CBCS SCHEME

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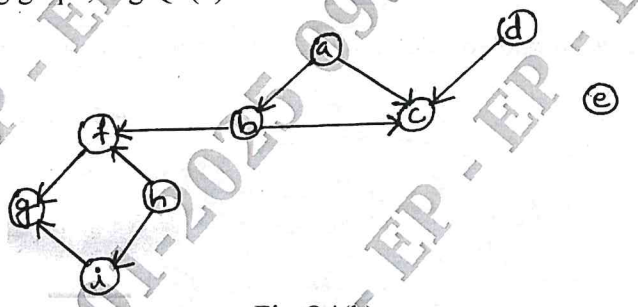
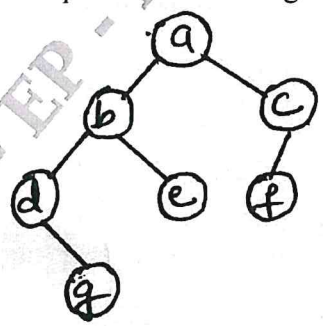
BCS401

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Analysis and Design of Algorithms

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain the various steps in algorithm design and analysis process with the flow diagram.	08	L1	CO1
	b.	Give formal and informal definitions of asymptotic notations.	06	L1	CO1
	c.	Explain the general plan of mathematical analysis of recursive algorithm with an example.	06	L1	CO1
		OR			
Q.2	a.	Design algorithm for tower of Hanoi problem and obtain time complexity.	10	L1	CO1
	b.	Write an algorithm to search an element in an array using sequential search. Discuss the best case, worst case and average case efficiency of this algorithm.	10	L1	CO1
		Module – 2			
Q.3	a.	Write an algorithm to sort the numbers using insertion sort. Discuss its efficiency.	10	L2	CO2
	b.	Design quick sort algorithm and obtain its best, average and worst case efficiency.	10	L2	CO2
		OR			
Q.4	a.	Write merge sort algorithm and sort the list E X A M P L E.	08	L2	CO2
	b.	Apply the DFS based algorithm to solve the topological sorting problem for the following graph, Fig.Q4(b)  Fig.Q4(b)	06	L3	CO2
	c.	Write algorithm for pre-order, post order and in order traversals of a tree. Write pre-order, in-order and post order for the given tree.  Fig.Q4(c)	06	L2	CO2

Module – 3

Q.No.		Question	Marks	Level	CO
Q.5	a.	Define AVL tree. Construct AVL tree for the list 5, 6, 8, 3, 2, 4, 7.	10	L3	CO3
	b.	Define heap. Sort the following lists by heapsort: H E A P S O R T (in alphabetical order)	10	L3	CO3

OR

Q.No.		Question	Marks	Level	CO
Q.6	a.	Write the algorithm for comparison counting sort. Discuss its efficiency.	10	L2	CO4
	b.	Design Horspools algorithm for string matching. Apply Horspools algorithm to find the pattern BARBER on the text JIM_SAW_ME_IN_BARBERSHOP	10	L3	CO4

Module – 4

Q.7 a. Write Warshall's algorithm and apply the same to compute transitive closure of a directed graph. — 10 | L3 | CO3

$$\begin{array}{c} \\ a \\ b \\ c \\ d \\ e \end{array} \begin{array}{c} \begin{array}{ccccc} a & b & c & d & e \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 \end{bmatrix} \end{array}$$

b. Construct minimum cost spanning tree using Kruskal's algorithm for the following graph, Fig.Q7(b). — 10 | L3 | CO4

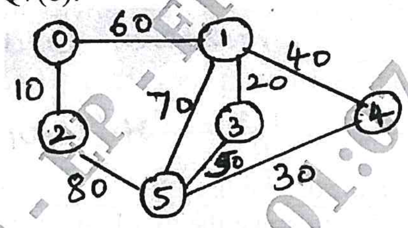


Fig.Q7(b)

OR

Q.8 a. Solve the following single source shortest path problem assuming vertex '5' as the source. — 10 | L3 | CO4

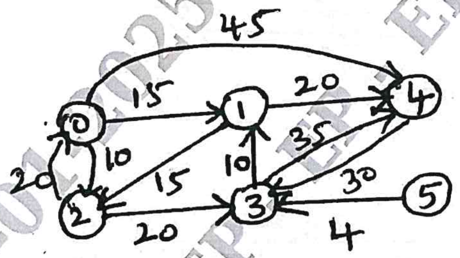


Fig.Q8(a)

b. Write Huffman's algorithm. Construct Huffman tree and resulting code word for the following: — 10 | L4 | CO4

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

Encode the text DAD_CBE.

Module – 5

Q.No.		Question	Marks	Level	CO
Q.9	a.	Explain the following with example: (i) P problem (ii) NP problem	06	L1	CO5
	b.	What is decision tree? Construct decision tree for the three element insertion sort.	08	L2	CO5
	c.	Construct state space tree to solve 4 queens problem.	06	L3	CO5

OR

Q.10	**a.**	What is backtracking? Apply back tracking to solve the below instance of sum of subset problem: s = {3, 5, 6, 7}, d = 15	**10**	**L3**	**CO6**
	b.	Solve the following instance of knapsack problem using branch and bound technique knapsack capacity = 10.	**10**	**L4**	**CO6**

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

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