with the same number of friends. Discuss.

13. A vertex v of a connected graph G wth at least three vertices is a cut vertex of G if and only if there exist vertices u and w of G, distinct from v, such that v is in every u-w path in G.

14. Prove that K_5 is nonplanar.

UNIT - III

15. Consider the DFA $M = (\{s_0, s_1, s_2\}, \{a, b\}, \delta, s_0, \{s_0, s_1\})$ and $\delta(s_0, a) = s_0, \delta(s_0, b) = s_1$, $\delta(s_1, a) = s_0, \delta(s_1, b) = s_2, \delta(s_2, a) = s_2, \delta(s_2, b) = s_2$. Find $\delta^*(s_1, abb)$.

16. Consider the NFA with final state is q_1 and draw the transition graph with $\delta(q_0, a) = q_1, \delta(q_1, \lambda) = q_2, \delta(q_2, \lambda) = q_0$. Find $\delta(q_1, a), \delta^*(q_1, a), \delta^*(q_2, \lambda), \delta(q_2, aa)$.

17. Contruct a DFA equivalent to the given NFA, $\delta(q_0, a) = q_1, \delta(q_1, a) = q_1, \delta(q_1, \lambda) = q_2, \delta(q_2, b) = q_0$. where q_1 is the final state.

(6 × 2 = 12 Weightage)

Part C

Answer any ***two*** questions. Each question carries 5 weightage.

18. Let $X = N \times N$ on X, $(x_1, y_1) \leq (x_2, y_2)$ if and only if $x_1 \leq x_2$ and $y_1 \leq y_2$. Prove that it is a poset, lattice but it is not a chain. Also draw the lattice diagram.

19. Let X be a boolean algebra, then
    (a) Find out all the boolean functions in two variables.
    (b) Find out all the atoms of this boolean algebra.
    (c) List all the symmetric boolean functions from the above collection.
    (d) Find out the characteristic numbers of all symmetric boolean functions listed above.

20. For any loopless connected grph G
    (a) $\kappa(G) \leq \lambda(G) \leq \delta(G)$
    (b) Discuss the case of strict inequality for the above inequality with an example.

21. State and prove Whitney's theorem on 2- connected graphs.

(2 × 5 = 10 Weightage)

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