NARULA INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT

B.TECH/CSE /EVEN/4th SEM / CS402/2020-2021
PAPER TYPE: REGULAR/ SUPPLE(R18)
YEAR: 2021

DESIGN AND ANALYSIS OF ALGORITHMS
CS402

TIME ALLOTTED: 3 HOURS FULL MARKS: 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple Choice Type Questions)

1. Answer any ***ten*** from the following, choosing the correct alternative of each question: **10×1=10**

SL. NO.	Question	CO No.	Marks
(i)	Linked lists are not suitable for (A) Insertion sort (B) Binary search (C) Radix sort (D) Polynomial manipulation	1	1
(ii)	Average successful search time for sequential search on 'n' items is (A) n/2 (B) (n-1)/2 (C) (n+1)/2 (D) n^2	4	1
(iii)	In Randomized Quick sort, the expected running time of any input is (A) O(n) (B) O(n^2) (C) O(n log n) (D) O(n^3)	4	1
(iv)	kruskal's algorithm uses-------- and prim's algorithm uses------ in determining the MST (A) edges, vertex (B)vertex, edges (C)edges, edges (D)vertex, vertex	3	1
(v)	T (n) = 2T (n/2) + (n/ log n) then T (n) = (A) Θ (n log n) (B) Θ (n log (n log n)) (C) Θ (n^2 log (n log n)) (D) Θ (n^2 log n)	4	1
(vi)	"In which of the following cases n-queen problem does not exist" (A) n=2 and n=4 (B) n=4 and n=6 (C) n=2 and n=3 (D) n=4 and n=8"	1	1
(vii)	If each node in a tree has value greater than every value in its left sub tree and value less than every value in its right sub tree, the tree is known as	3	1

(A) complete tree
(B) full binary tree
(C) binary search tree
(D) threaded tree

(viii)	The depth of a complete binary tree with 'n' nodes is (A) log (n+1)-1 (B) log n (C) log (n-1)+ 1 (D) log n +1	4	1
(ix)	The running time of Dijkastra's algorithm is- (A) O(V2) (B) O(V+E) (C) O(n log n) (D) all of the above"	2	1
(x)	Given 2 sorted lists of size 'm' and 'n' respectively. Number of comparisons needed in the worst case by the merge sort algorithm will be (A) mn (B) max(m,n) (C) min(m,n) (D) m+n-1	2	1
(xi)	Which of the following best described sorting? (A) Accessing and processing each record exactly once (B) Finding the location of the record with a given key (C) Arranging the data in some given order (D) Adding a new record to the data structure	3	1
(xii)	Find an optimal parenthesization of a matrix chain product whose sequence of dimension s is <5,4,3> (for three matrices) (A) 125 (B) 130 (C) 135 (D) 140	1	1

GROUP – B*
(Short Answer Type Questions)

Answer any ***three*** from the following: **3×5=15**

SL. NO.			CO No.	Marks
2.	(a)	Describe the role of space complexity and time complexity of a Program?	1	3
	(b)	Explain quick sort algorithm and simulate it for the following data 20, 5,10,16 ,54 ,21	1	2
3.		Illustrate quick sort algorithm and discuss its best case and average case time complexity	1	5
4.		Construct a max-heap using the above algorithm with the following data. <14,16,11,10,3,7,2,9,4,8,1>	2	5
5.	(a)	What is order of growth?, Explain.	2	3
	(b)	What is meant by 'divide and conquer'.	3	2
6.	(a)	Define Class P and NP problem.	2	2

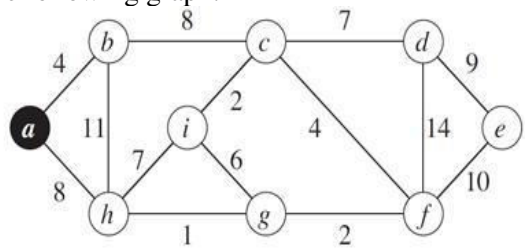
	(b)	Show that C-SAT problem is NP Complete problem	4	3

GROUP – C*
(Long Answer Type Questions)

Answer any ***three*** from the following: **3×15=45**

SL. NO.			CO No.	Marks
7.	(a)	Define Ω-notation.	2	2
	(b)	Prove that the running time of an algorithm is Θ(g(n)) if and only if its worst case running time is O(g(n)) and its best case running time is Ω(g(n)).	4	5
	(c)	Explain how do you solve the Job sequencing with deadline by greedy approach.	2	8
8.	(a)	Discuss activity selection problem for job sequencing	1	4
	(b)	Solve the recurrence T(n)=3T(n/2)+n by substitution method	2	5
	(c)	Differentiate the main features of greedy method and dynamic programming.	2	6
9.	(a)	Write a Matrix Chain Multiplication Algorithm to find the optimal parenthesis for given n numbers of matrices. What is the time complexity?	3	**8**
	(b)	Find an optimal solution of parenthesization of a matrix-chain Multiplication whose sequence of dimension {4, 10, 3, 12, 20, and 7}.	2	7
10.	(a)	What do you mean by recursion tree?	1	3
	(b)	Write non deterministic algorithm for sorting and searching	1	7
	(c)	Using KRUSKAL's algorithm find the Minimal Spanning Tree of the following graph.	2	5

(a)



11.	(a)	Explain the Strassen's Matrix Multiplication algorithm using Divide and Conquer approach	3	**7**
	(b)	Consider the following instance of the Knapsack Problem: n=4 Weight Vector =(20,18,10,15) and Profit Vector =(36,40,60,50) Knapsack Capacity is 25. Find the optimal solution of the problem using above algorithm.	2	**8**