CMPS 102: Homework #8

Due on Tuesday, June 2nd, 2015

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Problem 1

In the slides an algorithm was given for the following problem: Given a digraph G and a source node s and sink node t, find the maximum number of edge disjoint paths from s to t.
Give an algorithm that finds the maximum number of edge disjoint SIMPLE paths from s to t (i.e. paths with no loops). Hint: Start with the maximum number of disjoint paths from s to t and then delete loops.

a) Reason that the solution produces the correct maximum number of edge disjoint simple paths.
b) What is the running time of your algorithm?

Problem 2

In class we give a flow argument for showing that every k-regular bipartite graph has a perfect matching. In such graphs every women knows k men and every man knows k women.
Give an alternate proof using Hall's Theorem: That is show that for k-regular graphs the following holds: For every subset S of the women, $|N(S)| >= |S|$, where $N(S)$ is the total set of men they know together.

Problem 3

KT 12, p420.
Give a reason why your algorithm reduces the flow as much as possible.

Hint: Use Ford-Fulkerson to find a min cut. Somehow reduce the min cut.

Problem 4

KT 21, p427.
This uses bipartite matching.

Problem 5

5) KT 27, p431. Design a flow network where each driver p_j get flow $Delta_j$.
Then round up the capacities and use the integral flow theorem.

Problem 6

KT 45, p444. Think circulation!