RV COLLEGE OF ENGINEERING®
(An Autonomous Institution affiliated to VTU, Belagavi)
I Semester Master of Technology (Computer Science and Engineering)
ADVANCED DATA STRUCTURES AND ALGORITHM

Time: 03 Hours   Maximum Marks: 100
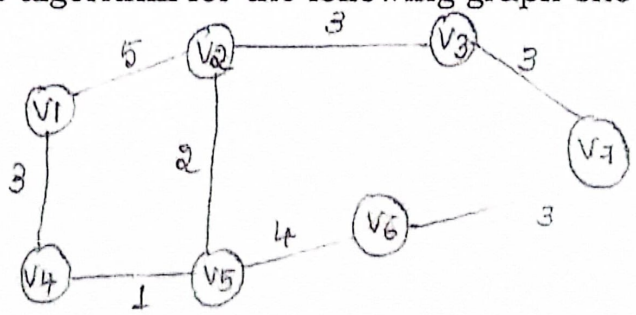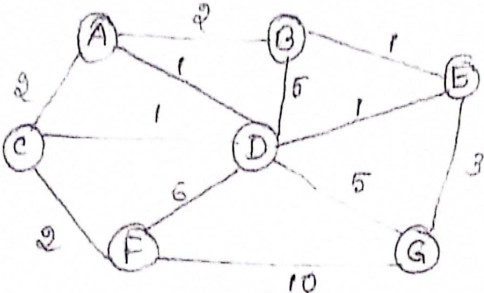
Instructions to candidates:
1. Each unit consists of two questions of 16 marks each.
2. Answer FIVE full questions selecting one from each unit (1 to 5).
3. Question 11 is mandatory and carries 20 marks.

UNIT-1

1	a	Explain stack *ADT* and its operations.	08
	b	Sort the following list using Bucket sort and also analyze its time efficiency.	
		66, 33, 40, 20, 50, 88, 60, 11, 77, 30, 45, 65.	08

OR

2	a	With an example, apply Radix sort algorithm to sort the numbers in descending order write an algorithm for the same and discuss its time efficiency.	08
	b	Find the time complexity of the following code in Big-Oh notation.	

i) $function\ (int\ n)$	ii) $void\ function\ (int\ n)$
$\{if\ (n == 1)return;$	$\{$
$for\ (int\ i = 1; i \leq n; i++)$	$int\ i = 1, s = 1;$
$\{for\ (int\ j = 1; j \leq n; j++)$	$while\ (s \leq n)$
$\{printf("*");\ break;$	$\{$
$\}$	$i++;$
$\}$	$s += i;$
	$printf("*");$
	$\}$
	$\}$

08

UNIT-2

3	a	Give Ford Fulkerson method for solving the maximum flow problem. With an example, show the residual network of a graph.	08
	b	Differentiate depth-first search and breadth-first search traversal of a graph with suitable examples.	08

OR

4	a	Illustrate Krukal's algorithm to find the minimum spanning tree of a graph. Trace the algorithm for the following graph shown in Fig. 4.a.	08

Fig 4a

	b	Apply prim's algorithm to compute a minimum cost spanning tree for the following graph in Fig. 4.b. $O(n+m)$	

Fig. 4.b

08

UNIT-3

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: $10, 2, 5, 6, 20, 9$. Discuss its efficiency in best, worst and average cases. (nlog n)	06

OR

6	a	Explain the Miller-Robin primality testing algorithm and how it determines whether a given number is prime or composite? Provide a step-by-step explanation of the algorithm, including the necessary computations.	08
	b	Check if the number 91 is prime using Miller-Robin primality testing algorithm.	08

UNIT-4

7	a	Given input $\{4371, 1323, 6173, 4199, 4344, 9679, 1989\}$ and a hash function $h(X) = X(mod\ 100)$, show the resulting:
		   i) Chaining
		   ii) Linear probing
		   iii) Quadratic probing.
			10

	b	Explain the technique of 'Hashing' as an effective searching technique. What are 'collisions'? How can they be handled?	06

OR

8	a	Differentiate between linear probing, quadratic probing, double hashing and Rehashing techniques with example. Consider the following hash table with the current status and $hash\ key = key\%11$. Explain the situation what happens when going to insert next key element 87 using linear probing method and rewrite the hash table.	

Index	Value
0	43
1	
2	46
3	25
4	36
5	
6	
7	18
8	29
9	
10	10

10

b | Explain Trie data structure with an example. List Trie implementation strategies. 06

UNIT-5

| 9 | a | Construct the Rabin-Karp matcher algorithm. Apply the algorithm when $T = 314152$, $p = 31415$, $d = 10$ and $q = 13$. | 10 |
| | b | Explain Naïve String matching algorithm with an example. | 06 |

OR

| 10 | a | Apply Knuth-Morris-Pratl (KMP) algorithm and search if or the pattern in the text. Discuss the time complexity of the algorithm
Text: ababcabcababa
Pattern: abab | 10 |
| | b | Generate the failure function or the π table for the patterns
Pattern1: ababcabab
Pattern2: ababcabcabaabb | 06 |

| 11 | a | Write the pseudocode for swapping the contents of adjacent nodes in a linked test. | 10 |
| | b | Write a program to illustrate reverse the contents of a stack using suitable ADT's. | 10 |