CBCS SCHEME

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17CS43

Fourth Semester B.E. Degree Examination, Aug./Sept.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. Define an algorithm. Explain the characteristics of an algorithm. **(04 Marks)**

b. What are Asymptotic notations? List and describe the various asymptotic notations with an example of each. **(08 Marks)**

c. Explain the general plan of mathematical analysis of non-recursive algorithm with an example. **(08 Marks)**

OR

2 a. What is the worst case, best case and average case efficiencies of sequential search? **(04 Marks)**

b. Illustrate mathematical analysis of recursive algorithm for Towers of Hanoi problem. **(08 Marks)**

c. Discuss the important problem types and fundamental data structures. **(08 Marks)**

Module-2

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

25	91	46	35	11	82	14	55

Derive best case complexity of quick sort algorithm. **(10 Marks)**

b. Obtain the topological sorting for the digraph shown in Fig.Q3(b), using source removal method.

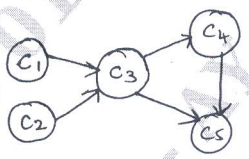

Fig.Q3(b) **(06 Marks)**

c. List out the advantages and disadvantages of divide and conquer technique. **(04 Marks)**

OR

4 a. Explain divide and conquer technique with its control abstraction. **(04 Marks)**

b. Develop an algorithm for sorting elements using Simple merge. Apply the same for sorting list of elements given below:

67	90	12	56	23	34	45

(08 Marks)

c. Apply Strassen's algorithm to compute

$$\begin{bmatrix} 1 & 0 & 2 & 1 \\ 4 & 1 & 1 & 0 \\ 0 & 1 & 3 & 0 \\ 5 & 0 & 2 & 1 \end{bmatrix} * \begin{bmatrix} 0 & 1 & 0 & 1 \\ 2 & 1 & 0 & 4 \\ 2 & 0 & 1 & 1 \\ 1 & 3 & 5 & 0 \end{bmatrix}$$

(08 Marks)

Module-3

5 a. State Job sequencing with deadline problem. Find the solution generated by job sequencing problem for 7 jobs given profits 3, 5, 20, 18, 1, 6, 30 and deadlines 1, 3, 4, 3, 2, 1, 2 respectively. **(04 Marks)**

b. Explain the concept of greedy technique for Prim's algorithm. Obtain a minimum cost spanning tree for the graph below in Fig.Q5(b).

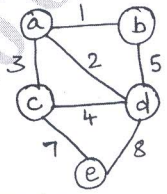

Fig.Q5(b) **(08 Marks)**

c. Sort the given list of number using Heap sort:

2	7	1	6	5	4	3

(08 Marks)

OR

6 a. Explain Greedy criterion. Apply greedy method for the following instance of knapsack problem. Capacity of the knapsack (M) = 5.

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

(08 Marks)

b. Construct a Huffman code for the following data and encode the test BADEC.

Character	A	B	C	D	E
Probability	0.4	0.1	0.2	0.15	0.15

(06 Marks)

c. Solve the below instance (Fig.Q6(c)) of single source shortest path problem with vertex a as the source.

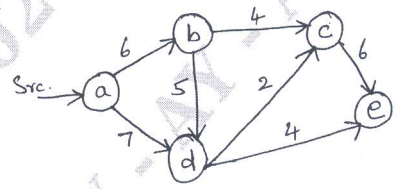

Fig.Q6(c) **(06 Marks)**

Module-4

7 a. What is Dynamic programming? Using Warshall's algorithm, obtain the transitive closure of the graph defined by the following adjacency matrix.

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

(04 Marks)

b. Define multistage graph problem. Determine the minimum cost path from source (S) to sink (T) for the graph in Fig.Q7(b) using forward approach.

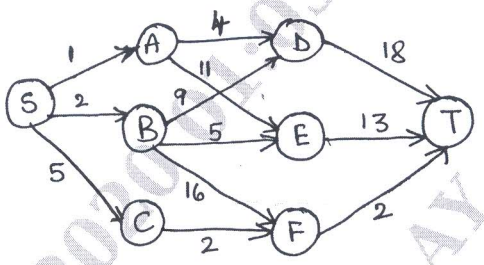

Fig.Q7(b) **(06 Marks)**

c. Solve the below instance of Bellman-Ford algorithm [Fig.Q7(c)].

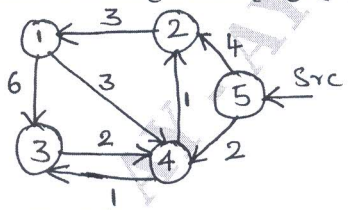

Fig.Q7(c) **(10 Marks)**

OR

8 a. Explain Travelling Salesperson Problem (TSP). Solve the below instance of TSP using dynamic programming.

	1	2	3	4
1	0	10	15	20
2	5	0	9	10
3	6	13	0	12
4	8	8	9	0

(08 Marks)

b. Obtain optimal Binary search Tree for the following identifiers.

	1	2	3	4
a[i]	do	if	int	while
p[i]	0.1	0.2	0.4	0.3

(12 Marks)

Module-5

9 a. Draw the state-space tree top generate solutions to 4-Queen's problem. **(04 Marks)**

b. Apply backtracking technique to solve the below instance of the subset sum problem.
$s = \{1, 3, 4, 6\}$ $d = 7$ **(08 Marks)**

c. Apply Branch_and_Bound technique to the following insurance of assignment problem.

$$C = \begin{matrix} \text{job1} & \text{job2} & \text{job3} & \text{job4} \\ \begin{bmatrix} 9 & 2 & 7 & 8 \\ 6 & 4 & 3 & 7 \\ 5 & 8 & 1 & 8 \\ 7 & 6 & 9 & 4 \end{bmatrix} & \begin{matrix} \text{Person a} \\ \text{Person b} \\ \text{Person c} \\ \text{Person d} \end{matrix} \end{matrix}$$

(08 Marks)

OR

10 a. How the Branch_and_Bound technique is different from backhacking? Solve the following insurance of knapsack problem using Branch_and_Bound technique. Give knapsack capacity = 10.

Item	1	2	3	4
Weight	4	7	5	3
Valve	40	42	25	12

(08 Marks)

b. Define Hamiltonian cycle. Check whether the Hamiltonian cycle exists for the graph given below in Fig.Q10(b).

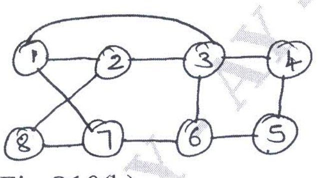

Fig.Q10(b)

(04 Marks)

c. Define the following :
(i) Class P (ii) Class NP (iii) NP Complete Problem (iv) NP Hard Problem.

(08 Marks)

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