NARULA INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT

B.TECH/CSE/EVEN/4TH SEM/R_21/ CS402/2022-2023
YEAR: 2023

Design & 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	Question	Marks	Co	Blooms Taxonomy Level
(i)	Which of the following are characteristics of an algorithm? a. Algorithm should be clear b. Algorithm should be unambiguous c. Algorithms must terminate after a finite number of steps d. All of the above	1	1	1
(ii)	An algorithm should have _____ well-defined inputs. a. 0 b. 1 c. 0 or more d. 1 or more	1	1	1
(iii)	The measure of the longest amount of time possibly taken to complete an algorithm expressed as __. a. Little-O b. Little-Omega c. Big-Omega d. Big-O	1	1	1
(iv)	Potential function method is the technique that performs an amortized analysis based on ___. a. Financial model b. Computational model c. Algorithm analysis d. Energy model	1	1	2
(v)	___ is not a balanced search tree. a. AVL tree b. Binary tree c. Red-black tree d. B-tree	1	1	2
(vi)	Which of the given options provides the increasing	1	2	4

order of asymptotic complexity of functions f1, f2, f3, and f4?

f1(n) = 2n
f2(n) = n(3/2)
f3(n) = n*log(n)
f4(n) = nlog(n)

a) f3, f2, f4, f1 b) f3, f2, f1, f4
c) f2, f3, f1, f4 d) f2, f3, f4, f1

(vii) Which algorithm finds the solution for the single-source shortest path problem fora tree? 1
a. Prim's b. Dijkstra's
c. Kruskal's d. Huffman code

(viii) The basic operation of the ___ algorithm is the comparison between the element and the array given. 1
a. Binary search b. Greedy
c. Brute force d. Insertion sort

(ix) An algorithm that defines every operation exclusively is called ___ algorithm. 1
a. NP-hard b. Deterministic
c. non-deterministic d. NP-complete

(x) Which of the following sorting algorithms has a worst-case time complexity of O(n^2)? 1
a. Merge Sort b. Heap Sort
c. Quick Sort d. Bubble Sort

(xi) Which of the following algorithms is used to find the shortest path between all pairs of vertices in a graph with positive and negative edges? 1
a. Dijkstra's algorithm
b. Bellman-Ford algorithm
c. Floyd-Warshall algorithm
d. Kruskal's algorithm

(xii) Which of the following data structures is best suited for implementing a hash table? 1

a. Array b. Linked list c. Stack d. Queue

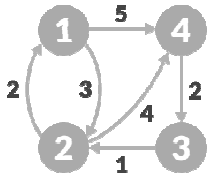
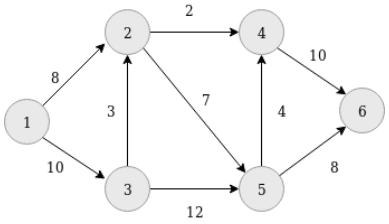
GROUP – B
(Short Answer Type Questions)
(Answer any three of the following) 3 x 5 = 15

SL		Question	Marks	Co	Blooms Taxonomy Level
2.		Write a recursive algorithm to find the solution of the following series: F(x) = 1+2+3+4+5+…. +n.	5	1	1
3.		Write a recursive algorithm for calculating the factorial of a number.	5	1	1
4.		Find optimal solution to the knapsack problem instance n=6, m=15, (p1…p6) = (10,5,15,7,6,18), (w1…w6) = (2,3,5,7,1,4)	5	2	2
5.		Differentiate between DFS and BFS with example.	5	3	1
6.		Show the solution space of 4 queen problem and Find the all possible set.	5	4	1

GROUP – C
(Long Answer Type Questions)

(Answer any three of the following) 3 x 15 = 45

SL		Question	Marks	Co	Blooms Taxonomy Level
7.	(i)	State Master Theorem. Solve the recurrence relation using Master Theorem: T = 2(T/2) + n^2+2n+55	2+5	1	1
	(ii)	Find all m-colors of a graph with undirected connections v1→v2, v1→v3, v1→v4, v2→v3, v2→v4, v2→v5, v3→v4, v4→v5 using backtracking technique.	8	3	1
8.	(i)	Write down the algorithm for Floyd Warshall algorithm. Discuss the time complexity.	5+2	4	2

	(ii)	Consider an example and solve it through the above algorithm. 	8	4	2
9.	(i)	Five Jobs with following deadlines and profits. JobID Deadline Profit a 2 100 b 1 19 c 2 27 d 1 25 e 3 15	5	4	1
	(ii)	What is spanning tree? Which spanning tree algorithm is more efficient and why? Give proper justification with example.	10	4	1
10.		Solve Maxflow Mincut theorem with the following examples: 	15	5	3
11.		Write a short note on: Dynamic Programming, Relation between P, NP, and NP Hard Class, Backtracking.	5x3	5	2