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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2024 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Information Science and Engineering **Duration: 3 hrs.**
Course Code: 22IS4PCADA **Max Marks: 100**
Course: Analysis and Design of Algorithms

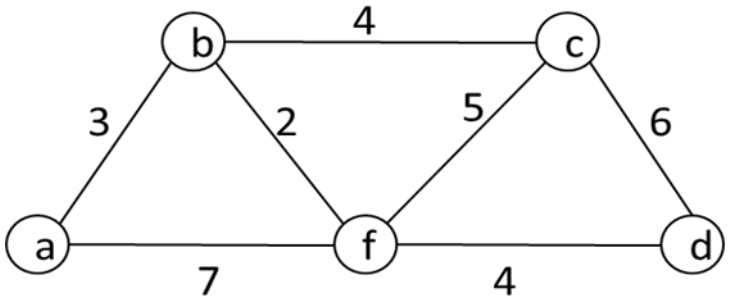
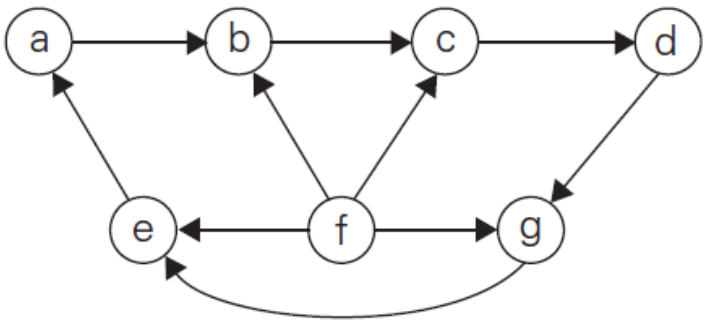
Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Explicate a general plan for analyzing the time efficiency of Nonrecursive algorithms. List the following functions according to their order of growth from the lowest to the highest: $(n-2)!$, $5 \lg(n+100)^{10}$, $0.001n^4 + 3n^3 + 1$, $\ln^2 n$, 3^n	*CO2*	*PO2*	**10**

	b)	Consider the algorithm given below and answer the questions that follow:
		ALGORITHM Enigma(A[0..n − 1, 0..n − 1])
		//Input: A matrix A[0..n − 1, 0..n − 1] of real numbers
		for i ←0 to n − 2 do
		for j ←i + 1 to n − 1 do
		if A[i, j] != A[j, i]
		return false
		return true
		i) What does this algorithm compute?
		ii) What is its basic operation?
		iii) How many times is the basic operation executed?
		iv) What is the efficiency class of this algorithm?
		v) Suggest an improvement, or a better algorithm altogether, and indicate its efficiency class. If you cannot do it, try to prove that, in fact, it cannot be done.
			CO2	*PO2*	**10**

		UNIT - II			
2	a)	Write the Selection Sort algorithm. Sort the list {E, X, A, M, P, L, E} in alphabetical order by selection sort.	*CO2*	*PO2*	**10**
	b)	Write Dijikstra's algorithm to find all the shortest paths from a given source vertex to all other vertices in a graph. Trace the following graph to get shortest path from vertex 'a' to all other vertices.	*CO3*	*PO3*	**10**

						
			OR			
3	a)	Write the quick sort algorithm. Apply the algorithm to sort the list {5, 3, 1, 9, 8, 2, 4, 7}.	*CO1*	*PO1*	**10**
	b)	Write the brute force string matching algorithm. Determine the number of character comparisons made by the brute-force string matching algorithm in searching for the pattern GANDHI in the text {THERE IS MORE TO LIFE THAN INCREASING ITS SPEED}. Assume that the length of the text is 47 characters long and is known before the search starts.	*CO2*	*PO2*	**10**
		UNIT - III			
4	a)	Apply Horspool's algorithm to search for the pattern BARBER in some text considering the following cases. i) No match at all ii) Match found but not with last character iii) Only last (1 or more) character is matching iv) Match found with last as well as with other characters	*CO3*	*PO3*	**12**
	b)	With suitable example, explain the depth first search and breadth first search algorithms.	*CO1*	*PO1*	**08**
		OR			
5	a)	Write an algorithm for breadth first search. Apply the DFS-based algorithm to solve the topological sorting problem for the following digraph. 	*CO2*	*PO2*	**08**
	b)	For the input {30, 20, 56, 75, 31, 19} and hash function h(K) = K mod 11 i) construct the open hash table. ii) find the largest number of key comparisons in a successful search in this table.	*CO2*	*PO2*	**08**

			iii) find the average number of key comparisons in a successful search in this table.			
		c)	Generate all permutations of the given set {3, 5, 7} using Johnson-Trotter algorithm.	*CO2*	*PO2*	**04**
			UNIT - IV			
	6	a)	Solve the all-pairs shortest-path problem for the digraph with the following weight matrix: $\begin{array}{c} \\ a \\ b \\ c \\ d \\ e \end{array}\begin{array}{c} \begin{array}{ccccc} a & b & c & d & e \end{array} \\ \begin{pmatrix} 0 & 2 & \infty & 1 & 8 \\ 6 & 0 & 3 & 2 & \infty \\ \infty & \infty & 0 & 4 & \infty \\ \infty & \infty & 2 & 0 & 3 \\ 3 & \infty & \infty & \infty & 0 \end{pmatrix} \end{array}$	*CO2*	*PO2*	**10**
		b)	Write the two-stage heapsort algorithm. Apply the same to sort the list {2, 9, 7, 6, 5, 8}.	*CO3*	*PO3*	**10**
			UNIT - V			
	7	a)	Write the decision tree for three-element selection sort.	*CO1*	*PO1*	**06**
		b)	Distinguish between P, NP and NP-Complete problems. Give example for each category.	*CO1*	*PO1*	**06**
		c)	Solve the following job assignment problem using branch and bound design technique. $\begin{array}{cccc} \text{job 1} & \text{job 2} & \text{job 3} & \text{job 4} \end{array}$ $\begin{bmatrix} 9 & 2 & 7 & 8 \\ 6 & 4 & 3 & 7 \\ 5 & 8 & 1 & 8 \\ 7 & 6 & 9 & 4 \end{bmatrix}$ person *a* person *b* person *c* person *d*	*CO2*	*PO2*	**08**

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