MCS-212

MASTER OF COMPUTER APPLICATIONS (MCA-NEW)

Term-End Examination

June, 2022

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 questions no. 2 to 5.*

1. (a) Write the mathematical notation for the following : *4*

(i) The set of all odd numbers

(ii) The set of all natural numbers whose square is more than 26

(b) Assuming that p and q are two propositions, find if the following two statements are logically equivalent or not, by constructing the truth table. *5*

$\sim (p \vee q) \vee \sim q$ and $(p \vee \sim q) \vee q$

(c) Use the principle of mathematical induction to prove that

$$1 + 2 + 3 + \ldots + n = \frac{n(n+1)}{2} \text{ for each } n \in N. \quad 5$$

(d) Define the term regular expression with the help of an example. *5*

(e) How many different permutations are possible of the letters, taken all at a time, of the word : ASSESSES ? *3*

(f) A die is rolled once. What are the probabilities of the following events : *4*

(i) Getting an odd number

(ii) Getting at least a value 2

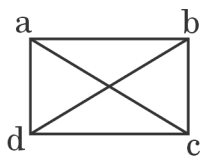
(iii) Getting at most a value 2

(iv) Getting at least 7

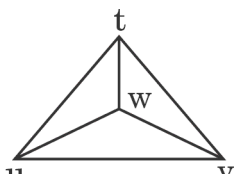
(g) Define the problem of the Tower of Hanoi. Explain the recurrence relation to solve this problem. *6*

(h) Draw a hypercube graph Q_3 (also called the cubical hypercube). *3*

(i) Find, if the following graphs G_1 and G_2 are isomorphic or not. Explain how you arrived at your answer. *5*



G_1



G_2

2. (a) Define the degree and order of a recurrence relation. Find the degree and order of the following recurrence relations : *6*

(i) $a_n = a_{n-1}^2 + a_{n-2}\, a_{n-3}\, a_{n-4}$

(ii) $a_n = na_{n-2} + 2^n$

(b) What is a finite automata ? Why is it needed ? How is a finite automata represented ? Explain with the help of an example. *8*

(c) What is divide-and-conquer approach ? Explain how this approach can be used to apply binary search in a sorted list. *6*

3. (a) What is proposition ? Explain with the help of an example. Explain Disjunction and Conjunction with the help of truth table for each. *6*

(b) Prove the following theorem by direct proof method :

"The square of an even integer is an even integer." *6*

(c) Given the Boolean expression $(a' \vee (b \wedge c')) \wedge (b \vee d')$, draw the corresponding circuit, where a, b, c and d are the inputs to the circuitry. *8*

4. (a) Show the intersection and difference operation on two sets using Venn diagram. *4*

(b) Define the terms Domain, Co-domain and Range in the context of a function. Also find the domain, co-domain and range for a function A to B, where A = {1, 2, 3, 4} and B = {1, 4, 9, 16, 25}. *6*

(c) A committee consisting of 2 male and 2 female workers is to be constituted from 8 male and 9 female workers. In how many distinct ways can this be done ? *4*

(d) Show, using the pigeonhole principle, that in any group of 30 people, 5 people can always be found who were born on the same day of the week. *3*

(e) Find how many of the four digit numbers are even. *3*

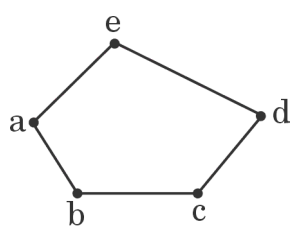
5. (a) Define the following in the context of graph, with the help of an example : *6*

(i) Complete graph

(ii) Star topology

(iii) Degree of a vertex

(b) Find the complement of the following graph : *5*



(c) What is a bipartite graph ? Explain with the help of an example. *4*

(d) Differentiate between Eulerian graph and Eulerian circuit. Find the Eulerian circuit in the following graph, if it exists. *5*