

Math 5490, Network Flows

Review for Midterm (Spring 2006)

The midterm will be on Thursday, March 30, and will be closed book and closed notes. The test will include material covered up through Chapter 7. Specifically, the following topics will be covered by the exam. You should also review the homework problems.

1. Fundamentals

- Residual network
- Node potentials
- Reduced costs
 - Effect on paths and cycles
- Flow decomposition
- Complexity: Big O , Big Ω , Big Θ , P , NP , $NP - complete$.
- Topological ordering (including algorithm for finding topological ordering, or finding a cycle).

2. Shortest Paths

- Label-setting vs. label-correcting algorithms
- Shortest paths on acyclic networks
- Dijkstra's algorithm
- Predecessor graph
- Breadth first search
- Shortest path tree
- Optimality conditions
 - (Theorem 5.1)
 - Nonnegative reduced costs
- Generic label-correcting algorithm
- Detecting negative cycles

3. Maximum Flows

- Feasible flow problem (Application 6.1)
- $s - t$ cuts
- Residual capacity (of a cut)
- Generic augmenting path algorithm
- Max-Flow Min-Cut Theorem
- Augmenting path theorem (generic)
- Establishing a feasible flow when positive lower bounds are present.
- Distance labels
 - Valid labels
 - Admissible arcs/paths
- Capacity scaling algorithm
- Shortest augmenting path algorithm
- Pre-flow push algorithm (generic)