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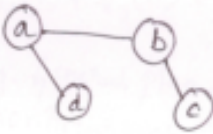
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RV COLLEGE OF ENGINEERING®
 (An Autonomous Institution affiliated to VTU)
 IV Semester B. E. Examinations Oct/Nov – 2022
 COMMON FOR CSE/ISE
DESIGN AND ANALYSIS OF ALGORITHMS

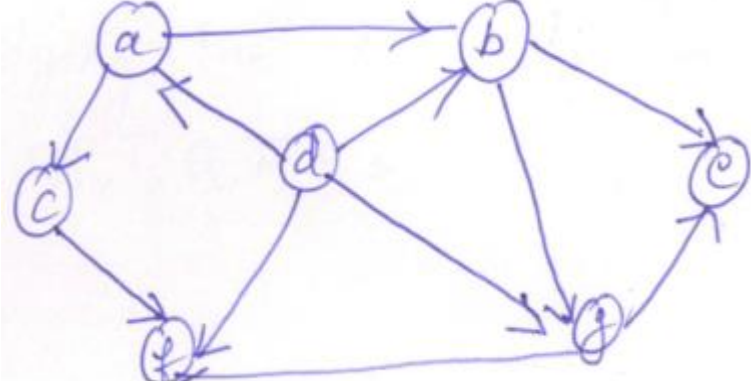
*Time: 03 Hours**Maximum Marks: 100***Instructions to candidates:**

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	Solve $T(n) = 3T(n/3) + n/2$ using master theorem.	02
	1.2	What is the time and space complexity of the following code: Int a=0, b=0; for(i=0;i<N;i++) { a=a+rand();} for(j=0;j<M;j++) { b=b+rand();}	02
	1.3	If the height of 2-3 tree is 3 (root is at height 0), then what will be the maximum number of elements the tree can have?	02
	1.4	How many character comparisons are done while searching a pattern COVID_VIRUS in the text YEAR_2020_CLRS_COVID_VIRUS using horspool algorithm.	02
	1.5	Applying insertion sort on the list 10,7,8,9,4,2 to sort the elements in ascending order, the resultant list after the iteration is _____	02
	1.6	Identify the articulation points in a given graph Fig 1.6. <div style="text-align: center;">  </div> <p style="text-align: center;">Fig 1.6</p>	02
	1.7	Construct max heap by using top down approach from the list 12 11 8 10 4 16	02
	1.8	Using Huffman encoding technique, the average length of each character is found to be 3.6 bits, what is the number of bits used to represent 100 characters.	02
	1.9	Polynomial time complexity problems are known as _____	01
	1.10	The DFS traversal is equivalent to the _____ traversal in the binary trees.	01
	1.11	In a state space tree, if a node has a possibility of reaching a solution, then it is termed as _____	01
	1.12	What is the time complexity of floyd's all pairs shortest path algorithm?	01

PART-B

2	a	Prove the theorem If $f_1(n) \in O(g(n))$ & $f_2(n) \in O(g_2(n))$ then $f_1(n) + f_2(n) \in O(\max\{g_1(n), g_2(n)\})$	08
	b	Apply general plan for analyzing time efficiency of non-recursive algorithm to find products of two n - by - n matrices A and B.	08
3	a	Write a merge sort algorithm and discuss its efficiency. Sort the list 38, 27, 43, 3, 9, 82, 10 in ascending order.	10
	b	Demonstrate the basic idea of strassen's matrix multiplication with an aid of an example.	06
OR			
4	a	Compare DFS and BFS with respect to the following: i. Data structures ii. No. of vertex ordering iii. Efficiency iv. Edge types	08
	b	Apply topological sort algorithm using DFS method for the following graph given in Fig 4b and analyze its time complexity.	
			08
		Fig 4b	
5	a	Construct 2-3 tree for the list INFORMATION. (use the alphabetical order of the letters and insert them successively starting with the empty tree)	06
	b	Write an algorithm to construct the heap using bottom-up approach and analyze its time complexity.	06
	c	Consider the problem of finding the smallest and largest elements in an array of n numbers. i. Design a presorting based algorithm for solving this problem and determine its efficiency class. ii. Compare the efficiency of the two algorithms: the brute force algorithm and this presorting based algorithm.	04
OR			
6	a	The possible list of values is [P,Q,R,S,T], sort the following list in alphabetical order by applying the distribution counting algorithm R,S,P,T,Q,T,P,S,R,Q,S.	08
	b	Apply input enhancement technique for the pattern SKMASK and find the occurrence of this pattern in the text STAY_SAFE_WEASKSKMASK by using Boyer Moore algorithm. Write the total number of character comparison done.	08

7	a	Write prims algorithm to find minimum spanning tree and analyze its time complexity.	05
	b	Write Dijkstra's algorithm to find the shortest path and analyze its time complexity.	06
	c	Solve the following Knapsack instance using dynamic programming technique: $n=5, \{w_1, w_2, w_3, w_4, w_5\} = \{2,4,1,3,2\}$ $\{P_1, P_2, P_3, P_4, P_5\} = \{12, 15, 18, 20, 15\}$ and capacity of knapsack is 6.	05
8	a	Generate state space tree for 4-queens problem by backtracking and indicate all possible solutions.	06
	b	Illustrate with an example the solution to traveling salesman problem using branch and bound design technique.	06
	c	Compare P, NP and NP complete problems.	04