Register for Certification exam (https://examform.nptel.ac.in/2023_01/exam_form/dashboard)

Course outline

How does an NPTEL online course work? ()

Week 0 ()

Week 1 ()

Week 2 ()

Week 3 ()

Week 4 ()

Week 5 ()

Week 6 ()

Week 7 ()

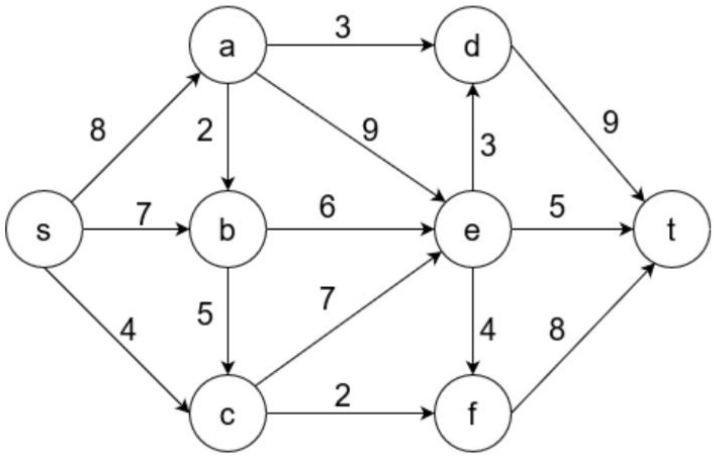
Week 8: Assignment 8

Your last recorded submission was on 2023-03-20, 16:30 IST Due date: 2023-03-22, 23:59 IST.

1) In the Ford-Fulkerson algorithm, what is the residual capacity of a forward edge? ***1 point***

- The maximum capacity of the edge
- The flow in the edge
- The maximum capacity of the edge minus the flow in the edge
- None of the above

2) Consider the network given below with source s and sink t, with the numbers on the edges denoting maximum capacity across a particular edge

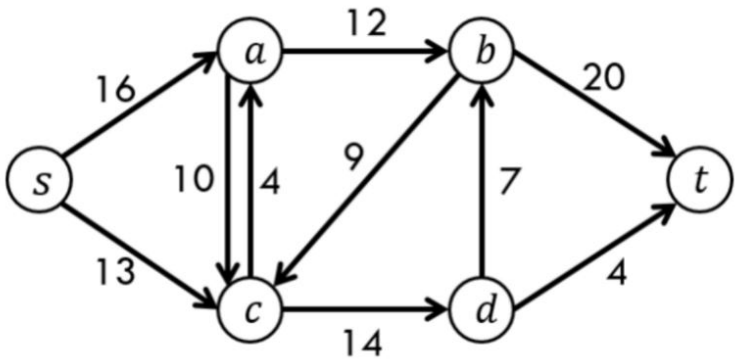


The value of the maximum flow in the given network is__

17

1 point

3) Consider the following network:



Consider the network given above with source **s** and sink **t**, with the numbers on the edges denoting maximum capacity across a particular edge. The value of the maximum flow in the given network is__.

23

1 point

4) Given a flow network (G, s, t, c) and a flow f, how will you determine if f is maximum flow? ***1 point***

- If there is any edge that is not saturated to full capacity, then we can conclude that f is not a maximum flow.
- If the residual graph does not have any augmenting paths then f is a maximum flow.
- If the value of the flow f is not the sum of the capacities of the edges coming out of the source s then f is not a maximum flow.
- If the value of the flow f is not the sum of the capacities of the edges coming into the sink t then f is not a maximum flow.

5) Assume there are n teachers and 2n subjects. Each teacher has to teach exactly 2 subjects. Their preferences are modelled as a directed graph G, such that there exists an edge from a teacher node T_i to a subject node S_j in G, if T_i prefers teaching S_j. How can this problem be modelled as a network flow problem? ***1 point***

- It can be modelled as a network flow problem, where the source node is connected to every teacher node in G with capacity of n, and every subject node in G is connected to the sink node with capacity of 2n.
- It can be modelled as a network flow problem, where the source node is connected to every teacher node in G, and every subject node in G is connected to the sink node. All edges in the network flow graph have equal capacity.

It can be modelled as a network flow problem, where the source node is connected to every teacher node in G with capacity of 2, and every subject node in G is connected to the sink node with capacity of 1.

It can be modelled as a network flow problem, where the source node is connected to every teacher node in G with capacity of 1, and every subject node in G is connected to the sink node with capacity of 2.

6) An electrical circuit is modelled as a network from source to ground. Three lines from the source with a combined transmitting capacity of 5 units per hour, two lines end in ground with a combined transmitting capacity of 4 units per hour, and the in-between networks are unknown. What is the maximum transmission capacity of the electrical circuit? ***1 point***

- 4 units per hour
- 5 units per hour
- 9 units per hour
- **There is not enough information to solve the problem**

7) What is the time complexity of the Ford-Fulkerson algorithm and finding an augmented path in the algorithm? $|V|$ and $|E|$ is the number of vertices and edges respectively. ***1 point***

- $O(maxflow * |E|), O(|E|log|V|)$
- **$O(maxflow * |E|), O(|E|)$**
- $O(|E|^2), O(|V| * |E|)$
- $O(|E|^2 log|V|), O(|E|^2)$

8) A man has two kids who keep fighting. When on their way to school, they want to take routes such that they both don't have to travel through the same road. You are given the map from their **home(H)** to the **school(S)** which resembles a directed acyclic graph. From the graph, can you implement some algorithmic technique to determine if both kids can go to the same school without having to travel through the same roads? ***1 point***

- If maxFlow through the graph ≥ 1, then, both kids can go to the same school without having to travel through the same roads.
- If count ≥ 2, where count is number of times S is encountered in a single run of some modified DFS with H as starting point.
- **Run Ford Fulkerson algorithm on the given graph with edge capacities = 1. If maxFlow comes out to be ≥ 2, then, both the kids can go to the same school without having to travel through the same roads.**

You may submit any number of times before the due date. The final submission will be considered for grading.

Submit Answers