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# RV COLLEGE OF ENGINEERING®
### (An Autonomous Institution affiliated to VTU)
### VSemester B. E. Fast Track ExaminationsJuly-19
## Computer Science and Engineering
# ADVANCED 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 | Name the algorithm design technique used in Bellman ford algorithm. | 01 |
|---|---|---|---|
| | 1.2 | When an sorted array is given the running time of insertion sort is _____. | 01 |
| | 1.3 | Mention the data structure used in Edmonds Corp algorithm used to find the augmenting path. | 01 |
| | 1.4 | The composite numbers which fails Fermat's test are called_____. | 01 |
| | 1.5 | Name the algorithm where in reweighting is used while finding the shortest path. | 01 |
| | 1.6 | What is depth of the parallel FFT circuit for n inputs? | 01 |
| | 1.7 | What are Carmichael numbers? | 02 |
| | 1.8 | Compute the total number of nodes in a binomial tree $B_4$ | 02 |
| | 1.9 | In amortized analysis, what will be the cost of insertion of the $6^{th}, 5^{th}, 12^{th}$ and $9^{th}$ insertion into a dynamic table respectively. | 02 |
| | 1.10 | In KMP string matching algorithm the value of the prefix table ($\pi$) for the pattern ababaca is ___. | 02 |
| | 1.11 | In finite automata based string matching what is the value of the following transition function $\delta(2, b)$ and $\delta(4, a)$ for the following:<br>Text:abababacaba<br>pattern: ababaca | 02 |
| | 1.12 | State Max-flow and min-cut theorem. | 02 |
| | 1.13 | State the cancellation Lemma used in complex $n^{th}$ roots of unity. | 02 |

## PART B

| 2 | a | Use recursion tree method to determine a good asymptotic upper bound on the recurrence $$T(n) = 3T\left(\frac{n}{3}\right) + C_n$$ | 08 |
|---|---|---|---|
| | b | Discuss the aggregate analysis and potential function method on performing a sequence of n increment operations in a binary counter. | 08 |
| 3 | a | Explain the Rabin-Karp string matching algorithm working module q=11, how many spurious hits does the Rabin-karp matcher encounter for the Text T=3141592653589793,when looking for the pattern p=2 6? | 08 |

| | b | Write an algorithm for finding the all-pair shortest path for a sparse graph. Find the time complexity. | 08 |
|---|---|---|---|
| | | **OR** | |
| 4 | a | Write an algorithm for finding the single source shortest paths in DAG. Trace the above algorithm for the graph shown in Figure 4a, considering r as the source vertex. | |
| | |  Fig 4a | 08 |
| | b | Write an algorithm to compute the prefix function in KMP string matching. Compute the prefix table for the following inputs: Text: 001001002000l002012200 pattern: 00100201 | 08 |

| 5 | a | Discuss the insertion operations on a red-black tree. Build a red-black tree for the given set of elements 10,20,-10,15,17,40,50,60. | 08 |
|---|---|---|---|
| | b | Discuss and apply Ford-Fulkerson algorithm for the graph given in Fig 5b. | |
| | |  Fig 5b | 08 |
| | | **OR** | |
| 6 | | Write Short note on the following: <br> i. Fibonacci leap <br> ii. Skip-List <br> iii. Cuts of flow networks. <br> iv. Bipartite Maximum matching. | 16 |

| 7 | a | Explain RSA public key cryptosystem. Now consider an RSA key set with p=11,q=3 and e=3. What value of d should be used as the secret key? What is the encryption of the message m=7. | 08 |
|---|---|---|---|
| | b | Illustrate modular exponentiation procedure to compute $a^c \bmod n$, as c is increased by doublings and incrementation from 0 to b. Apply the same for the input a=7,b=560 and n=561. | 08 |

| 8 | a | Draw the parallel FFT circuit which computes the FFT on n inputs for n=8. | 08 |
|---|---|---|---|
| | b | With an algorithm, discuss iterative FFT implementation. | 08 |