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RV COLLEGE OF ENGINEERING®

(Autonomous Institution affiliated to VTU)

IV Semester B. E. Fast Track ExaminationsJuly-19

Computer Science and Engineering

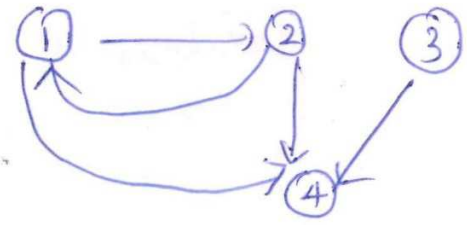
DESIGN AND ANALYSIS OF ALGORITHMS

Time: 03 Hours ***Maximum Marks: 100***

Instructions to candidates:

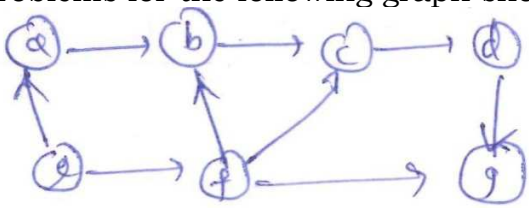
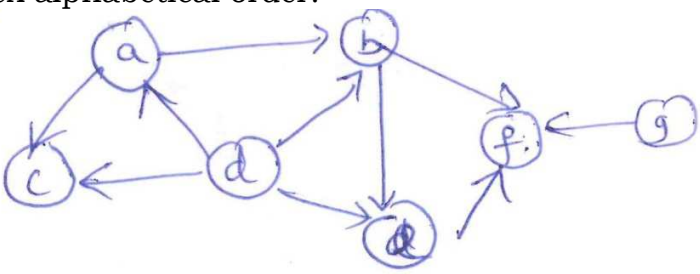
1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

PART A

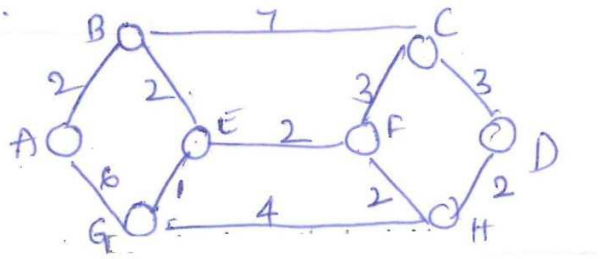
1	1.1	Prove that $\frac{1}{2}\, n\,(n-1) \in\ \theta(n^2)$.	02
	1.2	Apply Master's theorem to find the efficiency of $T(n) = 16T\left(\frac{n}{4}\right) + n$.	01
	1.3	Suppose there are four sorted list of eight elements each; if we merge these lists into a single sorted list of 32 elements. The key comparisons that are needed in worst case using an efficient algorithm are _____.	02
	1.4	The worst case and best case time complexity of insertion sort is _____ and _____ respectively.	01
	1.5	Define spanning tree.	02
	1.6	Compute good suffix table for the following pattern. $XYXAXYX$	02
	1.7	_____ data structure is suitable for representing sparse graphs.	01
	1.8	In the following directed graph shown in fig 1.8, identify back edge(s) and forward edge(s) if Depth-First-Search (DFS) starts at vertex 1.  Fig 1.8	02
	1.9	Differentiate between feasible solution and optimal solution.	02
	1.10	Compare and contrast dynamic programming and divide-and-conquer algorithm design techniques.	02
	1.11	Construct min-heap using bottom up approach for the following list if elements. $20, 100, 1, 25, 30, 40$	02
	1.12	Transformation of problem's instance to an instance of a different problem for which an algorithm is already available is called _____.	01

PART B

2	a	Explain asymptotic notations big O, big Omega and big Theta.	06
	b	Explain general plan of mathematical analysis of non-recursive algorithm.	06
	c	Illustrate mathematical analysis of recursive algorithm for Tower of Hanoi problem.	04

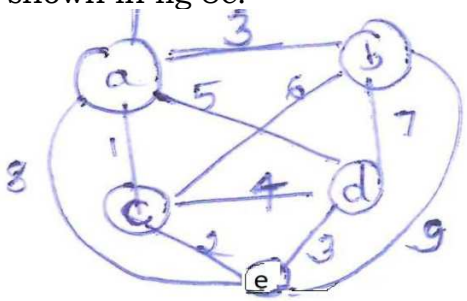
3	a	Apply merge sort to sort the list $M, E, R, G, E, S, O, R, T$ in alaphabetical order.	06
	b	Define topological ordering. Apply DFS based algorithm to solve the topological sorting problems for the following graph shown in fig 3b.  Fig 3b	06
	c	Write Johnson-Trotter algorithm for generating all permutations of a given n −element set.	04
		OR	
4	a	Traverse the following graph shown in fig 4a by Breadth-First-Search (BFS) and construct the corresponding Breadth-First-Search forest. Give the order in which vertices visited. Start the traversal at vertex $'a'$ and resolve ties by the vertex alphabetical order.  Fig 4a	06
	b	Write an algorithm for quick sort and discuss the efficiency.	10

5	a	Write an algorithm to compute mode in a given list of numbers using transform and conquer design technique and also give the efficiency of this algorithm.	06
	b	Write an algorithm for computing shift table entries used by Horspool algorithm. Apply Horspool's algorithm to search for the pattern $TCCTAT$ in the text $TTACATXYZTXCTATCCTATA$	10
		OR	
6	a	Write an algorithm for checking whether an array $H[1 \ldots n]$ is a heap and determine its efficiency.	07
	b	Construct a $2-3$ tree for the following list of elements. $7, 6, 5, 4, 3, 2, 1$	05
	c	Compare the efficiency of Brute-Force and Horspool string matching algorithm.	04

7	a	Apply Dijkstra's algorithm for the following graph shown in fig 7a to find shortest path by taking source vertex as $'a'$.  Fig 7a	06
	b	Solve the following instance of Knapsack problem using memory functions and indicate the entries of dynamic programming table that are retrieved without re-computing.	

Item	*Weight*	*Value*
1	2	\$10
2	1	\$6
3	3	\$12
4	2	\$6

		Knapsack capacity =06	06
	c	Explain how prefix free codes are used in variable length encoding.	04

8	a	Define the following: i) Class P ii) Class NP iii) NP complete.	03
	b	Using backtracking, obtain solutions to the subset sum problem by taking $S = \{ 6, 8, 2, 14 \}$ and $d = 16$.	06
	c	Apply branch & bound algorithm to solve the travelling salesman problem for the following graph shown in fig 8c.  Fig 8c	07