

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR
Even Semester End-term Examination, 2021-22

Course Code: MAO441

Full Marks: 30

Course Name: Discrete Mathematics

Time: 90 Minutes

Question Paper No.: NITDGP/MAO441/1

Date of Exam: 29/04/2022

Instructions: Answer any two questions from Group - I and any six question from Group - II

Materials to be supplied: Graph paper shall be supplied, if required.

Question No.	Body of the Question	Marks	Mapped CO
Group - I			
1	(i) What is Divide and Conquer recurrence relation? (ii) A problem has n number of inputs and Divide & Conquer recurrence relation is $T(n) = aT\left(\frac{n}{b}\right) + f(n)$ and if $n = b^k$. Then prove that $T(n) = a^k T(1) + \sum_{i=0}^{k-1} a^i f\left(\frac{n}{b^i}\right)$.	3	CO2
2	Suppose $W = p(x, y)$ and we have an interpretation with Domain $D = \{0, 1\}$, then prove the following equivalences $\forall x \forall y \equiv \forall y \forall x$ and $\exists x \exists y \equiv \exists y \exists x$.	3	CO1
3.	Define lexicographic ordering. Find the lexicographic ordering of the bit strings: 0, 01, 11, 001, 010, 011, 0001, 0101, and 0111 based on the ordering $0 < 1$.	3	CO3
Group - II			
4	If an expression has the form $t_1 + t_2 + \dots + t_n$, with n number of terms, form a relation that shows the number of ways to parenthesize the expression and solve using the concept of Generating Function.	4	CO2
5	State and prove Generalized Pigeonhole Principle.	4	CO2
6	Solve the recurrence relation $F_n = 5F_{n-1} - 6F_{n-2}$ where $F_0 = 1$ and $F_1 = 4$ by forming characteristic equation.	4	CO2
7	Write Warshall's algorithm to find out the transitive closure of a relation, give appropriate example.	4	CO3
8	Define Big 'O' and Big Θ (Theta) notations. If $f(n) = 3n^2 + 6n$ representing time complexity of an algorithm. Then represent it using Big O and Big Θ notations	4	CO1
9.	Define small 'o' and small ' ω ' notations for the representation of time complexity of an algorithm.	4	CO1
10.	Write Kruskal's algorithm to find minimum spanning tree	4	CO3
11.	Check whether $(D_7,)$ forms a lattice or not. If it forms find out the Maximal and Minimal set of elements. Draw the corresponding Hasse diagram.	4	CO3

CO1: To enable the students to apply the basic concept of Logic to solve engineering and Artificial Intelligence related problems.

CO2: To enable the students to solve problems of combinatorics.

CO3: Students will have knowledge of Graph Theory which arises in many engineering and physical problems.