MCS-212

MASTER OF COMPUTER APPLICATIONS (MCA) (NEW)

Term-End Examination

December, 2022

MCS-212 : DISCRETE MATHEMATICS

Time : 3 Hours　　　　　*Maximum Marks : 100*

Weightage : 70%

Note : *(i)　Question No. **1** is compulsory*

*(ii)　Attempt any **three** questions from the rest.*

1. (a) Differentiate between predicate and proposition. Also, write De Morgan's laws for both.　　5

   (b) Use De Morgan's law to derive AND gate from NOR gate.　　5

   (c) Explain the conditions for a relation to be an equivalence relation.　　5

   (d) Prove that S* = (S*)* = S**, where S is a set of strings.　　5

(e) Briefly discuss non-deterministic Turing machine.   5

(f) What is addition principle ? Use addition principle to solve the following case :   5

"Say there are three political parties P_1, P_2 and P_3 having 4, 5 and 6 members respectively." In how many ways we can select two persons from same party to become President and Vice President ?   5

(g) What is power set ? Find the power set for the following given sets :   5

A : {0, 1, 3, 5}

B : {ϕ, A, B, C, E}

(h) Briefly discuss Pigeon hole principle with suitable example.   5

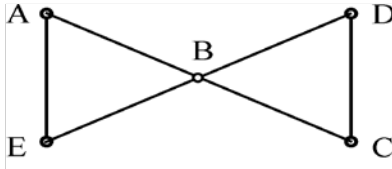2. (a) Using induction, verify :   5

$$\sqrt{5}f_n = \left[\frac{1+\sqrt{5}}{2}\right]^n - \left[\frac{1-\sqrt{5}}{2}\right]^n \quad n \geq 1$$

(b) Define "Stirling number of the second kind." Calculate S_3^2 and S_4^2.   5

(c) Explain Handshaking theorem with suitable example.   5

(d) What is a spanning tree ? Can we have a unique spanning tree ? Draw three spanning tress for the graph given below : 5

3. (a) For any two propositions x and y, verify that :   5

$$\sim (x \vee y) = \sim x \wedge \sim y$$

(b) Find the number of three-letter words that can be formed using the letters of the English alphabet. How many of them end in 'x' ? How many of them have a vowel in the middle position ?   7

(c) What is regular expression ? Find a regular expression to describe each of the following languages :   2+3+3

   (i) $\{a, b, c\}$

   (ii) $\{\wedge, a, abb, abbbb .... \}$

4. (a) Differentiate between the following :   10

   (i)   Deterministic finite automata and Non-deterministic finite automata

   (ii) Moore machines and Mealy machines

(b) Briefly discuss the Halting problem.   5

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(c) A box contains 3 red, 3 blue and 4 white balls. In how many ways can 8 balls be drawn out of the box, one at a time provided order is important ? 5

5. (a) Determine the recurrence relation and iterative relation for the power set p (S) of set 'S'. 10

(b) Write short notes on the following : 2×5=10

(i) Path in a graph

(ii) Circuits in a graph

(iii) Cycles in a graph

(iv) Degree of vertex

(v) Regularity of graph