

# CBCS SCHEME

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15CS43

## Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019 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. What is an algorithm? What are the properties of an algorithm? Explain with an example. (04 Marks)
- b. Explain the general plan for analyzing the efficiency of a recursive algorithm. Suggest a recursive algorithm to find factorial of a number. Derive its efficiency. (08 Marks)
- c. If  $t_1(n) \in O(g_1(n))$  and  $t_2(n) \in O(g_2(n))$  prove that  $t_1(n) + t_2(n) \in O(\max\{g_1(n), g_2(n)\})$ . (04 Marks)

OR

- 2 a. Explain the asymptotic notations with examples. (06 Marks)
- b. Distinguish between the two common ways to represent a graph. (04 Marks)
- c. Discuss about the important problem types and fundamental data structures. (06 Marks)

### Module-2

- 3 a. Discuss how quick-sort works to sort an array and trace for the following data set. Draw the tree of recursive calls made.

65	70	75	80	85	60	55	50	45
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- Derive the best case complexity of quick sort algorithm. (10 Marks)
- b. Briefly explain the Strassen's matrix multiplication. Obtain its time complexity. (06 Marks)

OR

- 4 a. Explain the concept of divide and conquer. Design an algorithm for merge sort and derive its time complexity. (10 Marks)
- b. What are the three major variations of decrease and conquer technique? Explain with an example for each. (06 Marks)

**Module-3**

- 5 a. Explain the concept of greedy technique for Prim's algorithm. Obtain a minimum cost spanning tree for the graph shown in Fig.Q5(a). (08 Marks)

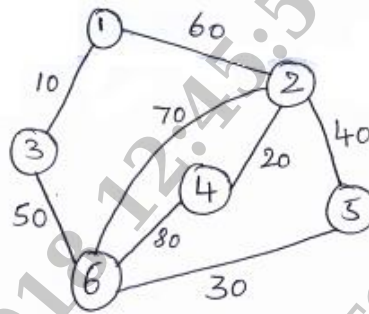


Fig.Q5(a)

- b. Solve the below instance of the single source shortest path problem with vertex 6 as the source. With the help of a suitable algorithm. (08 Marks)

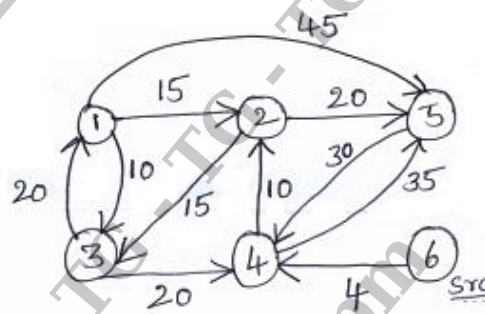


Fig.Q5(b)

**OR**

- 6 a. What are Huffman trees? Explain. Construct a Huffman code for the following data :

Character	A	B	C	D	E	-
Probability	0.5	0.35	0.5	0.1	0.4	0.2

Encode DAD\_CBE using Huffman encoding.

(08 Marks)

- b. Explain transform and conquer technique. Sort the below list using Heap sort :  
3, 2, 4, 1, 6, 5.

(08 Marks)

**Module-4**

- 7 a. Define transitive closure of a graph. Write Warshall's algorithm to compute transitive closure of a directed graph. Apply the same on the graph defined by the following adjacency matrix :

$$R = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

(08 Marks)

- b. Using Dynamic programming, solve the below instance of knapsack problem.

(08 Marks)

Item	Weight	Value
1	2	12
2	1	10
3	3	20
4	2	15

Capacity  $w = 5$

OR

- 8 a. Obtain a optimal binary search tree for the following four-key set. (08 Marks)

Key	A	B	C	D
Probability	0.1	0.2	0.4	0.3

- b. Solve the following travelling sales person problem represented as a graph shown in Fig.Q8(b), using dynamic programming. (08 Marks)

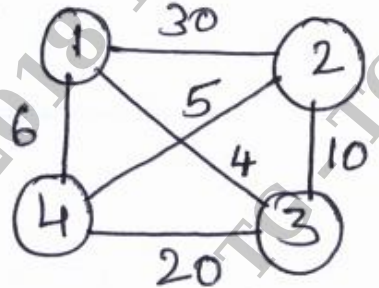


Fig.Q8(b)

**Module-5**

- 9 a. What is the central principle of backtracking? Apply backtracking to solve the below instance of sum of subset problem  $S = \{5, 10, 12, 13, 15, 18\}$   $d = 30$ . (08 Marks)
- b. Solve the below instance of assignment problem using branch and bound algorithm.

$$C = \begin{matrix} & \begin{matrix} \text{Job}_1 & \text{Job}_2 & \text{Job}_3 & \text{Job}_4 \end{matrix} \\ \begin{matrix} \text{Person a} \\ \text{Person b} \\ \text{Person c} \\ \text{Person d} \end{matrix} & \begin{pmatrix} 9 & 2 & 7 & 8 \\ 6 & 4 & 3 & 7 \\ 5 & 8 & 1 & 8 \\ 7 & 6 & 9 & 4 \end{pmatrix} \end{matrix}$$

(08 Marks)

OR

- 10 a. Draw the state-space tree to generate solutions to 4-Queen's problem. (04 Marks)
- b. Apply backtracking to the problem of finding a Hamiltonian circuit in the graph shown below : (04 Marks)

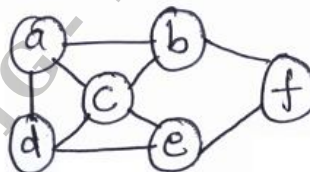


Fig.Q10(a)

- c. Define the following :
- Class P
  - Class NP
  - NP complete problem
  - NP hard problem.

(08 Marks)

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