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RV COLLEGE OF ENGINEERING®

(An Autonomous Institution affiliated to VTU)

V Semester B. E. Fast track Examinations Oct-2020

Computer science Engineering

ADVANCED ALGORITHMS (ELECTIVE)

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

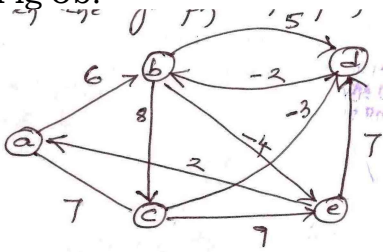
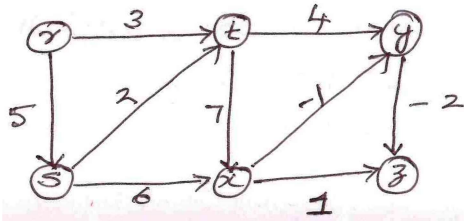
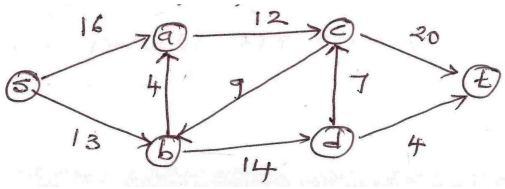
Instructions to candidates:

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	On solving the recurrence $T(n) = T\left(\frac{2n}{3}\right) + 1$, compute the time complexity.	01
	1.2	Name the two algorithm combinations from which the Johnson's algorithm is derived?	01
	1.3	The composite numbers which fails Fermat's test are called _____.	01
	1.4	State the running time of the Johnson's algorithm used in finding the shortest path.	01
	1.5	Complex roots of unity can be evaluated and interpolated polynomials in _____ time.	01
	1.6	If n denotes the size of the text and m denotes the size of the pattern, what is the time taken to construct the prefix table in KMP string matching algorithm.	01
	1.7	Find the total number of nodes at level 3 in a binomial tree B_3. (Assume root to be at level 0).	02
	1.8	What is the running time to merge two binomial heaps of order (size) m and n?	02
	1.9	In table doubling, to store 56 elements how many tables need to be dynamically allocated?	02
	1.10	In Rabin-karp string matching algorithm, how many non-spurious hit will occur, while find the occurance of the pattern 26 in the text 3141592653589726 with the working modulo $q = 11$.	02
	1.11	In finite automata based string matching, what is the value of the transition functions $\delta(2, d)$ and $\delta(3, a)$ for the input Text:$aabaabadaba$ Pattern: $bada$	02
	1.12	The residual capacity of an augmenting path P is given by _____.	02
	1.13	State the halving lemma used in complex nth roots of unity.	02

PART-B

2	a	Suppose we perform a sequence of n operations on a data structure in which the i^{th} operation costs i, if $(i-1)$ is an exact power of 2 and 1 otherwise. Determine the amortized cost per operation using aggregate analysis.	08
	b	Using recursion tree method, solve the following recurrence. $T(n) = 3T\left(\frac{n}{2}\right) + n^2$	08
3	a	Discuss Finite Automata based string matching. Also, write the transition table (δ) for the pattern: *ababaca*, while searching it in the text : *abababacaba*. Trace the algorithm for the input given.	08
	b	Write an algorithm to find the shortest path using Bellman-ford , find the shortest path from the source vertex '*a*' to the remaining vertices in the graph shown in Fig 3b.  Fig 3b	08
		OR	
4	a	Write an algorithm to find the single source shortest paths in DAG. Trace the algorithm for the graph given in Fig 4a [S as source].  Fig 4a	08
	b	Write and discuss the Rabin Karp string matching algorithm with an example.	08
5	a	Write and apply Ford-Fulkerson algorithm for the graph given in Fig 5a.  Fig 5a	
	b	With a proper example, explain the pseudo code for performing the left-Rotate on red black trees.	08
		OR	
6	a	Write a note on the following: i) Skip list ii) Bipartite maximum matching.	08

	b	Define Fibonacci heap. Write an algorithm to extract minimum node from the Fibonacci heap.	08
7	a	Find all integers that leave remainders 4,6 and 8 when divided by 5,8 and 9 respectively using Chinese remainder theorem.	08
	b	With an algorithm discuss how to solve the equation $ax \equiv b(mod\ n)$. Apply the same to solve $14x \equiv 30(mod\ 100)$.	08
8	a	Write the recursive FFT algorithm and determine the recurrence for the run time of the procedure.	08
	b	Draw the parallel FFT circuit which computes the FFT on n inputs for $n = 8$.	08