3134 Data Structures in Java

Lecture 21
Apr 18 2007
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Announcements

- Theory reposted..

- Almost done...
Today

- Graphs
- Network flows
- Algorithms...
Dijkstra...

- Just to be sure... I want to demo dijkstra to make sure you all can do it in your sleep

- Will need to code it for hw...
flow networks

- sometimes we are interested in graph as a capacity problem:
  - Represent graph of capacity between two points
  - Want to see what is the max flow the graph can carry between the points

- application: oil pipeline, electricity grid, etc
First step…

- Given a graph with a flow capacity

- What strategies can you think will allow you
  - any flow
  - max flow
  - min flow
Lets draw

- Capacity graph
- Add flow
- Draw residual graph...
- Lets do simple example...
Solution

- Ford-Fulkerson algorithm
- computes the maximum flow in a flow network examining the residual graph (with backedges).
- The idea:
  - As long as there is a path from the source (start node) to the sink (end node), with available capacity on all edges in the path, we send flow along one of these paths.
  - Then we find Next...etc.
  - Path with available capacity is called an augmenting path.
Example on board....
See it live…

- http://www-b2.is.tokushima-u.ac.jp/~ikeda/suuri/maxflow/Maxflow.shtml.en
Another Graph problem

- say you have a bunch of tasks which have to be done over time
- some can be done in parallel
- some have to wait for a specific task to be done before being able to be started

- think building construction, can’t paint the inside without putting up the walls...etc
Critical path analysis…

- Node is specific activity
- Weight = cost
- Edges represent precedence..

- Solution is max path
graph connectivity

- biconnected:
  - graph is biconnected is there are no vertices which can disconnect the graph
  - i.e no articulation points
    - points of failure
    - how to find them all??