CBCS SCHEME

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18CS42

Fourth Semester B.E. Degree Examination, July/August 2022
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. Give the definition of an Algorithm and also discuss the characteristics of an Algorithm. **(05 Marks)**

b. Define Space Complexity and Time Complexity of an algorithm and compute the time complexity of Fibbonocci Numbers algorithm. **(05 Marks)**

c. What are the various basic Asymptotic efficiency classes? Explain Big – O , Big - Ω , Big - θ notations with examples. **(10 Marks)**

OR

2 a. Give the Mathematical Analysis of Non recursive Matrix Multiplication Algorithm. **(05 Marks)**

b. Give the general plan for analyzing Time efficiency of Recursive algorithms and also Analyze the Tower of Hanoi Recursive algorithm. **(10 Marks)**

c. Mention the important problem types considered for design and analysis. Explain any two problem types. **(05 Marks)**

Module-2

3 a. Give the Recursive algorithm to find maximum and minimum element from the list and apply the algorithm to find maximum and minimum to the list
[31 , 22 , 12 , -7 , 75 , -6 , 17 , 47 , 60]. **(10 Marks)**

b. Apply both mergesort and quicksort algorithm to sort the characters VTUBELAGAVI. **(10 Marks)**

OR

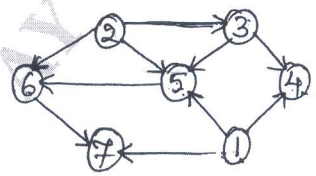
4 a. Apply Strassen's algorithm for matrix multiplication to multiply the following matrices and justify how the Strassen's algorithm is better.

$$\begin{bmatrix} 4 & 3 \\ 1 & 2 \end{bmatrix} \times \begin{bmatrix} 1 & 2 \\ 6 & 5 \end{bmatrix}.$$

(10 Marks)

b. Obtain the topological sort for the graph , Fig. Q4(b) using i) Source Removal method ii) DFS method. **(10 Marks)**

Fig. Q4(b)



Module-3

5 a. Solve the Greedy Knapsack problem, Fig, Q5(a) of capacity 5kgs. **(05 Marks)**

Fig. Q5(a)

Items	1	2	3	4
Profit	5	9	4	8
Weight	1	3	2	2

b. Find the Optimal solution for the Greedy Job sequencing problem given n = 4 , profits [10 , 30 , 60 , 40] , deadlines [2 , 3 , 1 , 3]. **(05 Marks)**

c. Apply Prims and Kruskal's algorithm to find the minimal cost spanning tree for the graph given in Fig. Q5(c). **(10 Marks)**

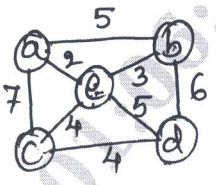


Fig. Q5(c)

OR

6 a. A document contains the letters "A" through "E" with frequencies is follows :
A : 22 , B : 13 , C : 18 , D : 16 , E : 31.
Construct a Huffman Tree and codes and
Encode : CAB , ADD , BAD , ACE
Decode : 110011 and 1000110001. **(10 Marks)**

b. Apply Heapsort for the list [9 , 7 , 1 , 8 , 3 , 6 , 2 , 4 , 10 , 5] using Bottom up approach. **(10 Marks)**

Module-4

7 a. Apply Floyd's algorithm to find the all pairs shortest path for the given adjacency matrix. Fig. Q7(a).

$$W = \begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array} \begin{array}{c} \begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \end{array} \\ \begin{bmatrix} 0 & 1 & \infty & 1 & 5 \\ 9 & 0 & 3 & 2 & \infty \\ \infty & \infty & 0 & 4 & \infty \\ \infty & \infty & 2 & 0 & 3 \\ 3 & \infty & \infty & \infty & 0 \end{bmatrix} \end{array}$$

Fig. Q7(a) **(10 Marks)**

b. Solve the instance of 0/1 Knapsack problem Fig. Q7(b), using Dynamic Programming approach. **(10 Marks)**

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

Capacity W = 5

Fig. Q7(b)

OR

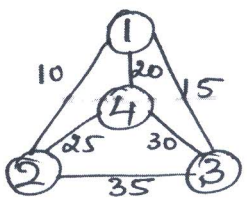
8 a. Construct an Optimal Binary search tree for the set of keys given in Fig. Q8(a). **(10 Marks)**

Keys	A	B	C	D
Probability	0.1	0.2	0.4	0.3

Fig. Q8(a)

b. Apply Dynamic programming approach to solve the given Travelling Salesman problem. **(10 Marks)**

Fig. Q8(b)

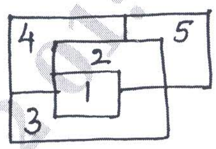


Module-5

9 a. With the help of State Space tree, solve the 4 – queens problem by using Backtracking approach. **(10 Marks)**

b. Color the regions in the Map given in Fig. Q9(b), by applying backtracking graph color algorithm. Color = (R G B & Y). **(10 Marks)**

Fig. Q9(b)



OR

10 a. Apply LC – Branch and Bound approach to the assignment problem Fig. Q10(a). **(10 Marks)**

Fig. Q10(a)

$$C = \begin{array}{c} \begin{matrix} 1 & 2 & 3 & 4 \end{matrix} \\ \begin{bmatrix} 9 & 2 & 7 & 8 \\ 6 & 4 & 3 & 7 \\ 5 & 8 & 1 & 8 \\ 7 & 6 & 9 & 4 \end{bmatrix} \end{array} \begin{matrix} \text{Person a} \\ \text{Person b} \\ \text{Person c} \\ \text{Person d} \end{matrix}$$

b. Apply Branch and Bound approach to solve the instance of 0/1 Knapsack problem.

KnapSack Capacity W = 10

Items	1	2	3	4
Weight	4	7	5	3
Value	$ 40	$ 42	$ 25	$ 12

Fig. Q10(b) **(10 Marks)**

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