PASS Session

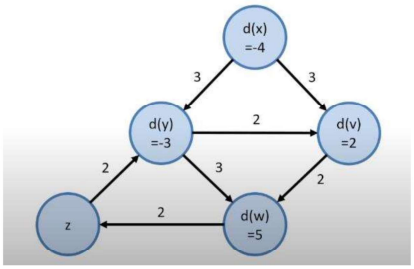
Wednesday, 1 June, 2022 21:48

Network Flow

Circulation with Demands

- We tweak the Flow Conversion Property to become **Demand Constraint**
- Incoming(v) – Outgoing (v) = demand(v)
- You will have Demand Constraint Diagram, has no cycle or sink/target
- Given a diagram with d(v) of all vertices and all edges with constraints, find out the flow of the diagram

Example



1. Create source
2. Link it to all negative demands
3. Its edges should be the remaining that completes the demand calculation
4. Create sink
5. Link all positive demands to it
6. Repeat 3.
7. Use diagram to identify flow
8. Run Ford-Fulkerson

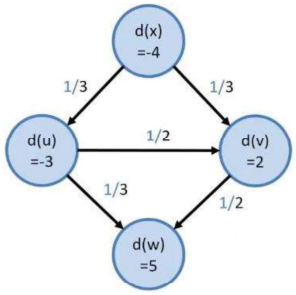
Feasibility

- Perform cut to find min-cut
- If it exists, then it is feasible

Network Flow

Capacity Constraint

- Lower bound for an edge <= Flow <= Capacity for and edge
- Transform diagram by removing lower bound to temporary network
- This reduces the constraint along with the demand
- Moving back to the main diagram, change the edge representation to "constraint/flow/capacity"



Why are these important?

- **Network Flow** → Very practical application in a lot of real-life scenarios (e.g. Piping, "Network" Flow, etc.)
- **Bipartite Graph** → Same as Network Flow

What's Next?

- **Hash Tables**
- **AVL Trees**

Studio10 Q1

Monday, 9 May, 2022 15:38

Problem 1. Consider the following circulation with demands problem presented in Figure 1. Does it have a feasible solution?

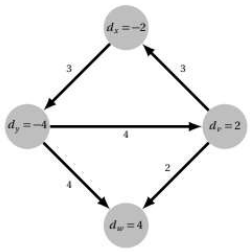
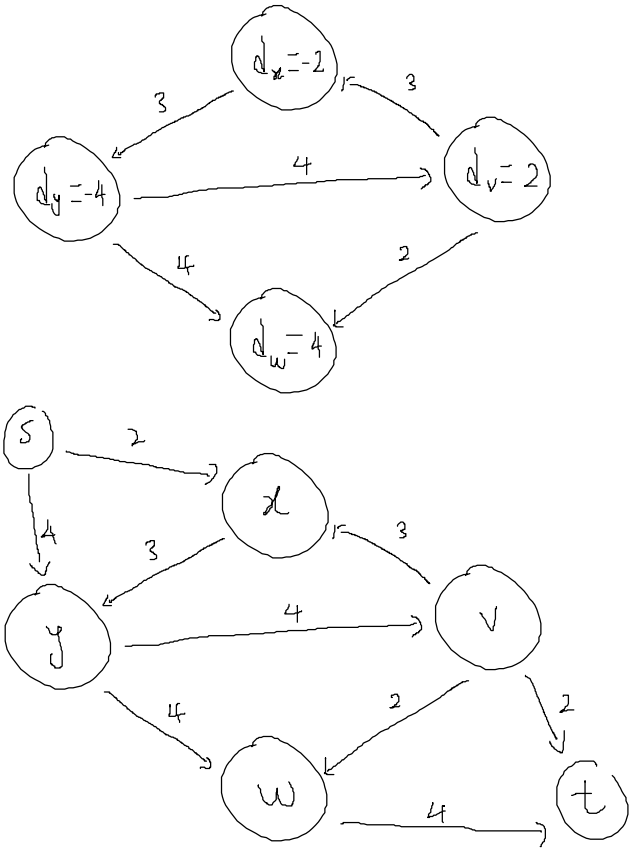
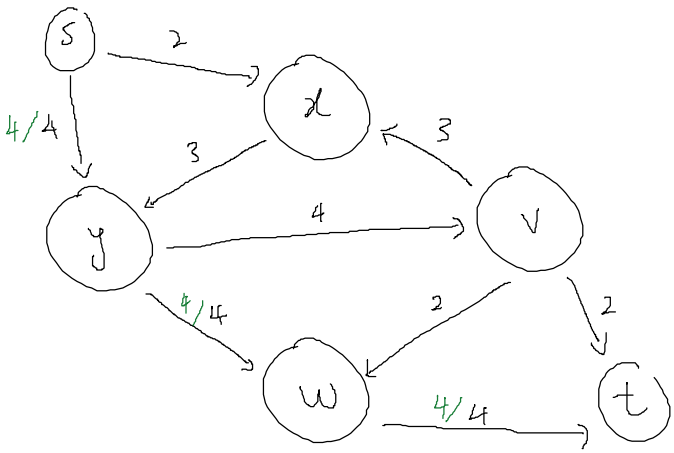
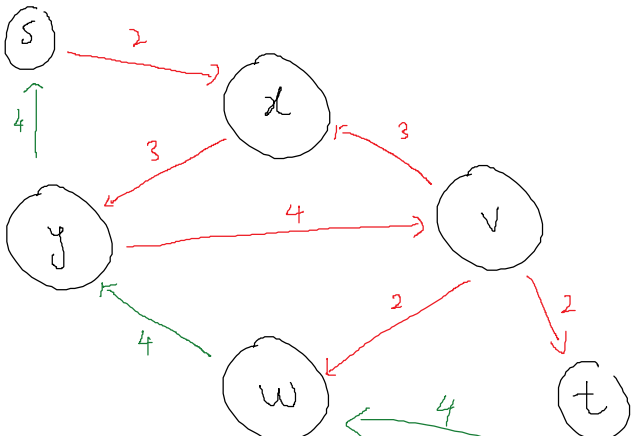


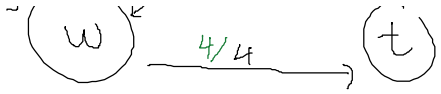
Figure 1: An instance of the circulation with demands problem. The demand is indicated in each vertex, and the capacity in each edge.

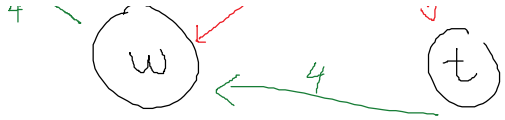


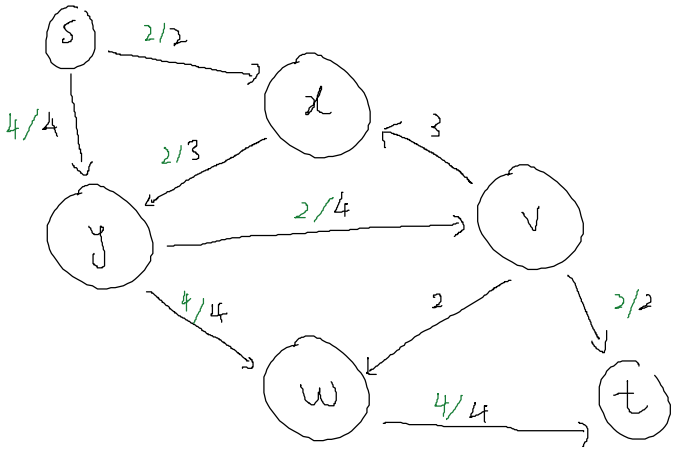
Run ford fulkerson



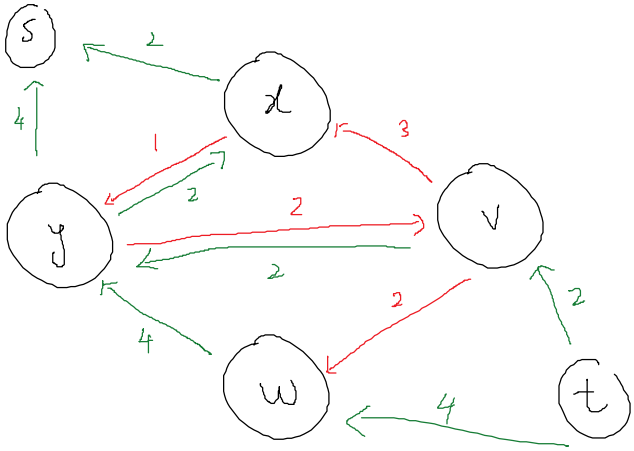






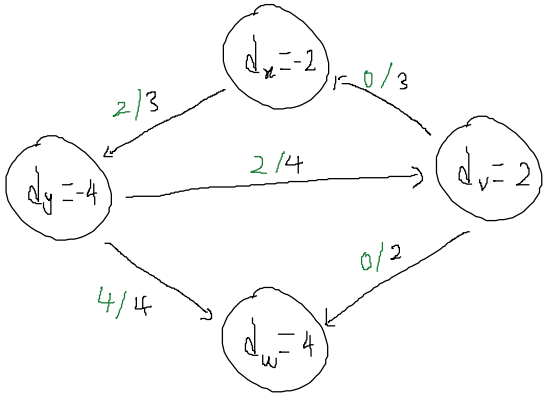


max-flow : 6



min-cut : $\{s\}$

$\{x, y, v, w, t\}$



Yes, it is feasible. Incoming - outgoing = 0

Studio10 Q2

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Problem 2. Consider the following circulation with demands and lower bounds problem presented in Figure 2. Does it have a feasible solution?

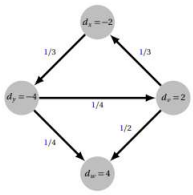
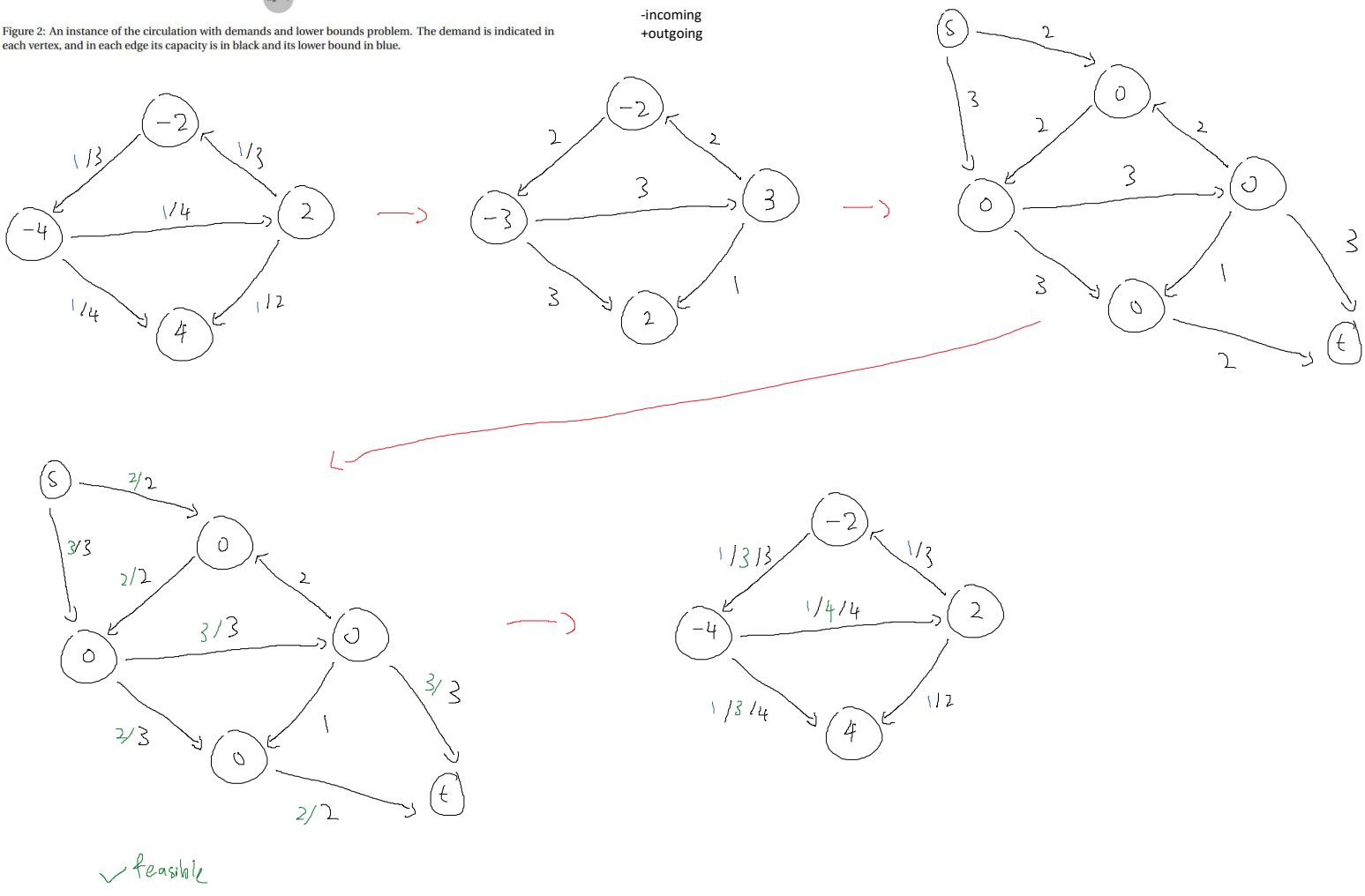


Figure 2: An instance of the circulation with demands and lower bounds problem. The demand is indicated in each vertex, and in each edge its capacity is in black and its lower bound in blue.

Step 1: Eliminate lower bound
Step 2: Eliminate Demand
Step 3: add source and sink
Step 4: Feasibility with Ford Fulkerson

-incoming
+outgoing



✓ feasible

Feasible when the flow from the source is maximised and also the flow to the sink is also maximized then it is feasible.

Studio10 Q3

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Problem 3. Consider the following circulation with demands and lower bounds problem presented in Figure 3. Does it have a feasible solution?

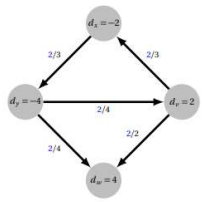
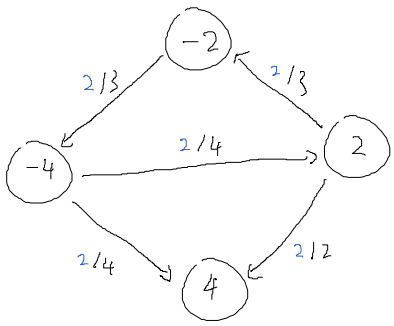
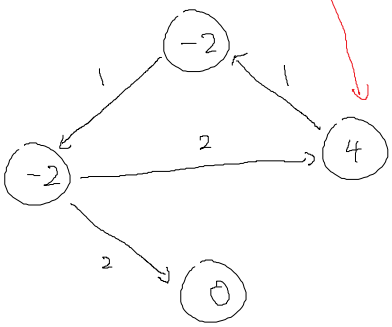


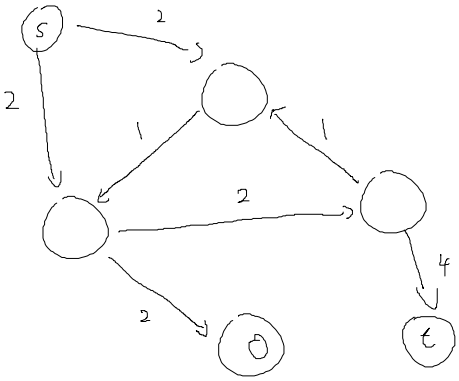
Figure 3: An instance of the circulation with demands and lower bounds problem. The demand is indicated in each vertex, and in each edge its capacity is in black and its lower bound in blue.

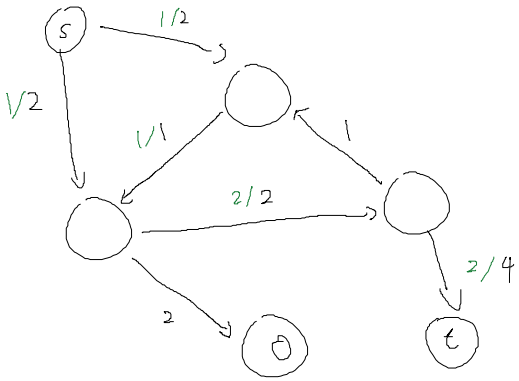
-incoming
+outgoing

Short cut incoming edge of 2 confirm can't Be feasible since it won't have enough to satisfy the demand









X feasible