CBCS SCHEME

USN

15CS43

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the worst case, best case and average case efficiencies of an algorithm, with an example each case. **(08 Marks)**

b. Explain the method of comparing the order of growth of two functions using limits, compute the order of growth of: (i) $\log_2 n$ and $\sqrt{n}$ (ii) 2^n and $n!$ **(08 Marks)**

OR

2 a. Define Big Oh notation. Prove that if $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$ then $t_1(n) + t_2(n) \in O(\max\{g_1(n), g_2(n)\})$ **(08 Marks)**

b. Explain the general plan for analyzing the efficiency of a recursive algorithm by considering Tower of Honoi problem as an example. **(08 Marks)**

Module-2

3 a. Explain the concept of divide and conquer. Design and algorithm for merge sort. **(08 Marks)**

b. Apply Stressen's matrix multiplication algorithm to compute product of following two matrices: $\begin{bmatrix} 4 & 5 \\ 5 & 1 \end{bmatrix} * \begin{bmatrix} 1 & 3 \\ 4 & 5 \end{bmatrix}$ **(08 Marks)**

OR

4 a. Discuss how Quick sort works to sort an array. Trace Quick sort algorithm for the following data set: 2, –4, 1, 0, 3, 5, –7. Also derive the worst case time complexity of Quick sort. **(08 Marks)**

b. Design and analyse an algorithm for findings the maximum and minimum of an elements using Divide and Conquer Approach. **(08 Marks)**

Module-3

5 a. Write the algorithm to find optimal solution for job sequencing problem with deadline. Apply the same algorithm for the following dataset and find an optimal solution.
$n = 4$, Profit $(p_1, p_2, p_3, p_4) = (100, 10, 15, 27)$,
Deadlines: $(d_1, d_2, d_3, d_4) = (2, 1, 2, 1)$ **(08 Marks)**

b. Write a Kruskal's algorithm to find minimum cost spanning tree and obtain minimum spanning tree for the graph shown in Fig.Q5(b).

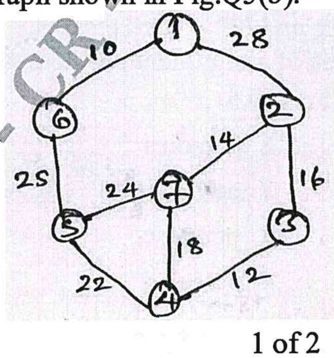

Fig.Q5(b) **(08 Marks)**

OR

6 a. What is an Heap? Write an algorithm to sort the elements using Heap Sort. **(08 Marks)**

b. Obtain the shortest distance cost and paths from node 5 to other nodes from the graph shown in Fig.Q6(b).

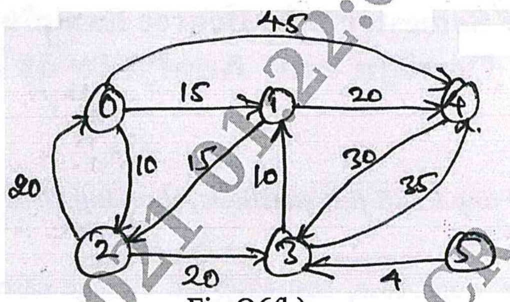

Fig.Q6(b) **(08 Marks)**

Module-4

7 a. Write Warshall's algorithm and find the transitive closure of the matrix given below:

$$R = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 \end{bmatrix}$$ **(08 Marks)**

b. Explain multistage graphs with example. Write multistage graph algorithm using forward approach. **(08 Marks)**

OR

8 a. Using dynamic programming, solve the following knapsack instance:

$n = 4$, $[w_1, w_2, w_3, w_4] = [2, 1, 3, 2]$,

$[p_1, p_2, p_3, p_4] = [12, 10, 20, 15]$ and $M = 5$ **(08 Marks)**

b. Solve the following traveling sales person problem using dynamic programming.

$$\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$$ starting city 1. **(08 Marks)**

Module-5

9 a. Discuss the general backtracking algorithm. Draw the state space tree for 4 – Queen's problem. **(08 Marks)**

b. Solve the following instance of Knapsack problem using Branch and Bound Approach, $n = 4$, $[w_1, w_2, w_3, w_4] = [4, 7, 5, 3]$, $[v_1, v_2, v_3, v_4] = [40, 42, 25, 12]$

The knapsack's capacity w is 10. **(08 Marks)**

OR

10 a. Define P, NP, NP – complete and NP – Hard classes. **(08 Marks)**

b. Solve the following instances of assignment problem using Branch and Bound.

	Job 1	Job 2	Job 3	Job 4	
C =	9	2	7	8	person a
	6	4	3	7	person b
	5	8	1	8	person c
	7	6	9	4	person d

(08 Marks)

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