CBCS SCHEME

USN | | | | | | | | | | 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

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)**

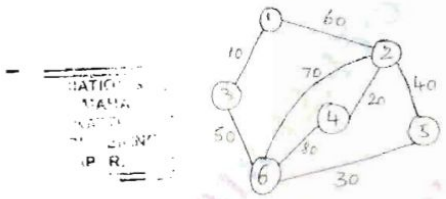

Fig.Q5(a)

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)**

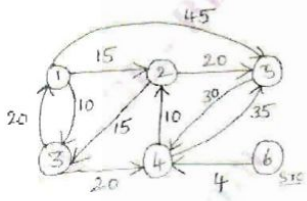

Fig.Q5(b)

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)**

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 : (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)

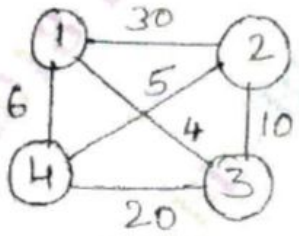

Fig.Q8(b)

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.

$$C = \begin{bmatrix} Job_1 & Job_2 & Job_3 & Job_4 & \\ 9 & 2 & 8 & & \text{Person a} \\ 6 & 4 & 7 & & \text{Person b} \\ 5 & 8 & 1 & 8 & \text{Person c} \\ 7 & 6 & 9 & 4 & \text{Person d} \end{bmatrix}$$

(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)

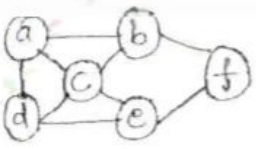

Fig.Q10(a)

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

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17CS43

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain Asymptotic notations in detail with example. **(12 Marks)**

b. Outline an algorithm to find maximum of n elements and obtain its time complexity. **(08 Marks)**

OR

2 a. Design algorithm for tower of Hanoi problem and obtain time complexity. **(10 Marks)**

b. Prove the theorem
if $f_1(n) \in 0(g_1(n))$ and $f_2(n) \in 0(g_2(n))$ Then $f_1(n) + f_2(n) \in 0(\max\{g_1(n), g_2(n)\})$. **(10 Marks)**

Module-2

3 a. Design a recursive algorithm for binary search and calculate time complexity. **(10 Marks)**

b. Write the algorithm for merge sort and Trace 60, 50, 25, 10, 35, 25, 75, 30. **(10 Marks)**

OR

4 a. Develop an algorithm for Quick sort and derive its time complexity. **(10 Marks)**

b. What is topological sorting? Apply DFS for below graph to solve topological sorting. **(10 Marks)**

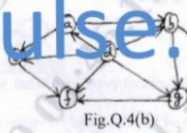


Fig.Q.4(b)

Module-3

5 a. Find the optimal solution to the knap sack instant n = 7, m = 15 using greedy method.

Object	1	2	3	4	5	6	7
Weight	02	03	05	07	01	04	01
Profit	10	05	15	07	06	18	03

(10 Marks)

b. Find the minimum spanning tree using Kruskal's algorithm.

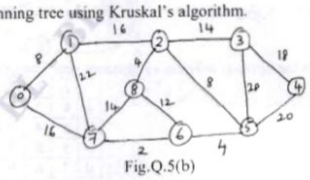


Fig.Q.5(b)

(10 Marks)

OR

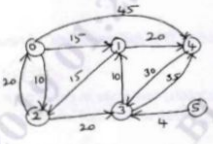
6 a. Construct a Huffman code for the following data:

Characters	A	B	C	D	-
Probability	0.4	0.1	0.2	0.15	0.15

Encode the text ABACABAD and decode 100010111001010 **(10 Marks)**

b. Calculate the shortest distance and shortest path from vertex 5 to vertex 0 using Dijkstra's. **(10 Marks)**

Fig.Q.6(b)



Module-4

7 a. Explain the general procedure to solve a multistage graph problem using backward approach with an example. **(10 Marks)**

b. Construct an optimal binary search tree for the following:

Items :	A	B	C	D
Probabilities :	0.1	0.2	0.4	0.3

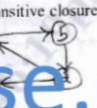
(10 Marks)

OR

8 a. Design Floyd's algorithm to find shortest distances from all nodes to all other nodes. **(10 Marks)**

b. Apply Warshall's algorithm to compute transitive closure for the graph below. **(10 Marks)**

Fig.Q.8(b)



Module-5

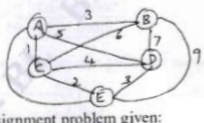
9 a. What is Hamiltonian circuit problem? What is the procedure to find Hamiltonian circuit of a graph? **(10 Marks)**

b. Explain the classes of NP-Hard and NP-complete. **(10 Marks)**

OR

10 a. Apply the branch and bound algorithm to solve the travelling salesman problem for the graph below.

Fig.Q.10(a)



(10 Marks)

b. Obtain the optimal solution assignment problem given:

	J_1	J_2	J_3	J_4
a	9	2	7	8
b	6	4	3	7
c	5	8	1	8
d	7	6	9	4

(10 Marks)

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