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RV COLLEGE OF ENGINEERING®

(An Autonomous Institution affiliated to VTU)

IV Semester B. E. Examinations April/May-19

Computer Science and Engineering

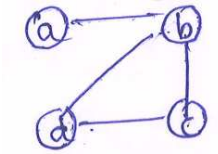
DESIGN AND ANALYSIS OF ALGORITHMS

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

Instructions to candidates:

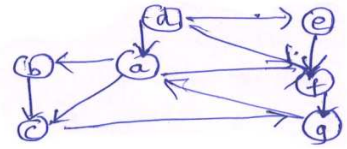
1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

PART A

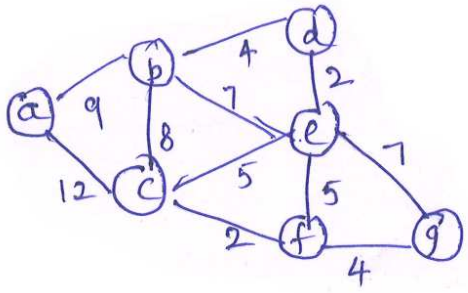
1	1.1	The maximum number of keys with height h (root is at height 0) in a 2 – 3 tree is given by _____.	01
	1.2	The running time of merge sort algorithm can be recursively represented by _____.	01
	1.3	Differentiate between promising and non-promising nodes of a state – space – tree.	01
	1.4	Define spanning tree.	01
	1.5	An algorithm has two phases. The first phase initialization takes time $0(n)$. The second phase which is the main computation takes time $0(n \log n)$. The complexity of the overall algorithm is _____.	01
	1.6	_____ algorithm can be used to find a path in a graph with the fewest number of edges between two given vertices.	01
	1.7	What is prefix – free code word of a character? Give example.	02
	1.8	Compute good suffix table for the pattern $P = 10000$	02
	1.9	Differentiate between dynamic programming and divide and conquer design technique.	02
	1.10	Write the principle idea of greedy design technique.	02
	1.11	Count the number of different paths of length 2 between each pair of vertices in the following graph using transform and conquer technique. 	02
	1.12	Solve the recurrence relation using backward substitution method. $T(n) = T(n-1) + n - 1 \quad n > 1$ $T(1) = 0 \qquad\qquad n = 1$	02
	1.13	Define NP-complete problems.	02

PART B

2	a	Explain asymptotic notations used in algorithm analysis.	06
	b	Write a recursive algorithm to find number of digits in the binary representation of a positive decimal integer. Analyze its efficiency.	06

	c	Prove the following assertions: i) $\frac{n(n-1)}{2} \in \theta(n^2)$ ii) $n^2 + 5n + 5 \in O(n^2)$	04
3	a	Compute $1234 * 2131$ by applying the divide and conquer algorithm.	06
	b	Write an algorithm to sort given set of elements using quick sort and give its efficiency.	07
	c	Is quick sort a stable algorithm? Give reasons.	03
		OR	
4	a	Write an algorithm to traverse the tree using DFS method. Apply the DFS algorithm to construct DFS forest for the graph shown in fig 4a. Indicate the type of each edge in the DFS forest  Fig 4a	10
	b	Apply the partition based algorithm to find the median of list of numbers: $28, 9, 32, 61, 20, 38, 7, 111, 35$	06
5	a	Let $A = \{a_1, \dots, a_n\}$ and $B = \{b_1, \dots, b_m\}$ be two sets of numbers. Consider the problem of finding their intersection i.e., the set C of all the numbers that are in both A and B. Design a pre-sorting based algorithm for solving this problem and compare the efficiency of this algorithm with the brute-force algorithm.	08
	b	Apply Boyer Moore algorithm to search for the pattern $P = GTATAT$ in the text $T = GTTBATATGTATGTGTAGTAGTATAT$	08
		OR	
6	a	Write an algorithm for checking whether an array $H[1 \dots n]$ is a heap and determine its efficiency.	06
	b	Construct a $2-3$ tree for the lsit: $A, L, G, O, R, I, T, H, M$. Use the alphabetical order of the letters and insert them successfully starting with the empty tree.	04
	c	Apply Horspool's Algorithm with example to explain how shift takes place based on the text characters when: i) Character is not in pattern ii) Character is in pattern (but not the right most) iii) The right most character do match.	06
7	a	Apply the memory function method to the following instance of the knapsack problem. $W = 6$	06

Item	*Weight*	*Values* (\$)
1	3	25
2	2	20
3	1	15
4	4	40
5	5	50

	b	Solve the following instance of the single – source shortest path problem with the vertex a as the source.  	06
	c	Write an algorithm to compute binomial coefficient using dynamic programming.	04
8	a	Draw a binary decision tree for binary search in a four element array.	03
	b	Apply backtracking method to solve the following instance of subset sum problem. $S = \{10, 5, 11, 6, 16\}$ and $d = 21$	06
	c	Apply the branch and bound algorithm to solve the following instance of job assignment problems. $C = \begin{bmatrix} Job1 & Job2 & Job3 & Job4 & \\ 5 & 7 & 11 & 6 & person\ a \\ 8 & 5 & 9 & 6 & person\ b \\ 4 & 7 & 10 & 7 & person\ c \\ 10 & 4 & 8 & 3 & person\ d \end{bmatrix}$	07