USN | | | | | | | | | | |

18CS42

Fourth Semester B.E. Degree Examination, July/August 2021
Design & Analysis of Algorithms

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. Define algorithm. Explain the following asymptotic notations: (i) Big O (ii) Big Omega and (iii) Big Theta notations. **(08 Marks)**

b. Design a recursive algorithm for solving Tower of Hanoi problem and give the general plan of analyzing that algorithm. Show that the time complexity of tower of Hanoi algorithm is exponential in nature. **(08 Marks)**

c. If $f_1(n) \in O(g_1(n))$ and $f_2(n) \in O(g_2(n))$, prove that $f_1(n) + f_2(n) \in 0(\max\{g_1(n), g_2(n)\}$ **(04 Marks)**

2 a. Define time and space complexity. Explain important problem types. **(08 Marks)**

b. Design a non recursive algorithm to find the maximum element in an array of n elements. Give the mathematical analysis of this non recursive algorithm. **(08 Marks)**

c. Explain two common ways of representing a graph. **(04 Marks)**

3 a. Illustrate the tracing of quicksort algorithm for the following set of numbers: 5, 3, 1, 9, 8, 2, 4, 7. **(08 Marks)**

b. Write a recursive algorithm for binary search and also bringout its efficiency. **(08 Marks)**

c. Explain the concept of divide and conquer. **(04 Marks)**

4 a. Illustrate the topological sorting for the following graph using source removal method. Also list out the advantages and disadvantages of divide and conquer method (Fig. Q4 (a)). **(08 Marks)**

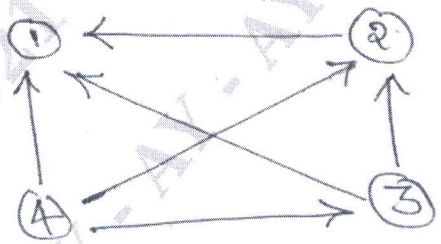

Fig. Q4 (a)

b. Write an algorithm for merge sort. Analyze its efficiency. **(08 Marks)**

c. Explain the concept of decrease and conquer. **(04 Marks)**

5 a. Write the algorithm to obtain optimal solution for Knapsack problem using Greedy method. Apply the algorithm for n = 3 capacity m = 20, values : 25, 24, 15 and weights : 18, 15, 10 respectively. **(08 Marks)**

b. Sort the given list of numbers using heapsort : 2, 9, 7, 6, 5, 8. **(08 Marks)**

c. Explain Greedy criteria. **(04 Marks)**

6 a. Write Kruskal's algorithm and find minimum spanning tree for the graph given below : Fig. Q6 (a). **(08 Marks)**

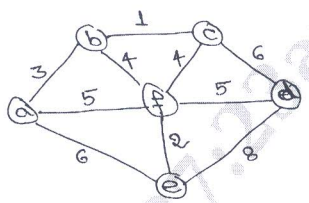

Fig. Q6 (a)

b. Construct a Huffman tree and resulting code word for the following:

Character	A	B	C	D	-
Probability	0.35	0.1	0.2	0.2	0.15

Encode the words : DAD and ADD. **(08 Marks)**

c. Explain Dijkstra's algorithm to find single source shortest path. **(04 Marks)**

7 a. Write Warshall's algorithm to compute transitive closure. Trace following graph using Warshall's algorithm. **(08 Marks)**

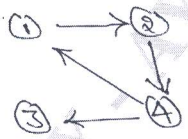

Fig. Q7 (a)

b. Solve the following instance of knapsack problem using dynamic programming knapsack capacity is 5. **(08 Marks)**

Item	Weight	Values
1	2	$12
2	1	$10
3	3	$20
4	2	$15

c. Explain the concept of dynamic programming. **(04 Marks)**

8 a. Explain multistage graph with an example, write graph algorithm using forward approach. **(08 Marks)**

b. Explain Bellman Ford algorithm to find shortest path from single source to all destinations for a directed graph with negative edge cost. Give examples. **(08 Marks)**

c. Explain the concept of Reliability design. **(04 Marks)**

9 a. Explain back tracking concept. Illustrate Nqueens problem using back tracking to solve 4-queens problem. **(08 Marks)**

b. Solve subset sum problem for the following example: S = {3, 5, 6, 7} and d = 15. Construct a state space tree. **(08 Marks)**

c. Explain P and NP problems. **(04 Marks)**

10 a. Explain branch and bound concept. Apply branch and bound to the following instance of assignment problem. **(08 Marks)**

	Job 1	Job 2	Job 3	Job 4
Person A	9	2	7	8
Person B	6	4	3	7
Person C	5	8	1	8
Person D	7	6	9	4

b. Solve the following Knapsack problem using LC branch and bound. n = 4, $(P_1, P_2, P_3, P_4) = (10, 10, 12, 18)$, $(W_1, W_2, W_3, W_4) = (2, 4, 6, 9)$, m = 15. **(08 Marks)**

c. Explain Graph coloring problem with example. **(04 Marks)**