CBCS SCHEME

USN

16/17SCS23

Second Semester M.Tech. Degree Examination, Jan./Feb. 2021

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. Describe the different types of Asymptotic Notations with examples and graphs. **(08 Marks)**

b. What are the different ways to solve recurrence relations? Apply the substitution method to show that.

i) $T(n) = 2T(\lfloor n|2 \rfloor) + n$ is $0(n\ell gn)$ ii) $T(n) = T(n-1) + n$ is $0(n^2)$ **(08 Marks)**

OR

2 a. State the master theorem. Solve the following using the master theorem:

i) $T(n) = 2T\left(\left\lfloor \frac{n}{2} \right\rfloor\right) + \theta(n)$ ii) $T(n) = 9T\left(\left\lfloor \frac{n}{3} \right\rfloor\right) + n$ **(08 Marks)**

b. Describe the aggregate analysis method for amortized analysis for stack operations and for the increment operation of binary counter. **(08 Marks)**

Module-2

3 a. Write the Directed Acyclic Graph (DAG) shortest path algorithm. Apply the algorithm to find single source shortest path from 'S' to the other vertices. **(08 Marks)**

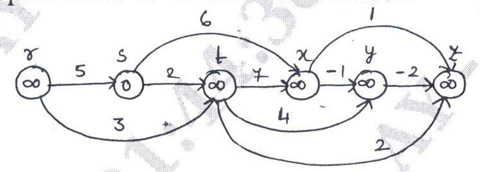


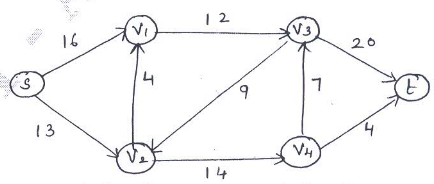
Fig.Q.3(a)

b. Explain coefficient representation with an example. **(02 Marks)**

c. Explain point value representation. Write the point value representation for the equation $x^3 - 2x + 1$ assume the unique $x_k = 0, 1, 2, 3$. Using the Lagrange's interpolation method convert the calculated point value representation back to the original equation i:e $x^3 - 2x+1$. **(06 Marks)**

OR

4 a. Write the Ford-Fulkerson algorithm. Apply the algorithm for the following graph. Draw the residual network and the flow network for each step. Assume 's' as the source node and 't' as sink node. **(10 Marks)**



b. Prove the cancellation Lemma, Halving Lemma and the Summation Lemma. **(06 Marks)**

Module-3

5 a. Prove the theorem: for any integers a, b, p IF both gcd (a, p) = 1 and gcd (b, p) = 1 then gcd (ab, p) = 1. **(06 Marks)**

b. Write the Euclid's algorithm to find the gcd of two numbers. Explain the algorithm with an example. **(04 Marks)**

c. Write the extended Euclid's algorithm. Obtain the value of 'd', 'x' and 'y' using extended Euclid's algorithm when a = 30 and b = 21. **(06 Marks)**

OR

6 a. Briefly describe what is a group. When does a group become an Abelian group? Show that (z, +) is A group where 'Z' is a set of integers and '+' is a regular addition operation. **(05 Marks)**

b. Prove that the system (z_n, $+_n$) is a finite Abelian group. **(05 Marks)**

c. Write the algorithm to solve the modular linear equations. Using the algorithm solve for 'x' for the below equation. $14x \equiv 30 \pmod{100}$. **(06 Marks)**

Module-4

7 a. What are string matching algorithms? Give some applications where string matching algorithms are useful. **(05 Marks)**

b. Write the native string matching algorithm. Apply the algorithm when the text T = acaabc and the pattern to be searched is P = aab. **(05 Marks)**

c. Write the Rabin-Karp Matcher algorithm. Apply the algorithm when T = 314152, P = 31415, d = 10, q = 13. **(06 Marks)**

OR

8 a. Give the 5-Touple definition of finite automata. **(04 Marks)**

b. Write the finite automata that accepts the string ababaca. **(04 Marks)**

c. Compute the prefix function π using the Knuth-Morris-Prat algorithm when p = abcdabd. Also write the algorithm for compute-prefix-function. **(06 Marks)**

d. Write the "Create Shift" procedure for the Boyer-Moore string matching algorithm. **(02 Marks)**

Module-5

9 a. Explain randomized deterministic algorithm by taking linear search as an example. **(08 Marks)**

b. Briefly describe how randomization can be applied to quicksort algorithm. Write the randomized permute function that can be applied during quicksort. **(08 Marks)**

OR

10 a. Explain Monte Carlo algorithm. Write and describe the Monte Carlo algorithm for testing polynomial equality. **(08 Marks)**

b. Explain minimum cuts in graphs. Write and describe the "McMinCut" algorithm. **(08 Marks)**

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