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RV COLLEGE OF ENGINEERING®

(An Autonomous Institution affiliated to VTU)

IV Semester B. E. Fast Track Examinations Oct-2020

Computer Science and Engineering

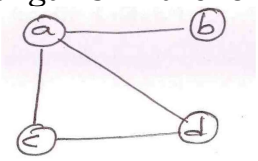
DESIGN AND ANALYSIS OF ALGORITHMS

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

Instructions to candidates:

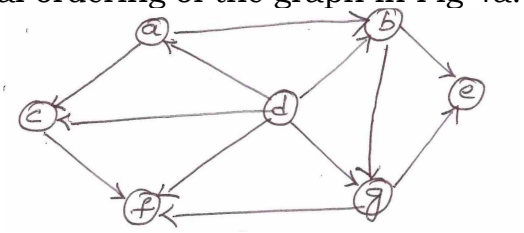
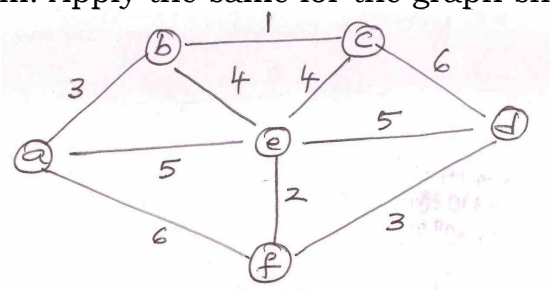
1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B.In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

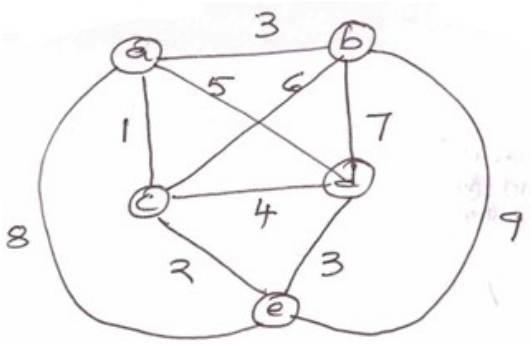
PART A

1	1.1	Arrange the following functions according to their order of growth from highest to lowest $3^n, \sqrt{n}, log_e{}^2 n, 5\log_{10}(n+10)^{100}, 2^{2n}, (n-2)!$	02
	1.2	Evaluate $T(n) = 4T\left(\frac{n}{2}\right) + n^3$ by master theorem.	02
	1.3	Compare and contrast DFS & BFS.	02
	1.4	On constructing a 2-3 tress for the list $10, 6, 9, 4, 3, 5, 8$. Identify the root node and its children.	02
	1.5	What does dynamic programming have in common with and differences from divide and conquer.	02
	1.6	State the basic operation in computing binomial coefficient $C(n,k)$ using dynamic programming. Write the recurrence along with base case to represent the number of times the basic operation gets executed.	02
	1.7	Find the number of paths of length 3 in the following graph. 	02
	1.8	How many character comparisons will be made by Horspool's algorithm in searching the following pattern's in the text of 1000 $A's$? a) $BAAAA$ b) $ABABA$	02
	1.9	Compare and contrast Backtracking & Branch and Bound.	02
	1.10	Construct a good suffix table for the pattern $BAGBAG$.	01
	1.11	Find the number of bits used to represent D in Huffman coding for the following data $Character$ | A | B | C | D $Probability$ | 0.1 | 0.4 | 0.2 | 0.3	01

PART B

2	a	Suggest a general plan for analyzing the efficiency of a recursive algorithm. Write a recursive algorithm to count the number of binary digits for a given number. Analyze it mathematically based on the plan suggested above.	08

	b	If $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$ Prove that $t_1(n) + t_2(n) \in O(\max(g_1(n), g_2(n)))$	04
	c	Write the sieve of Eratosthenes algorithm for generating prime numbers upto n (Where n is a positive integer ≥ 2)	04
3	a	Design an algorithm to merge two sorted arrays. Discuss about the efficiency of merge sort.	06
	b	Write the pseudocode of insertion sort. Trace the algorithm for the list. $E\ X\ A\ M\ P\ L\ E$	06
	c	Compute the median for the given set of elements using decrease and conquer $4, 1, 10, 9, 7, 12, 8, 2, 15$	04
		OR	
4	a	Write the pseudocode of the DFS traversal. Apply DFS based algorithm to perform the topological ordering of the graph in Fig 4a.  Fig 4a	06
	b	Design an algorithm for generating permutations using the method suggested by Johnson Trotter. Trace the above for $n = 4$.	06
	c	Compute 236×1234 using divide and conquer.	04
5	a	Write the pseudocode for the bottom-up heap construction. Trace the above algorithm for the list $1, 8, 6, 5, 3, 7, 4$	06
	b	Design Horspool algorithm and trace it to search a pattern $BAOBAB$ in a text $BESS\_KNEW\_ABOUT\_BAOBAB$. Show total number of comparisons made.	06
	c	Construct a 2-3 tree for the following elements: $A\ L\ G\ O\ R\ I\ T\ H\ M$	04
		OR	
6	a	Construct a max-heap using top down approach for the elements $14, 12, 9, 8, 7, 10, 18$. Apply heap sort for the same.	06
	b	Apply Boyer Moore's algorithm to find the pattern AT_THAT in the text $WHICH\_FINALLY\_HALTS\_RVCE\_AT\_THAT$	06
	c	Define a 2-3 tree with an example. Comment about the efficiency of performing insertion operation in a 2-3 tree	04
7	a	Write prim's algorithm. Apply the same for the graph shown in fig 7a  Fig 7a	06

	b	Solve the following instance of the knapsack problem using dynamic programming capacity of knapsack $W = 5$ $Item$ | $Weight$ | $Value$ 1 | 2 | 12 2 | 1 | 10 3 | 3 | 20 4 | 2 | 15	06
	c	Design an algorithm to compute $6C_5$ or $C(6,5)$	04
8	a	Design a backtracking algorithm to solve the sum of subset problem. Apply the same for the inputs. $S = \{2, 3, 5, 6, 7\}$ $d = 10$	08
	b	Apply branch and bound technique to solve the travelling salesman problem(TSP) for the instance given below in fig 8b  Fig 8b	08