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MCS–212

MASTER OF COMPUTER APPLICATIONS

(MCA–NEW)

Term-End Examination

December, 2025

MCS-212 : DISCRETE MATHEMATICS

Time : 3 Hours *Maximum Marks : 100*

Weightage : 70%

Note : *Question No.* ***1*** *is compulsory and carries 40 marks. Attempt any* ***three*** *questions from the rest.*

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1. (a) Verify that $[(p \rightarrow q) \wedge \sim q] \rightarrow \sim p$ is a tautology or not. 5

   (b) Show that $\sqrt{17}$ is irrational. 5

   (c) Construct the logic circuit and obtain the logic table for the expression $(x_1' \wedge (x_2 \vee x_3'))$. 5

   (d) Describe the term symmetric difference of two sets A and B with the help of a suitable example. Also, draw Venn diagram for symmetric difference. 5

   (e) Define Kleene closure. Write Kleene closure for $\Sigma = \{aa, b\}$ and $\Sigma = \{a, ba\}$. 5

   (f) Differentiate between permutation and combination. Also, find the number of distinct ways possible to seat 9 persons at a round table. 5

(g) Write the Greneralized Pigeonhole principle. 5

(h) Using the recurrence relation $C_n = C_{n-1} + (n - 1)$ with boundary $C_1 = 0$; show that $C_n = \frac{n(n-1)}{2}$, where $n \geq 1$. 5

2. (a) State and prove the Handshaking Theorem. 7

(b) Describe the following terms in the context of graphs with suitable diagram/example : 8

(i) Walk

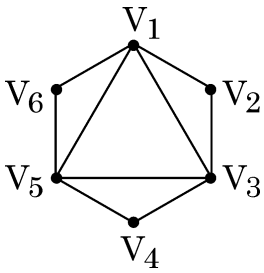
(ii) Path

(iii) Circuit

(iv) Cycle

(c) Is the subgraph of a Bipartite graph, bipartite ? Give reasons for your answer. 5

3. (a) Differentiate between Eulerian graph and Eulerian circuit. Prove that the graph given below is Eulerian by producing a Eulerian circuit in it : 7



(b) Is a Hamiltonian graph Eulerian ? Give reason for your answer. 5

(c) What are Hamiltonian graphs ? Write and explain 'Dirac's criterion' and 'Ore's criterion' for any graph to be Hamiltonian. 8

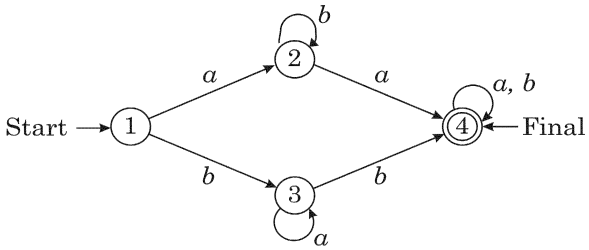
4. (a) Use mathematical induction to prove that $2^n > n^3$, for $n \geq 10$. 8

(b) Find inverse of the function : 6

$$f(x) = \frac{x-2}{x-3}.$$

(c) Define the 'P' and 'NP' classes of complexities with suitable example. 6

5. (a) Prepare the state transition table and deduce the regular expression for the language accepted by the finite automata given below :



Will this automata accept the input string "*a a a a b*", check. 5

(b) Write short notes on the following :

5×3=15

(i) Vertex colouring

(ii) Inclusion-Exclusion Principle

(iii) Undecidable problem

(iv) Mealy machines

(v) Symmetric relations

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