

29/9/2023

Indian Institute of Engineering Science and Technology, Shibpur
B.Tech. - M.Tech. Dual Degree 5th Semester (CST) Examination (Mid Semester) 2022
Graph Algorithms (CS 3104)

Full Marks: 30

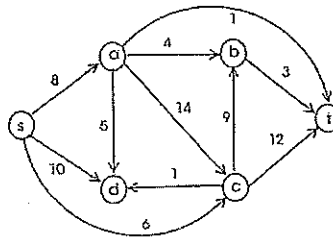
Time: 2 Hours

*Answer Question-1 and any three from the remaining.
Do all parts of a question together. Do not mix up answers to parts of different questions in the answer script.*

1. (a) State Max flow min cut theorem and prove it through an example.
(b) Prove that the number of vertices of odd degree in a graph is always even.

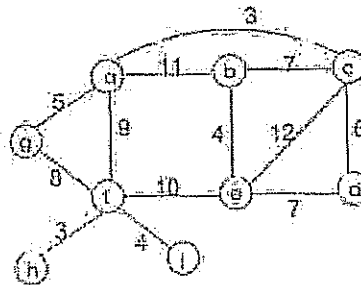
[3 + 3 = 6]

2. (a) Consider the following directed, weighted graph. The weights on the edges show the capacity of the edges. Compute the maximum flow from the source s to the sink t using the Ford-Fulkerson algorithm. At each step, clearly show the flow.



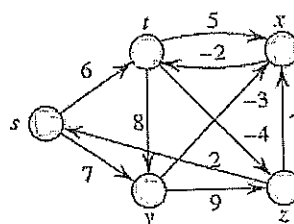
[8]

3. (a) Construct a possible spanning tree of the graph depicted in following Figure using the Kruskal's algorithm. Show the result of each iteration of the algorithm.



[8]

4. Run the Bellman-Ford algorithm (for finding Single-source shortest-path) for the following directed graph using the vertex, z as source. In each pass relax the light edges and show the d and π values after each passes.



[8]

5. (a) There are five cities in a network. The travel time for travelling directly from i to j is the $(i, j)^{th}$ entry in the matrix below. The matrix is not symmetric and an infinity entry indicates that there is no direct route. Determine the least travel time and quickest route from i^{th} city to j^{th} city for each pair (i, j) .

$$\begin{bmatrix} 0 & 10 & 20 & \infty & 17 \\ 7 & 0 & 5 & 22 & 33 \\ 14 & 13 & 0 & 15 & 27 \\ 30 & \infty & 17 & 0 & 10 \\ \infty & 15 & 12 & 8 & 0 \end{bmatrix}$$

[8]