CBCS SCHEME

15CS43

USN ☐☐☐☐☐☐☐☐☐☐

Fourth Semester B.E. Degree Examination, July/August 2022
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. Define Algorithm. Explain Bigon , Omega and Theta notations used in Analyzing algorithms. **(08 Marks)**
   b. Write an algorithm to compute n! recursively, set up a recurrence relation for the algorithm's basic operation count and solve it. **(08 Marks)**

OR

2 a. If $t_1(n) \in O(g_1(n)$ and $t_2(n) \in O(g_2(n))$, prove that $t_1(n) + t_2(n) \in O(\max\{g_1(n) , g_2(n)\})$. **(08 Marks)**
   b. Explain the general plan of mathematical analysis of non –recursive algorithm with an example. **(08 Marks)**

Module-2

3 a. Explain Divide and conquer technique with its control abstraction. List out the advantages of divide and Conquer method. **(08 Marks)**
   b. Sort the following elements using merge sort. Write the recursion tree. **(08 Marks)**

70	20	30	40	10	50	60

OR

4 a. Write an algorithm for quick sort. Derive the worst case time efficiency of the algorithm. **(08 Marks)**
   b. Obtain the topological sorting for the given digraph using Source Removal method.
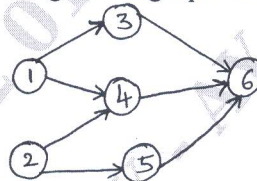

Fig. Q4(b)

(08 Marks)

Module-3

5 a. What is Job Sequencing with deadline problem? Find solution generated by Jon sequencing problem with deadlines for 7 jobs given : Profits 3, 5, 20, 18, 1, 6, 30 and deadline 1, 3, 4, 3, 2, 1, 2 respectively. **(08 Marks)**
   b. Define Minimum Cost Spanning tree. Give high level description of Prism's algorithm to find minimum cost spanning tree and find the Spanning tree for the graph shown in Fig. Q5(b). **(08 Marks)**
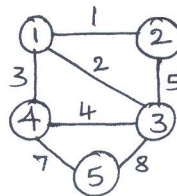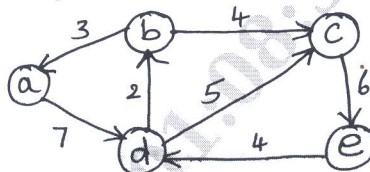

Fig. Q5(b)

OR

6 a. Apply Dijkstra's algorithm on Fig. Q6(a) with vertex as the source. **(08 Marks)**
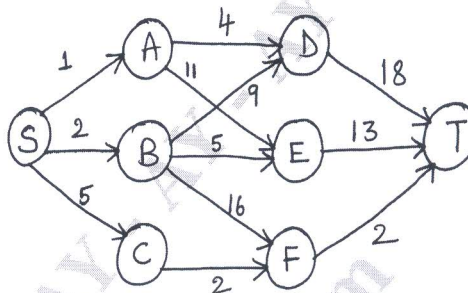
Fig. Q6(a)

b. Sort the following list of numbers using heap sort. 3, 10, 8, 7, 6, 9. **(08 Marks)**
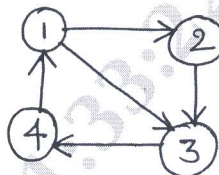
Module-4

7 a. Explain the concept of Dynamic programming. Solve the below instance of multistage graph problem to find a minimum – cost path from S to T (Forward approach). **(08 Marks)**

Fig. Q7(a)

b. With the help of Pseudo code, explain Warshall's algorithm, to find the transitive closure of a diagraph. Apply it to the graph shown below : **(08 Marks)**

Fig. Q7(b)

OR

8 a. Using Floyd's algorithm, solve the all – pair – shortest – path problem for the graph whose weight matrix is as below : **(08 Marks)**

$$\begin{bmatrix} 0 & 2 & \infty & 1 & 8 \\ 6 & 0 & 3 & 2 & \infty \\ \infty & \infty & 0 & 4 & \infty \\ \infty & \infty & 2 & 0 & 3 \\ 3 & \infty & \infty & \infty & 0 \end{bmatrix}$$

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

Item	Height	Value
1	2	$ 12
2	1	$ 10
3	3	$ 20
4	2	$ 15

Module-5

9 a. Explain Backtracking method. Illustrate N queens problem using Backtracking to solve 4 – Queens problem. **(08 Marks)**

   b. Solve the below instance of the subset sum problem. Construct a state space tree.
   $S = \{5, 10, 12, 13, 15, 18\}$ and $d = 30$. **(08 Marks)**

OR

10 a. Explain the concept of branch and bound. Obtain an optimal solution to the given assignment problem. **(08 Marks)**

$$
\begin{array}{c c}
 & \begin{array}{cccc} \text{Job}_1 & \text{Job}_2 & \text{Job}_3 & \text{Job}_4 \end{array} \\
\text{Person} \begin{array}{c} a \\ b \\ c \\ d \end{array} & \left[\begin{array}{cccc} 10 & 3 & 8 & 9 \\ 7 & 5 & 4 & 8 \\ 6 & 9 & 2 & 9 \\ 8 & 7 & 10 & 5 \end{array} \right]
\end{array}
$$

   b. Define the following : i) Class P   ii) Class NP   iii) NP complete problem iv) NP hard problem. **(08 Marks)**

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