USN | | | | | | | | | | |

RV COLLEGE OF ENGINEERING®

(An Autonomous Institution affiliated to VTU)

V Semester B. E. Examinations Nov/Dec-19

Computer Science and Engineering

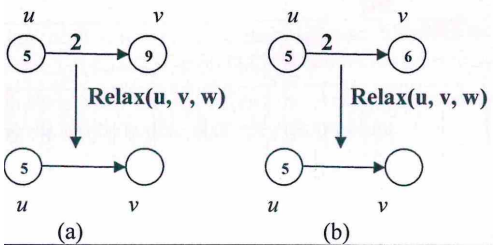
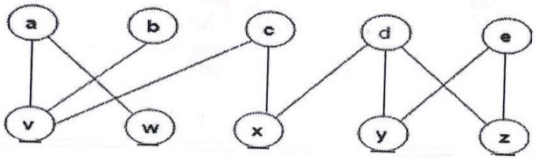
ADVANCED ALGORITHMS (ELECTIVE)

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

Instructions to candidates:

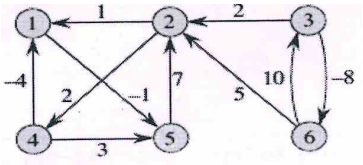
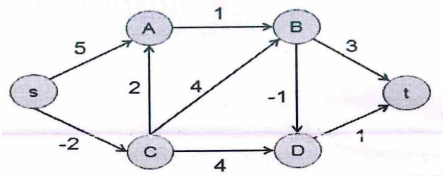
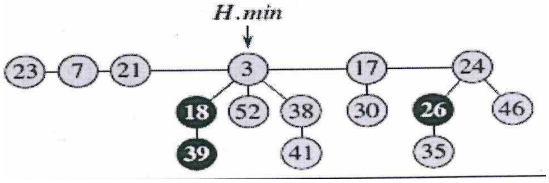
1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

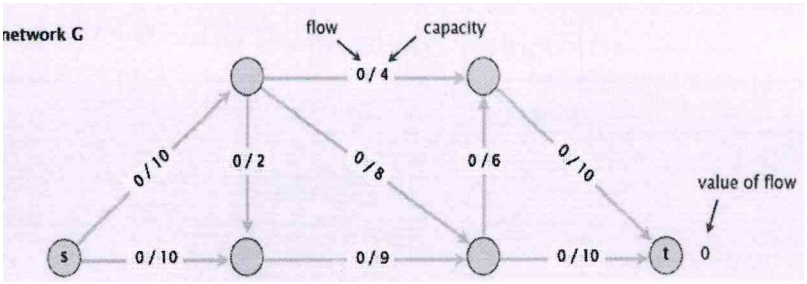
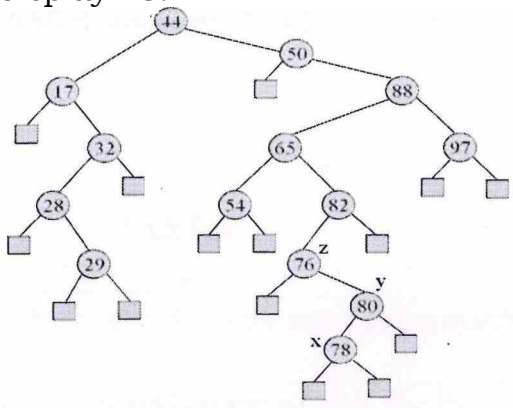
PART-A

1	1.1	What is the worst case time complexity of the Naïve string matching algorithm? Write the worst case scenario example.	02
	1.2	Give a tight asymptotic upper bound on the solution for the following recurrence using master method. $T(n) = 2T(n/8) + \sqrt[3]{n}$.	02
	1.3	Write the Relax function and also find the value of v in the given Fig. 1.3 after using the relax function  Fig. 1.3	02
	1.4	Given the string $T = \{123456\}$ and assume that $m = 3$. Numerical value t_0 is 123. Write the recursive formula and compute the remaining values of t_s, for $s = 1,2,3$.	02
	1.5	Consider the recurrence $T(n) = 2T(n/2) + cn$, the height is _____, no of levels is _____ and the total cost is _____.	02
	1.6	Find the GCD of 621 and 483 using Euclid's method.	01
	1.7	In Johnson's algorithm, the two important properties to be satisfied for the new set of edge weights w' are:	02
	1.8	Find $13^{-1}\ mod\ 5$.	01
	1.9	From the given graph in Fig. 1.9, how many vertices may be matched using maximum matching in bipartite graph algorithm?  Fig. 1.9	01
	1.10	The composite number which fails Fermat's test is _____.	01
	1.11	Compute the point-value representation for the given polynomial $8x^3 - 6x + 3$.	02

	1.12	What is the number of elements in Z_{14}^*, solve using Euler's phi function $\emptyset(14)$.	01
	1.13	The residual capacity $C_f(u,v) =$ _____, if $C(u,v) = 16, f(u,v) = 5$.	01

PART-B

2	a	Solve the following recurrence using Master Theorem, also state which case is applicable. $T(n) = 5T(n/3) + n\,logn$.	05
	b	Solve the following recurrence using a recursion tree method. Show the recursion tree and discuss how you obtained the solution from the tree. $T(n) = 4T(n/2) + n^2$.	06
	c	Suppose we perform a sequence of n operations on a data structure in which the i^{th} operation costs i, if i is an exact power of 2, and 1 otherwise. Use aggregate method of analysis to determine the amortized cost per operation.	05
3	a	Write Knuth-Morris-Pratt algorithm to compute the prefix function and also compute the prefix function π for the pattern $ababbabbabbababbabb$.	08
	b	Use Johnson's algorithm to find the shortest path between all pairs of vertices in the graph shown in Fig. 3.b. Show the values of h and w' computed by the algorithm.  Fig. 3.b	08
		OR	
4	a	Working modulo $q = 11$, how many spurious hits does the Rabin-Karp matcher encounter in the text $T = 6388238496038257$ when looking for the pattern $P = 38$?	08
	b	Demonstrate with an algorithm, the working procedure Bellman-Ford algorithm for solving single source shortest path problem for the graph shown in Fig. 4.b  Fig. 4.b	08
5	a	Define Fibonacci heap. Write an algorithm to extract minimum node from the Fibonacci heap. Using above algorithm, delete the minimum key for the given graph shown in Fig. 5.a and consolidate it.  Fig. 5.a	08

	b	Apply Ford Fulkerson algorithm to compute the maximum network flow for the given graph G shown in Fig. 5.b with s as source and t as sink nodes  Fig. 5.b	08
		OR	
6	a	Construct a red-black tree by inserting these nodes in the following order: $10, 85, 15, 70, 20, 60, 30, 50, 65, 80, 90, 40, 5, 55$.	08
	b	What are splay trees? Perform the splay operations on the given tree shown in Fig. 6.b to splay 78.  Fig. 6.b	08
7	a	Demonstrate with procedure, the extended form of Euclid's algorithm for the given equation $d = \gcd(a, b) = ax + by$. Also illustrate how $EXTENDED - EUCLID$ computes $gcd(81,57)$.	05
	b	Find all solutions to the equations $a \equiv 2(mod\ 5) and\ a \equiv 5(mod\ 13)$.	05
	c	Consider an RSA key set with $p = 53, q = 59$. What value of d should be used in the secret key? What is the encryption of the message $M = 89$?	06
8	a	Investigate the two ways of representing polynomials.	05
	b	Characterize the pseudocode for recursive FFT algorithms.	05
	c	Discuss butterfly operation. Show how to perform the operation on two input values.	06