Judah Goldring
Professor Leff
Spring 2023
Design and Analysis

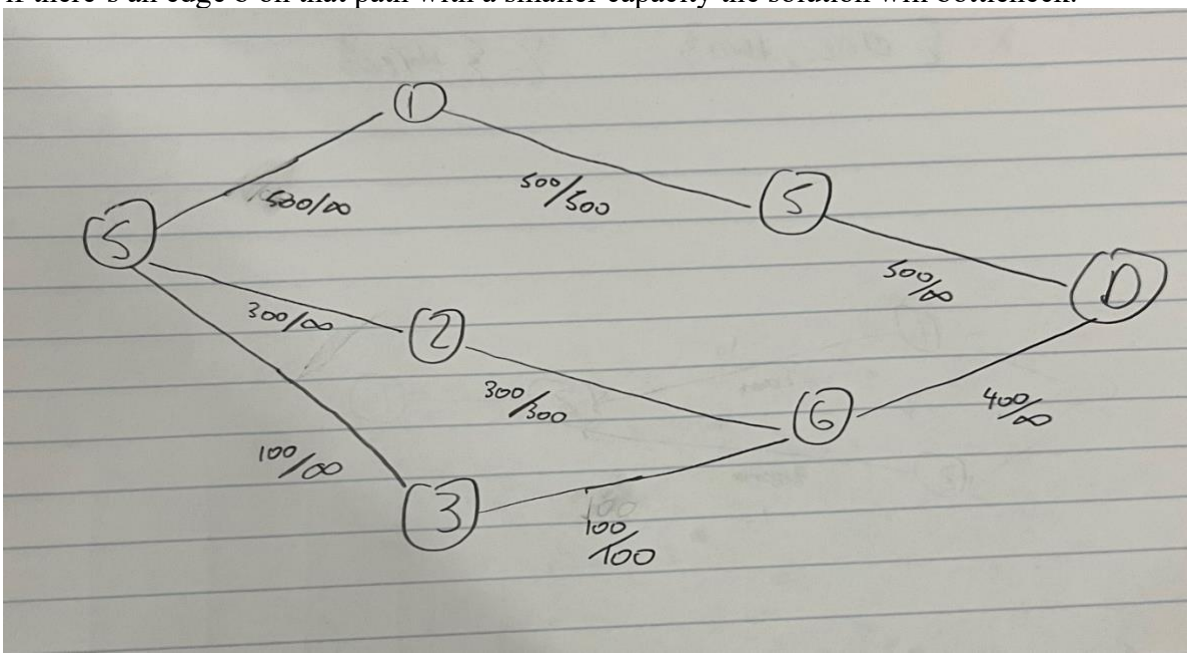
OverfullGranaries write-up:

First off would like to say thank you for a great semester!

Now for the assignment stuff:

This assignment was a trivial network flow problem that required a slight reduction. Like the Baseball Elimination problem all that needed to be added to the regular network flow program was the creation of two dummy nodes, a src and destination. The next step was to then add edges from every node in X to the src and every edge in Y to the destination, giving each of these edges a capacity of "infinity." Once this was done you can just let the magic of Ford Fulkerson happen. Even though you might think that pushing infinite amount of grain through X would push way too much grain to Y, the capacity on edges from X to Y would prevent this, and the only thing that would pass to Y is the max amount of grain Y could possibly get with its restriction within an hour, which is precisely what we're trying to solve!

Adding a dummy source and destination vertex maintains the basic requirements of a network flow problem, as seen with baseball elimination and bipartite matching, and giving an edge an infinite capacity is again within the realm of basic requirements as seen with baseball elimination. The beauty of network flow is that no matter how much capacity you give to some edge a, if there's an edge b on that path with a smaller capacity the solution will bottleneck.



As can be seen by this diagram, even though the edges going from source to the nodes in X, {1,2,3} have a capacity of infinity, the allowed of flow able to reach destination is capped by

the capacity of the edges to Y, {5, 6}. It's impossible to flow more than the edges allow because that would overflow the capacity which isn't allowed by the network flow requirements. In this example the max amount of flow able to reach all nodes in Y, which is essentially the D node, would be 900. And of its 900 bushels an hour in this trivial case it would take 10,000/900 hours to move 10,000 bushels to Y.

Side Note: All network flow code was taken directly from the Sedgewick website.