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18CS42

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

Time: 3 hrs.

Max. Marks: 100

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

Module-1

1   a.   Write an algorithm to find uniqueness of elements in an array and give the mathematical analysis of this non recursive algorithm with steps? **(08 Marks)**
    b.   Define algorithm with specifications for writing algorithm. **(06 Marks)**
    c.   Explain the following problem types:
         (i) sequencing   (ii) Sorting   (iii) Combinatorial problems **(06 Marks)**

OR

2   a.   Write the tower of Hanoii algorithm and steps for analysis of recursive algorithm. Show the analysis of above algorithm. **(08 Marks)**
    b.   Discuss fundamental data structures. **(06 Marks)**
    c.   Explain with example how a count variable is introduced in a program to find the number of steps required by a program to solve the problem. **(06 Marks)**

Module-2

3   a.   Compare the straight forward method and devide and conquer method of finding maximum and minimum elements of the list. **(08 Marks)**
    b.   Sort the following key word "ALGORITHM" by applying quick sort method. **(06 Marks)**
    c.   Explain Devide and Conquer technique with general algorithm. **(06 Marks)**

OR

4   a.   Show the number of element comparisons with example and show the proof of Binary search time for best, average and worst case analysis. **(08 Marks)**
    b.   Apply topological sorting algorithm for the following graph shown in Fig. Q4 (b) and find the topological sequence? **(06 Marks)**
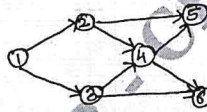

Fig. Q4 (b)

    c.   Write Merge Sort algorithm for sorting using devide and conquer. **(06 Marks)**

Module-3

5   a.   Construct the Huffman tree and resulting code word for the following set of values? **(08 Marks)**

Character	A	B	C	D	-
Probability	0.35	0.1	0.2	0.2	0.15

Encode the words DAD & ADD.

    b.   Apply the prim's algorithm to obtain minimum cost spanning tree for the given weighted connected graph? (Refer Fig. Q.No.5(b)) **(06 Marks)**
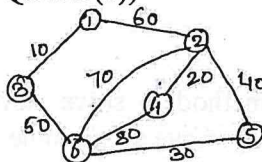

Fig. Q5 (b)

c. Find the optimal solution using greedy for the job sequencing with dead line problem with following values? n = 5.
Profit = {10, 3, 33, 11, 40}
Dead line = {3, 1, 1, 2, 2} **(06 Marks)**

OR

6 a. Explain bottom up heap construction algorithm with example. **(08 Marks)**

b. Apply single source shortest path algorithm to the following graph. Refer Fig. Q.No.6 (b). Assume vertex 'a' as source. **(08 Marks)**
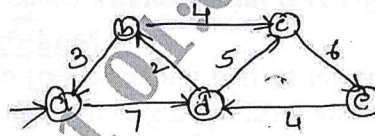

Fig. Q.No.6 (b)

c. Apply greedy method to obtain an optimal solution to the knapsack problem given M = 60.
W = {5, 10, 20, 30, 40}
P = {30, 20, 100, 90, 160}
Find total profit earned. **(04 Marks)**

Module-4

7 a. Explain multistage graph with an example. Write backward multistage graph algorithm. **(10 Marks)**

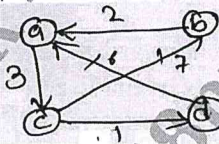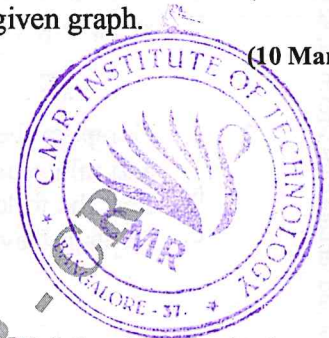b. Apply Floyd's algorithm to solve all pair shortest path for the given graph. (Refer Fig.Q7 (b)) **(10 Marks)**

Fig. Q7 (b)

OR

8 a. Apply Warshall's algorithm to find the transitive closure of the following graph shown in Fig.Q8 (a). **(10 Marks)**
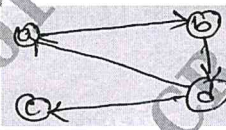

Fig. Q8 (a)

b. Construct optimal binary search tree for the following set of values: **(10 Marks)**

Keys	A	B	C	D
Probability	0.1	0.2	0.4	0.3

Module-5

9 a. Apply best first Branch and Bound algorithm to solve the instance of the given job assignment problem.

$$
\begin{array}{cccc}
J_1 & J_2 & J_3 & J_4 \\
\end{array}
$$

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

(10 Marks)

b. Apply Back Tracking method to solve sum of subset problem for the instance d = 30, S = {5, 10, 12, 13, 15, 18}. Give all possible solution with state space for construction. **(10 Marks)**

OR

10 a. Apply Branch and Bound method for Knapsack problem. C = 10

Items	1	2	3	4
Weights	4	7	5	3
Values	$40	$42	$25	$12

(10 Marks)

b. Write short note on the following:
- (i)   P
- (ii)   NP
- (iii) NP-complete
- (iv)   NP-Hard class problems

(10 Marks)

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