**16CS5A4**

**USN** | | | | | | | | | | |

# R. V. COLLEGE OF ENGINEERING

**Autonomous Institution affiliated to VTU**

**V Semester B. E. Examinations Nov/Dec-18**

## Computer Science and Engineering

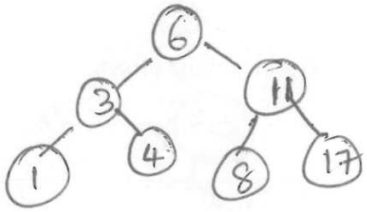
## ADVANCED ALGORITHMS (ELECTIVE)

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

***Instructions to candidates:***

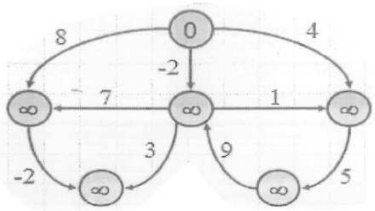
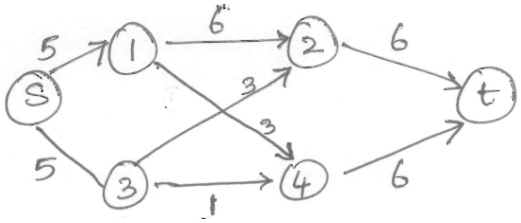
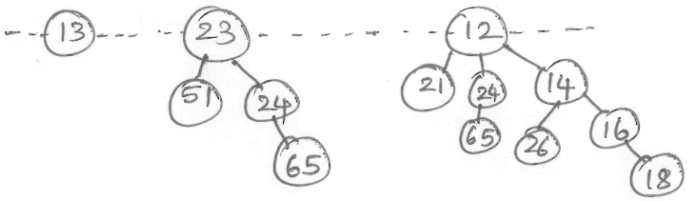
1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B.In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

**PART-A**

| | | | |
|---|---|---|---|
| 1 | 1.1 | For any two functions $g(n)$ and $f(n)$, if $f(n) = 3n + 2$ then prove that $f(n) = \Theta(g(n))$. | 02 |
| | 1.2 | Apply extended Euclid's algorithm to compute the values of $(d, x, y)$ for $(850, 360)$ numbers. | 02 |
| | 1.3 | Mention the different algorithm applied in Johnson's algorithm. What is the complexity of Johnson's algorithm? | 02 |
| | 1.4 | Apply Master theorem to solve the following equations<br>a) $T(n) = \sqrt{2}\,T(n/2) + log\ n$<br>b) $T(n) = 2T(n/4) + n^{0.51}$ | 02 |
| | 1.5 | List the properties that must be satisfied by a finite group $(S, \oplus)$ where $S$ is a set with binary operation $\oplus$ defined on $S$. | 02 |
| | 1.6 | Write the Euclid's Algorithm. | 02 |
| | 1.7 | Working with modulo $q = 11$, how many spurious hits does Rabin karp matcher encounter in the $T: 3141592653526$ and $P: 26$. | 02 |
| | 1.8 | Perform operation find (4) in the given splay tree   | 02 |
| | 1.9 | Find $DFT$ for vector $(2, 3)$. | 02 |
| | 1.10 | The composite numbers which fails Fermat's test are called _____. | 01 |
| | 1.11 | The iterative $FFT$ implementation runs in _____ time. | 01 |

**PART-B**

| | | | |
|---|---|---|---|
| 2 | a | Verify using substitution method the tiem complexity of recurrence relation $T(n) = T(n/3) + T(2n/3) + n\ is\ O(n \log n)$. | 06 |
| | b | Solve the following recurrence relation using recursion tree method. $T(n) = 3T(n/4) + cn^2$ | 06 |
| | c | Apply potential method of amortized cost analysis to compute total amortized cost for incrementing binary counter algorithm. | 04 |
| | | | |
| 3 | a | Construct a finite automation to match pattern $ababcab$ over alphabet $\Sigma = \{a, b, c\}$. Match the given pattern in test $T: c\ a\ a\ b\ a\ a\ b\ c\ a\ b\ a\ b\ a\ b\ c\ a\ b\ a\ b\ c\ a\ b$. | 08 |

| | | | |
|---|---|---|---|
| | b | Apply Bellman Ford algorithm to compute the shortest paths for graph given below.<br>  <br> | 08 |
| | | **OR** | |
| 4 | a | Define reweighting technique in Johnson's Algorithm. Prove how the shortest path property is preserved during reweighting. | 06 |
| | b | Trace the Knuth Morris Pratt string matching algorithm for the given text and pattern. $T$: "$ABABABCDABABCDABCACABABABC$" $P$: $ABCDABCA$. | 06 |
| | c | Discuss pseudo code for the Rabin-karp string matching algorithm. | 04 |
| | | | |
| 5 | a | Apply Ford Fulkerson algorithm, to compute the maximum network flow for the given graph with vertex $S$ as source.<br>  <br> | 06 |
| | b | Consider a Binomial queue $H$ given below and perform delete Min operation on it.<br>  <br> | 06 |
| | c | Insert $10, 20, 30$ and $15$ in empty red-black tree. | 04 |
| | | **OR** | |
| 6 | a | Insert $5, 3, 10, 6, 18, 14, 2$ and $100$ in the empty binomial queue. | 06 |
| | b | Illustrate with an example the maximum matching in bi-partite graph using Ford-Fulkerson algorithm. | 06 |
| | c | Discuss the different splay operations during node insertion in splay tree. | 04 |
| | | | |
| 7 | a | Find some integer $n$ that leaves reminder $1, 2$ and $3$ when divided by $9, 8$ and $7$ respectivley. | 08 |
| | b | Consider a $RSA$ key set up with two prime numbers 13 and 19. The small odd integer e is chosen as 7. What is the encryption of the message $M = 100$. | 04 |
| | c | Solve the given modular equation $35x \equiv 10\ (mod\ 50)$. | 04 |
| | | | |
| 8 | a | Illustrate the two ways of representing polynomials. | 08 |
| | b | Discuss the butterfly operation in $FFT$. Show how to perform the operation on two input values. | 08 |