

GUJARAT TECHNOLOGICAL UNIVERSITY
ME – SEMESTER-II(NEW)-EXAMINATION – WINTER-2020

Subject Code:3720216

Date: 28/Jan/2021

Subject Name: Advance Algorithms

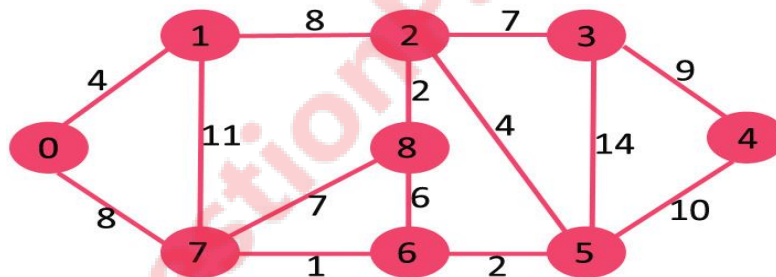
Time: 02:00 PM To 04:00 PM

Total Marks: 56

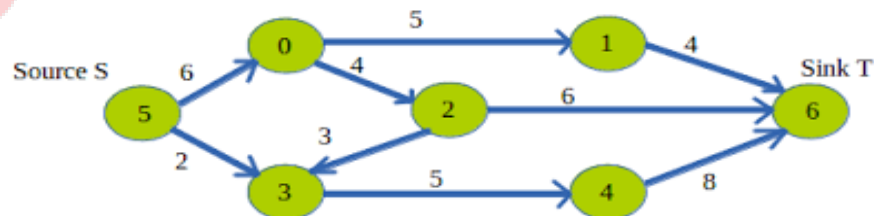
Instructions:

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

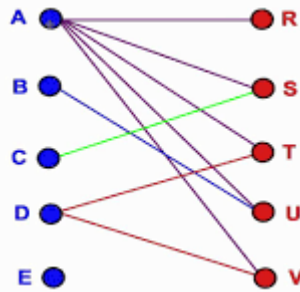
- Q.1 (a)**
1. Write selection sort algorithm to sort the characters of string 'advance algorithms'. **03**
 2. Consider a network of n nodes. There is a cut C on the network. Prove that the flow $f(C)$ across any cut C is equal to the total network flow value $|f|$. **04**
- (b)** List properties of Matroid. Let $E = \{A, B, C\}$. Let $I = \{\phi, \{A\}, \{B\}, \{C\}, \{B, C\}\}$. 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**



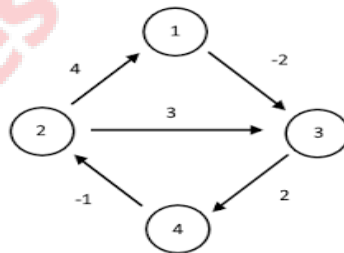
- (b)**
1. Define following terms: maximal matching, perfect matching, alternating path, augmenting path. **04**
 2. Generate maximal matchings from the following graph. **03**



- 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 $a = (a_0, a_1, \dots, a_{n-1})$, 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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