Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER-II(NEW)-EXAMINATION – WINTER-2020

Subject Code:3720216 **Date: 28/Jan/2021**

Subject Name: Advance Algorithms

Time: 02:00 PM To 04:00 PM **Total Marks: 56**

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

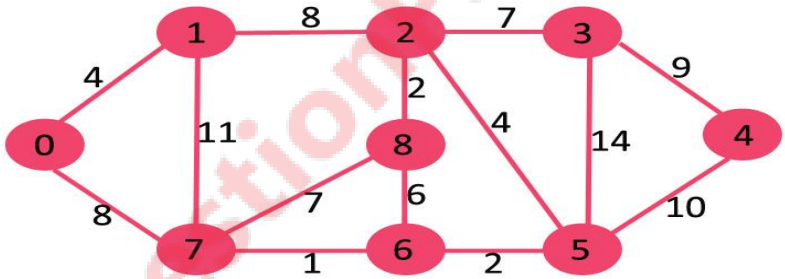
Q.1 **(a)** 1. Write selection sort algorithm to sort the characters of string 'advance algorithms'. **03**

2. Consider a network of n nodes. There is a cut C on the network. Prove that the flow f(C) across any cut C is equal to the total network flow value |f|. **04**

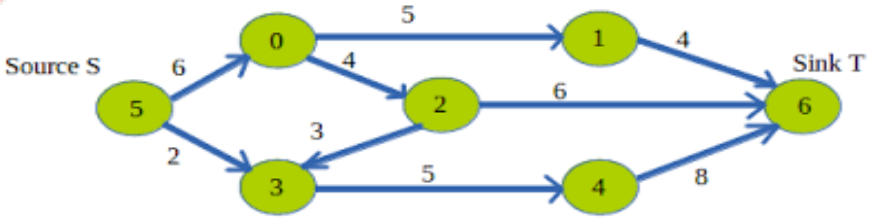
(b) List properties of Matroid. Let E = {A, B, C}. Let I = {ϕ, {A}, {B}, {C}, {B, C}}. Using the properties of matroid, check that M = (E, I) is a matroid? **07**

Q.2 **(a)** What is triangular matrix. Prove that (1) the product of two lower-triangular matrices is lower-triangular, (2) the determinant of a lower-triangular or upper-triangular matrix is equal to the product of its diagonal elements and (3) the inverse of a lower-triangular matrix, if exists, is lower-triangular. **07**

(b) Generate shortest path using BFS from source node 0 to destination node 5. **07**

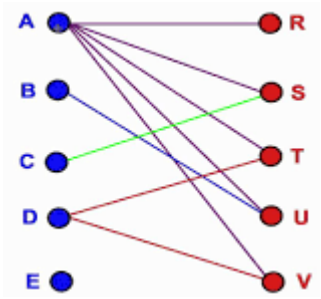


Q.3 **(a)** Find the maximum flow of the following network using Edmonds-Karp's maximum flow algorithm. Consider node 5 as source node and node 6 as sink node. **07**



(b) 1. Define following terms: maximal matching, perfect matching, alternating path, augmenting path. **04**

2. Generate maximal matchings from the following graph. **03**



Q.4 **(a)** 1. Explain various storage representations of directed and undirected graphs. **03**

2. Discuss accounting method of amortized analysis with suitable example. **04**

(b) Following are the two DNA sequences: **07**

X = ACGCCGTA

Y = CGT

Find a maximum length common sub-sequence of X and Y using dynamic programming method.

Q.5 **(a)** 1. Explain the key concepts used to prove that the given problem is NP-complete problem. **03**

2. Explain the different ways to represent polynomials. **04**

(b) Mention the major steps for solving systems of congruences with the Chinese remainder theorem. Solve the following systems of congruences using Chinese remainder theorem. **07**

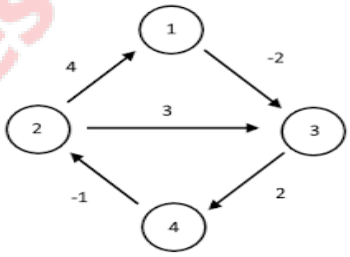
$x = 1 \pmod 3$

$x = 4 \pmod 5$

$x = 6 \pmod 7$

Q.6 **(a)** Write recursive FFT algorithm and explain how is it useful to compute DFT of an n-element vector $a = (a_0\ a_1,....,a_{n-1})$, where n is a power of 2? **07**

(b) Find shortest path between all pairs of following graph using Floyd-Warshall algorithm. **07**



Q.7 **(a)** Solve the following linear program using Simplex method. **07**

Maximize $18x_1 + 12.5x_2$

subject to

$x_1 + x_2 \leq 20$

$x_1 \leq 12$

$x_2 \leq 16$

$x_1, x_2 \geq 0.$

(b) Convert the following linear program into standard form. **07**

Minimize $2x_1 + 7x_2$

subject to

$x_1 = 7$

$3x_1 + x_2 \geq 24$

$x_2 \geq 0$

$x_3 \leq 0$.

Q.8 **(a)** Convert the following linear program into slack form. **07**

Maximize $2x_1 - 6x_3$

subject to

$$x_1 + x_2 - x_3 \leq 7$$
$$3x_1 - x_2 \geq 8$$
$$-x_1 + 2x_2 + 2x_3 \geq 0$$
$$x_1, x_2, x_3 \geq 0$$

(b) Explain with example that how can you solve vertex-cover problem with approximation algorithm. **07**

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