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MCS–212

MASTER OF COMPUTER

APPLICATIONS

(MCA) (NEW)

Term-End Examination

June, 2023

MCS-212 : DISCRETE MATHEMATICS

Time : 3 Hours

Maximum Marks : 100

Note : *Question No. 1 is compulsory and carries 40 marks. Attempt any **three** questions from the rest four questions (Question Nos. 2 to 5).*

1. (a) Apply precedence rules and write truth table for the expression : 4

$$p \oplus q \wedge r \rightarrow \sim p \vee q \leftrightarrow p \wedge r.$$

P. T. O.

- (b) Compare predicate logic with proposition logic and write De' Morgan's laws for both.

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- (c) Show that :

$$(p \rightarrow q) \wedge (p \rightarrow \sim r) \equiv \sim (p \wedge (q \vee r)),$$

without using truth table. 4

- (d) Write principle of optimality. Also, give the satisfiability condition for the principle of optimality. 4

- (e) Explain Disjunctive Normal Form (DNF) with a suitable example. 4

- (f) Given $f(x) = \frac{1}{x}$ and $g(x) = x^3 + 2$, find

$$(fg)(x) \text{ and } \left(\frac{f}{g}\right)(x). \quad 4$$

- (g) What is a regular expression ? Write the rules to develop a regular expression. 4

- (h) Briefly discuss the Turing Acceptable language and Turing Decidable language. 4

- (i) Suppose we want to choose two persons from a company consisting of 35 persons, as Chairman and Vice-Chairman. In how many ways this can be done. 4
- (j) Using induction, show that $T_n = 2^n - 1$ ($n \geq 1$) is the iterative expression for the recursive expression $T_n = 2T_{n-1} + 1$ with $T_1 = 1$. 4
2. (a) Represent the following propositions and their negations using logical quantifiers. Also interpret their negation in words : 8
- (i) The magician can fool all the people all the time.
- (ii) Every real number is the square of some real number.
- (iii) There is a lawyer who never tells lie.
- (b) Write pseudo-code for Floyd Warshall's Algorithm (FWA). Discuss its working strategy with suitable example. Also, discuss the case when FWA gives the best result. 7

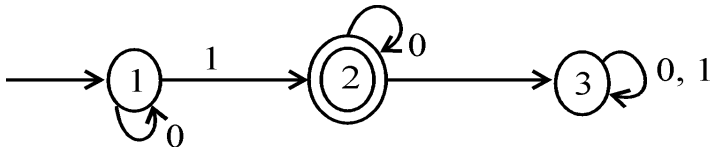
- (c) Draw the logical circuit for the expression :

$$(X'_1 \wedge X_2 \wedge X'_3) \vee ((X'_2 \vee X_1) \wedge X_3)$$

Also draw the truth table for the above expression. 5

3. (a) Differentiate between function and relation. Is every relation a function ? Justify with a suitable example. 5

- (b) Draw state transition table for the finite automata given below : 5



Also find the regular expression acceptable by the given finite automata.

- (c) Write short notes on the following : 10
- (i) Undecidable problem
 - (ii) Halting problem

4. (a) Suppose there are five married couples and they (10 people) are made to sit about a round table so that neither two men nor two women sit together. Find the number of such circular arrangements. 5
- (b) Give any *ten* different positive integers less than 107, use pigeonhole principle to show that there will be two disjoint subsets with the same sum. 5
- (c) What are surjective functions ? Discuss the application of inclusion-exclusion principle to the surjective functions. 5
- (d) Given the recurrence relation $S_n = 2S_{n-1}$ with $S_0 = 1$, show that $S_n = 2^n, n \geq 0$. 5
5. Write short notes on any *five* of the following :

$$5 \times 4 = 20$$

- (i) Isomorphic graphs and conditions of isomorphism

- (ii) Subgraph and spanning subgraph
- (iii) Path and circuits in a graph
- (iv) Eulerian Graph and Eulerian Circuit
- (v) Hamiltonian Graph and Dirac's criterion
- (vi) Map colouring problem