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14SCS23

# Second Semester M.Tech. Degree Examination, June/July 2016
## Advanced Algorithms

Time: 3 hrs. Max. Marks:100

**Note:** ***Answer any FIVE full questions.***





1 a. Define and explain the various asymptotic notations with related graphs and examples. **(08 Marks)**

b. Solve the following recurrence relation to give a tight upper bound using substitution method.

$$T(n) = 4T\left(\frac{n}{2}\right) + n^2$$ **(06 Marks)**

c. Illustrate the aggregate analysis of amortized analysis on the operation INCREMENT in a binary counter. **(06 Marks)**

2 a. Use a recursion tree to determine a good asymptotic upper bound on the recurrence $T(n) = 2T\left(\frac{n}{2}\right) + n$. **(09 Marks)**

b. State the Master theorem and solve the following recurrence relations using Master theorem.

i) $T(n) = 9T\left(\frac{n}{3}\right) + n$

ii) $T(n) = T\left(\frac{2n}{3}\right) + 1$ **(06 Marks)**

c. Write the Johnson's algorithm to solve all-pairs shortest path problem for sparse graphs. **(05 Marks)**

3 a. Using Bellman-Ford algorithm, find the shortest path from the source vertex 'S' to the remaining vertices in the graph shown in the Fig. Q3 (a). **(10 Marks)**

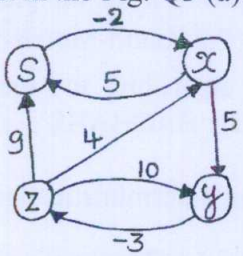


Fig. Q3 (a)

b. Find the shortest path from the source vertex 'S' to the remaining vertices in the DAG of Fig. Q3 (b). Use DAG shortest path algorithm. **(10 Marks)**

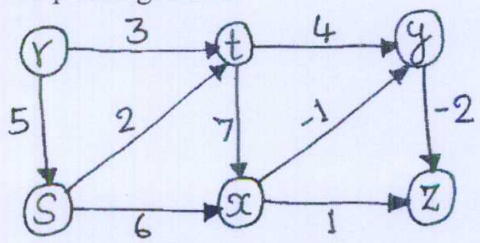


Fig. Q3 (b)

4 a. Starting from the flow network shown in the Fig. Q4 (a), find the maximum flow using the basic Ford-Fulkerson algorithm. **(05 Marks)**

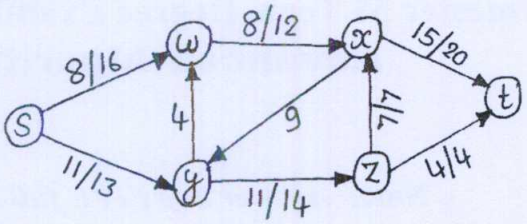


Fig. Q4 (a)

b. Explain the point-value representation of a polynomial with examples. **(07 Marks)**

c. Give the pseudocode for computing GCD of two numbers using extended form of Euclid's algorithm. Also, find GCD (899, 493) and show the computational steps at each level of recursion. **(08 Marks)**

5 a. Define the DFT of a vector and also compute the DFT of the vector (0, 1, 2, 3). **(05 Marks)**

b. Define a group and give its properties. Also, write the group table for the multiplicative group modulo 15$\left(z_{15}^{*}, \cdot 15\right)$. **(07 Marks)**

c. Write the Chinese remainder theorem. Also, find all integers that leave remainders 1, 2, 3 when divided by 9, 8, 7 respectively using Chinese remainder theorem. **(08 Marks)**

6 a. Write the procedural steps of the RSA public-key cryptosystem. Also, consider an RSA key set with P = 61, q = 53 and e = 17. What value of 'd' should be used in the secret key? What is the encryption of the message M = 65? **(10 Marks)**

b. Write and explain the Rabin-Karp string matching algorithm. Working modulo q = 11, how many spurious hits does the Rabin-Karp matcher encounter for the text T = 3 1 4 1 5 9 2 6 5 3 5 8 9 7 9 3 when looking for the pattern P = 26? **(10 Marks)**

7 a. Explain string matching with finite automaton. Also, write the state transition diagram and the transition function $\delta$ for the string matching automaton that accepts all the strings containing the pattern 'a b a b a c a' and illustrate its operation on the text string 'a b a b a b a c a b a'. **(08 Marks)**

b. Compute the prefix function $\pi$ for the pattern 'a b a b b a b b a b b a b a b b a b b' in the alphabet $\sum = \{a, b\}$ for the Knuth-Morris-Pratt algorithm. **(05 Marks)**

c. Apply Boyer-Moore algorithm to search for the pattern 'BAOBAB' in the text 'BESS_KNEW_ABOUT_BAOBABS'. **(07 Marks)**

8 a. Explain the randomizing deterministic algorithms by taking linear search as an example. **(10 Marks)**

b. Explain Monte Carlo and Las Vegas algorithms with suitable examples. **(10 Marks)**

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