CBCS Scheme

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16/17SCS23

Second Semester M.Tech. Degree Examination, June/July 2018
Advanced Algorithms

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Explain the following asymptotic notations: O, Ω, θ with suitable examples. **(06 Marks)**

b. Using master method, solve the following recurrences:
i) $T(n) = 9T(n/3) + n$ ii) $T(n) = 2T(n/2) + \theta(n)$ iii) $T(n) = 3T(n/4) + n\ell gn$
iv) $T(n) = 8T(n/2) + \theta(n^2)$ v) $T(n) = T(2n/3) + 1$ **(10 Marks)**

OR

2 a. Using substitution method, solve the following recurrence relation to give an upper and lower bound: $T(n) = 2T(n/2) + \theta(n)$. **(05 Marks)**

b. Construct a recursion tree for the recurrence, $T(n) = T(n/3) + T(2n/3) + cn$ and indicate the running time. **(05 Marks)**

c. Explain the aggregate analysis technique used in amortized analysis, using multipop stack and binary counter problems. **(06 Marks)**

Module-2

3 a. Write Bellman-Ford algorithm for solving single-source shortest paths problems. Trace it for the following graph.

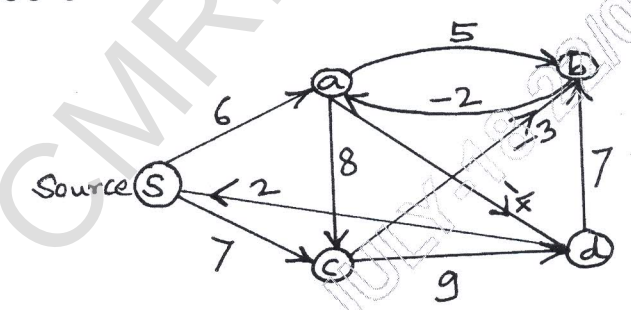

Fig.Q3(a) **(08 Marks)**

b. Briefly explain the following:
i) Flow networks ii) Residual networks
iii) Cuts iv) Augmenting paths **(08 Marks)**

OR

4 a. Write Johnson's algorithm for solving all pair shortest paths problem. Also indicate the running time. **(05 Marks)**

b. Describe how to find maximum bipartite matching for a given graph, considering suitable example. **(05 Marks)**

c. Write and explain recursive – FFT algorithm. **(06 Marks)**

Module-3

5 a. Write modular-linear-equation-solver algorithm and using the same, solve the following: $14x \equiv 30 \pmod{100}$. **(08 Marks)**

b. Apply the Chinese remainder theorem, to the following equations:
$a \equiv 2 \pmod 5$
$a \equiv 3 \pmod{13}$
Generate all the solutions, in the form of a table. **(08 Marks)**

OR

6 a. With the help of suitable example, describe Pollard's rho heuristic algorithm. **(08 Marks)**

b. Write the procedure for RSA public-key crypto system. Apply it for the following input $p = 3$ and $q = 11$, $e = 7$. Compute 'd' and encrypt $M = 2$. **(08 Marks)**

Module-4

7 a. Working modulo $q = 13$, demonstrate Robin-Karp string matching algorithm for the text: 2359023141526739921 and the pattern: 31415. **(08 Marks)**

b. Write compute-transition function of string matching automata. Illustrate the same for the pattern: ababaca over the alphabet $\Sigma = \{a, b, c\}$. **(08 Marks)**

OR

8 a. Write compute-prefix function of Knuth-Morris-Pratt string matching algorithm. Apply it on the pattern AAACAAAAAC. Indicate the running time of K-M-P algorithm. **(08 Marks)**

b. Write Boyer-Moore algorithm for string matching problem. Illustrate it on the following input.
Text: BESS_KNEW_ABOUT_BAOBABS
Pattern: BAOBAB **(08 Marks)**

Module-5

9 a. Describe how to randomize the deterministic algorithms considering the following problems:
i) Linear search algorithm
ii) Quick sort algorithm **(08 Marks)**

b. Write and explain, Monte-Carlo algorithm for testing polynomial equality, with the help of a suitable example. **(08 Marks)**

OR

10 a. Describe Las Vegas algorithm for the problem of searching a list with repeated elements. Also list the differences between Monte-Carlo and Las-Vegas algorithms. **(08 Marks)**

b. Explain minimum cut problem in graphs using edge contraction method, considering a suitable example. Also write a Monte-Carlo algorithm for the same. **(08 Marks)**

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