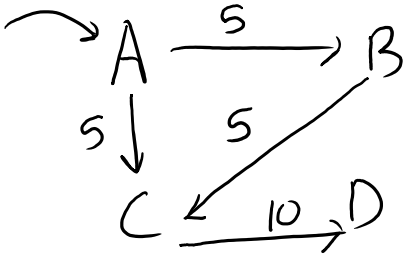
2018-02-20 Flow Rates

Wednesday, February 20, 2019 3:00 PM

- Flow rate analysis addresses the question, "How much stuff can we sent from Vertex A to Vertex B?"
  - What is the maximum rate of traffic flow between Arcata and Eureka?
  - How water (or sewage) can flow before pipes back up?
  - What's our maximum network throughput from our server to a typical client?

Simple Flow Rate Example



Edge weight represents maximum flow.
Question: How much stuff can move from A to D?

Ideas

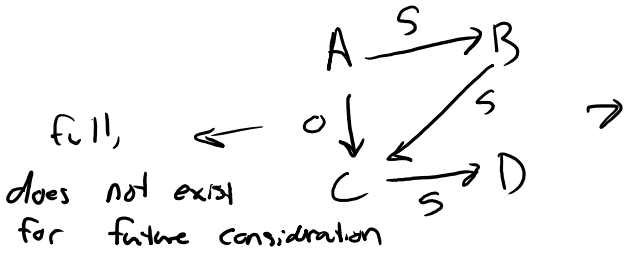
- Find a path (a good one)
- Track "pending flow" of a route by subtracting route flow from edge weight

Ideas for good path selection

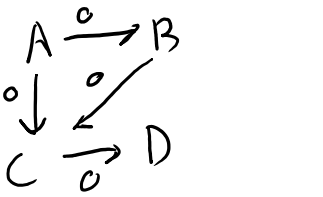
- Breadth-first (least edges)
- Dijkstra (least cost)
- Reverse Dijkstra (most cost)

use for first couple examples

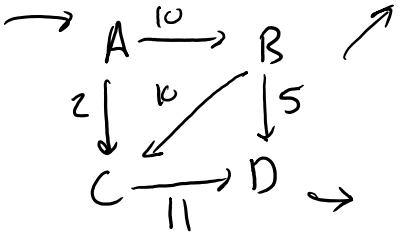
Path $\overline{ACD}$ (5 units)



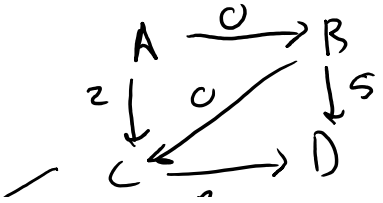
Path $\overline{ABCD}$ (5 units)

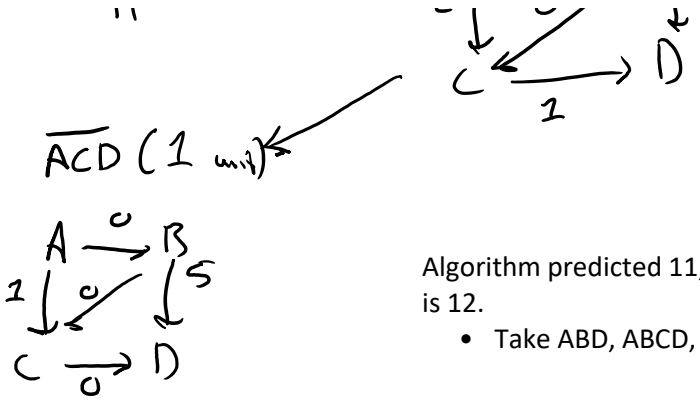


Example #2



$\overline{ABCD}$ (10 units)



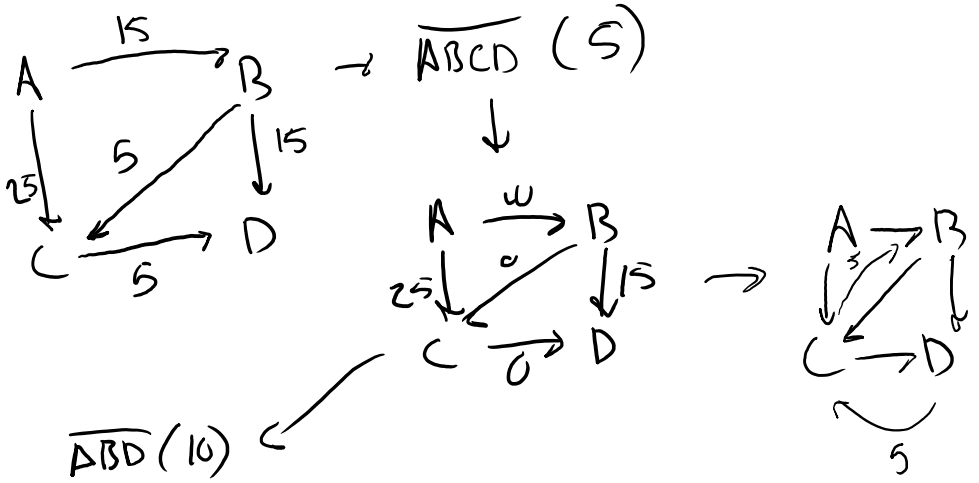


Algorithm predicted 11, actual result is 12.

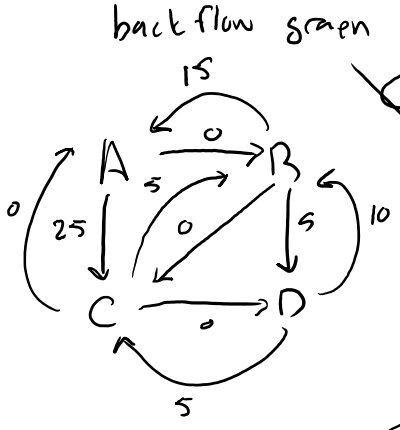
- Take ABD, ABCD, ACD yields 12

What if we change path selection algorithm?

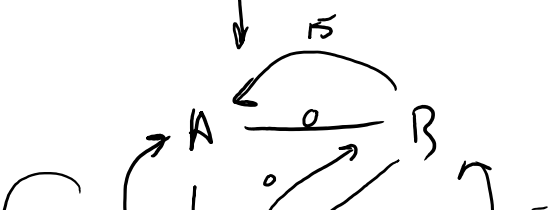
- Use real Dijkstras

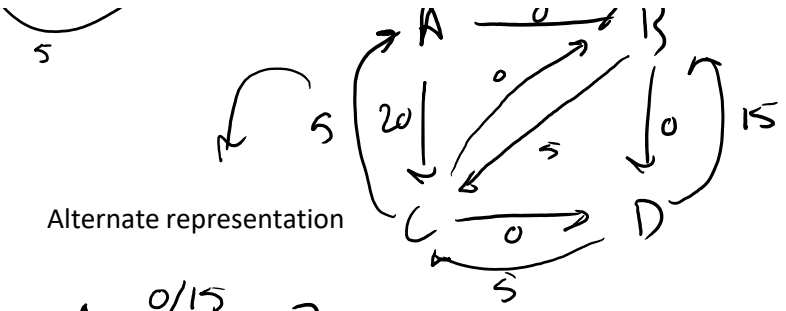


- No matter what, there probably exists a graph where any path selection algorithm will fail.

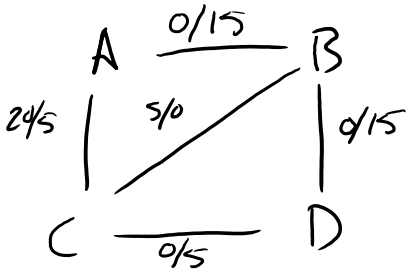


- Back edges open a new path ACBD with weight of 5. Thus, we now have…





Alternate representation



Class Exercise