NATIONAL INSTITUTE OF TECHNOLOGY KURUKSHETRA

THEORY EXAMINATION

Question paper

Roll No: _____

Month and Year of the Examination: Nov/Dec, 2019 | **Branch:** Information Technology

Subject: Design and Analysis of Algorithm | **Subject Code:** ITPC-21

Course: B.Tech | **Semester:** III

Time Duration: Three (3) Hours | **Maximum Marks:** 50

Total No. of Questions: Five (5) | **Number of Questions to be Attempted:** Five (5)

Note:

I. Attempt all parts of question together at one place. Marks allotted for each question are shown on the right hand margin. **Write your answer with question no.**

II. The Candidates, before starting to write the solutions, should please check the question paper for any discrepancy, and also ensure that they have been delivered the question paper of right course no. and right subject title.

III. Unless stated otherwise, the symbols have their usual meanings in context with the subject. **Assume suitably and state, additional data required, if any.**

No.	QUESTIONS	Marks
Q1.		
a)	Solve the following recurrence in terms of a and $d(n)$. $T(1) = 1$ $T(n) = aT(n\text{-}1) + d(n)$ for $n \geq 1$ Suppose in that $d(n) = c^n$ for some constant $c \geq 1$. How does the solution to $T(n)$ depend on the relationship between a and c.	5
b)	Write a program to enumerate all simple cycles of a graph. How many such cycles can there be? What is the time complexity of your program?	5
Q2.		
a)	Suppose we are given a depth-first spanning forest, and we list in post order each of the spanning trees (trees composed of spanning edges), from the leftmost to the rightmost. Show that this order is the same as the order in which the calls of *dfs* ended when the spanning forest was constructed.	5
b)	Show that the average-case running time of insertion sort is $\Omega(n^2)$. Show that any sorting algorithm that moves elements only one position at a time must have time complexity at least $\Omega(n^2)$.	5
Q3.		
a)	Modify the adjacency list representation for an undirected graph so that the first edge on the adjacency list for a vertex can be deleted in constant time. Write an algorithm to delete the first edge at a vertex using your new representation.	5
	Or	
	Show how to solve the fractional knapsack problem in O(n) time.	5
b)	Insert the integers 7, 2, 9, 0, 5, 6, 8 and 1 into a binary search tree by repeated application of the procedure for insertion in binary search tree. Show the result of deleting 7, then 2 from	5

	the final tree.	
Q4.		
a)	Suppose that we insert the keys {1,2,….n} into an empty B-tree with minimum degree 2. How many nodes does the final B-tree have?	5
b)	Give a memoized version of algorithm to compute longest common subsequence that runs in O(mn) time.	5
	Or	
	Explain backtracking approach for Hamiltonian cycles.	5
Q5.		
a)	Consider a variant of the matrix-chain multiplication problem in which the goal is to parenthesize the sequence of matrices so as to maximize, rather than minimize, the number of scalar multiplications. Does this problem exhibit optimal substructure?	5
b)	Suppose characters *a*, *b*, *c*, *d*, *e* and *f* have probabilities 0.07, 0.09, 0.12, 0.22, 0.23 and 0.27, respectively. Find an optimal Huffman code and draw the Huffman tree. What is the average code length?	5

***** **THE END** *****