CBCS SCHEME

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BCS401

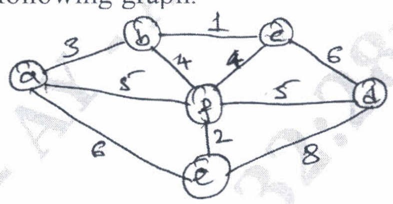
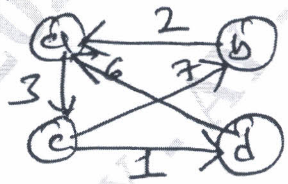
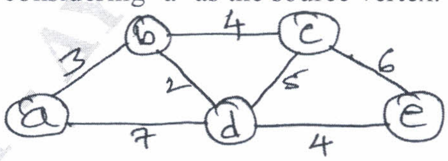
Fourth Semester B.E./B.Tech. Degree Supplementary Examination, June/July 2024

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.	What is Algorithm? And List the important points to be considered in designing of algorithms.	4	L1	CO1
	b.	Develop a recursive algorithm for computing factorial of a positive number. Calculate the efficiency in terms of order of growth.	6	L3	CO1
	c.	Develop a linear search algorithm and calculate the best-case, worse-case and average-case efficiency in terms of order of growth.	10	L3	CO1
		OR			
Q.2	a.	Write the block diagram of algorithm design and analysis process and define the following notations i) Big-oh(O) ii) Big-Theta (θ).	6	L1	CO1
	b.	Calculate and compare the orders of growth of the following: i) $\log_2 n$ and $\sqrt{n}$ ii) $\frac{1}{2}n(n-1)$ and n^2 iii) $n!$ and 2^n	9	L3	CO1
	c.	Make use of the definition of asymptotic notation to prove the following: if $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$, then $t_1(n) + t_2(n) \in O(\max\{g_1(n), g_2(n)\})$.	5	L3	CO1
		Module – 2			
Q.3	a.	Define exhaustive search algorithm design strategy. Develop a algorithm for sorting of keys using quicksort technique and calculate the efficiency of algorithm.	10	L3	CO2
	b.	Distinguish between decrease and conquer and divide and conquer algorithm design technique. Develop the insertion sort algorithm to sort a list of integers and calculate its efficiency.	10	L3	CO2
		OR			
Q.4	a.	Define master theorem. Show how Strassen's matrix multiplication reduce the number of multiplications in multiplying $n \times n$ matrices and calculate the efficiency.	10	L3	CO2

	b.	Define topological sorting. Develop a merge sort algorithm to sort the elements.	10	L3	CO2
		Module – 3			
Q.5	a.	Define AVL tree with an example. Build 2-3 tree for the list of keys : 9, 5, 8, 3, 2, 4, 7 by indicating each step of key insertion and node splits.	10	L3	CO3
	b.	Develop a comparison counting sort algorithm and demonstrate it for the following test of keys: 62, 31, 84, 96, 19, 47.	10	L3	CO3
		OR			
Q.6	a.	What is Heap tree? Develop the bottom-up-heap construction algorithm. Construct the heap tree for the list 2, 9, 7, 6, 5, 8 and demonstrate the heap sort algorithm.	10	L3	CO3
	b.	Develop the Horspool's String Matching algorithm and demonstrate to search the pattern string: "BARBER" in the text string: "JIM_SAW_ME_IN_A_BARBER_SHOP" by using Horspool's algorithm.	10	L3	CO3
		Module – 4			
Q.7	a.	Define transitive closure of directed graph. Develop the Warshell algorithm to compute the transitive closure and demonstrate with a suitable example. Prove that the time efficiency of Warshall's algorithm is cubic.	10	L3	CO4
	b.	Define spanning tree. Apply prims algorithm and construct minimum spanning tree for the following graph:  Fig.Q.7(b)	10	L3	CO4
		OR			
Q.8	a.	Develop the Floyd's algorithm to compute all pair-shortest-paths and demonstrate it for the following graph. Show that the time efficiency of Floyd's algorithm is cubic.  Fig.Q.8(a)	10	L3	CO4
	b.	Apply Dijkstra's algorithm to compute single source shortest path for the following graph by considering 'a' as the source vertex.  Fig.Q.8(b)	10	L3	CO4

		Module – 5			
Q.9	a.	Explain the decision tree for the 3-element insertion sort with diagram.	10	L2	CO5
	b.	Explain subset-sum problem and construct the state space tree for the set S = {3, 5, 6, 7}.	10	L3	CO5
		OR			
Q.10	a.	Explain the following with an example: i) P problem ii) NP problem iii) NP complete problem iv) NH hard problem.	10	L2	CO5
	b.	Apply Branch and Bound algorithm to solve the below instance of knapsack problem:	10	L3	CO5

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

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