RV COLLEGE OF ENGINEERING
Autonomous Institution affiliated to VTU
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
I Semester M.Tech. (Computer Science and Engineering)
June -2023 Examinations

COURSE TITLE Advanced Data Structures and Algorithms
COURSE CODE 22MCE12TL

(2022 SCHEME)
(Integrated Course – Lab + Theory)

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

Instructions to candidates:

1. Each unit consists of two questions of 16 marks each.
2. Answer FIVE full questions selecting one from each unit (1 to 5). Question No.11 lab component (compulsory).

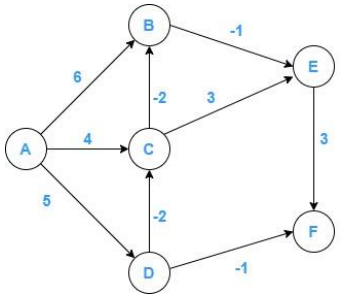
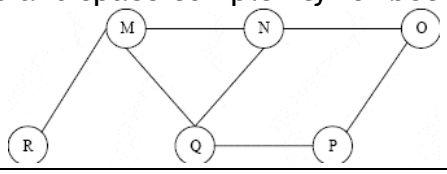
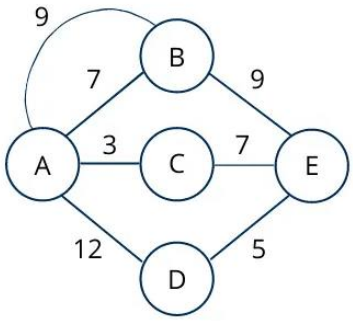
UNIT-I			
1	a	Solve the following recurrence relation to find the time complexity by using iterative method: $Tn = Tn-1 + n \quad for\ n>1$ $Tn=1 \quad for\ n=1$	08
	b	Apply an appropriate suitable stable sorting algorithm to sort in ascending order, the below given numbers and discuss the time and space complexity taken by the algorithm. Input data: 455, 61, 63, 45, 67, 135, 74, 49, 15, 5	06

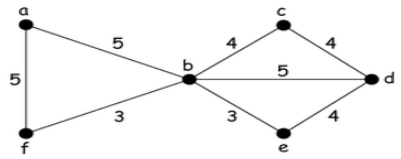
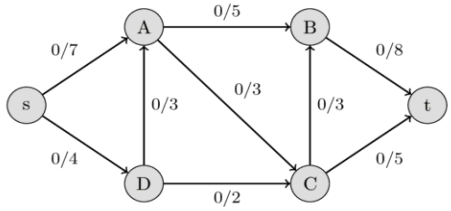
	c	What does the following code fragment do to the queue q?
		Stack<String> s = new Stack<String>();
		while(!q.isEmpty())
		s.push(q.dequeue());
		while(!s.isEmpty())
		q.enqueue(s.pop());
			02

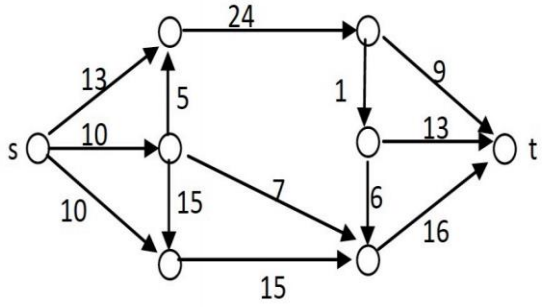
		OR	
2	a	Write an algorithm to implements the following, using suitable ADT. Reads in sequence of left and right parentheses, braces, and brackets from standard input and uses a stack to determine whether the sequence is properly balanced.	08

		For example, your program should print true for [()]{}{[()()]()} and false for [(]).	
	b	Apply an appropriate suitable stable sorting algorithm to sort in ascending order, the below given numbers and discuss the time and space complexity taken by the algorithm. 11, 9, 21, 8,17, 19, 13, 1, 24, 12.	06

	c	What does the following code fragment print when n is 50? Give a high-level description of what it does when presented with a positive integer n.
		`Stack<Integer> s = new Stack<Integer>();`
		`while (n > 0) {`
		`  s.push(n % 2);`
		`  n = n / 2;`
		`}`
		`while (!s.isEmpty())`
		`  System.out.print(s.pop());`
		`  System.out.println();`
			02

		UNIT-II	
3	a	Solve using Bellman-Ford Algorithm. Calculate the time complexity for the algorithm. 	06
	b	Perform BFS and DFS on the following graph and list the order of the nodes visted. Mention the time and space complexity for both BFS and DFS 	06
	c	Solve the below given problem by applying Kruskal's Algorithm to find the Minimum Spanning Tree. Calculate the time complexity for the algorithm. 	04
		OR	

4	a	Solve the below given problem by applying Prim's Algorithm to find the Minimum Cost Spanning Tree. Calculate the time complexity for the algorithm. 	06
	b	Calculate the max flow for the following network 	10
UNIT-III			
5	a	Discuss the Structure of Fibonacci heaps with a suitable example. Illustrate the following operations on the Fibonacci heaps (i) Decreasing a key (ii) Deleting a node	10
	b	Apply the Randomized Quicksort algorithm for the following data and perform sorting on it. 102, 100, 99, 86, 35, 25	06
		OR	
6	a	Explain the working of Miller-Rabin Primality Test by taking a suitable example.	10
	b	Apply Miller-Rabin Algorithm using base 2 to test whether the number 341 is composite or not.	06
UNIT-IV			
7	a	Illustrate with an example the following operations on Trie data structure and discuss the time complexity on performing the following operations: (i) Search (ii) Insert	10
	b	Discuss the advantages of Trie Datastructure with Hash tables	06
OR			
8	a	Explain the working of Double Hashing with a suitable example.	10
	b	With respect to Hash Table T, solve the following: (i) Calculate the Load factor (α) for the hash table T, with 25 slots that	06

		stores 2000 elements. (ii) Draw a hash table with chaining and a size of 9. Use the hash function "k%9" to insert the keys 5, 29, 20, 0, and 18 into your table.	
		UNIT-V	
9	a	Apply Rabin Karp algorithm and search for the Pattern in the Text. Discuss the time complexity of the algorithm. Text: 81238927897896 Pattern:896	10
	b	Generate the failure function or the π table for the patterns Pattern1: ababcabab Pattern2: abyabcabcabaabb	06
		OR	
10	a	Apply KMP algorithm and search for the Pattern in the Text. Discuss the time complexity of the algorithm. Text: ababcabcababa Pattern: abab	10
	b	Find the edit-distance values using minimum edit distance algorithm to convert the string "Hello World" to "Hello RVCE"	06
LAB COMPONENT			
11	a	Using suitable Abstract Data Types (ADTs) perform the following tasks: (i) Reverse the contents of a List using List ADT. (ii) Use dictionary ADT to count the number of occurrences of each word in an online book.	10
	b	Consider the electricity network as the graph shown below with utility poles as the different nodes in the graph. Calculate the maximum electricity that could be sent over the network without affecting the power grid. Use appropriate algorithm to solve the problem. 	10