21P104 (Pages: 2) Name: …………….………

Reg. No: ……………..…...

FIRST SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2021

(CBCSS-PG)

(Regular/Supplementary/Improvement)

CC19P MTH1 C04 - DISCRETE MATHEMATICS

(Mathematics)

(2019 Admission onwards)

Time: Three Hours Maximum: 30 Weightage

PART A

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

1. Define a Boolean function of n variables with an example.
2. If R is a partial order on a set X, then prove that R - $\{(x, x) : x \in X\}$ is a strict partial order on X.
3. State why there doesn't exist a Boolean algebra having 25 elements.
4. Define cut vertex and cut edge with examples.
5. In any graph of n vertices, show that number of vertices of odd degree is even.
6. Define Identity graph with example.
7. Find a grammar that generates $L=\{a^{n+2} b^n : n \geq 0\}$
8. Find a dfa for the language $L = \{w : |w| \bmod 5 \neq 0\}$ on $\Sigma = \{a, b\}$

(8 × 1 = 8 Weightage)

PART B

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

UNIT I

9. Let $(X, \leq)$ be a poset and A is a nonempty finite subset of X. Prove that A has a maximum element if and only if it has a unique maximal element.
10. Write the Boolean function $f(a, b, c) = a + b + c'$ in their disjunctive normal form.
11. Let $(X, +, \cdot, ')$ be a Boolean algebra. Prove that $x.(x + y) = x$, for all $x, y \in X$

UNIT II

12. Prove that a graph is bipartite if and only if it has no odd cycle.
13. Prove that $K_{3,3}$ is non-planar.
14. Prove that a simple cubic connected graph G has a cut vertex if and only if it has a cut edge.

UNIT III

15. Define a grammar and language with examples.

16. Find a dfa that accepts all strings on {0, 1} except those containing the substring 001.

17. Show that the language $\{awa: w \in \{a, b\}^*\}$ is regular.

(6 × 2 = 12 Weightage)

PART C

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

18. a) Prove that subalgebra of a Boolean algebra with induced operation is a Boolean algebra with same identity elements

    b) Prove that every Boolean algebra is isomorphic to a power set Boolean algebra.

19. State and prove Whitney's theorem on 2 connected graph.

20. For a connected graph G prove that following statements are equivalent.

    i) G is Eulerian.

    ii) Degree of each vertex of G is an even positive integer.

    iii) G is an edge disjoint union of cycles

21. Define non deterministic finite acceptor. Design an nfa for the set $\{abab^n: n \geq 0\}$ U $\{aba^n: n \geq 0\}$

(2 × 5 = 10 Weightage)

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