Lecture 2: We finished off formulating the 5 examples from the Exercise Set as Linear Programs. We noted that the size of the LP for MWST could be very large in terms of the input graph.

We discussed reductions to Network Flow and gave as an example the reduction of the open pit mining problem. Note that Chapters 19-23 of Chvatal and Chapter 7 of Kleinberg-Tardos discuss a variety of diverse problems which can be reduced to/formulated as Network Flow problems.

We defined the Fractional Relaxation of an IP (the LP obtained by dropping the constraint that the variables must be integers). We discussed Fractional Matching and noted a triangle had a fractional matching of size 3/2 but its largest matching was of size 1. We showed that fractional matching has the same solution as matching for bipartite graphs using the max matching/min cover theorem. We used this to reduce matching in bipartite graphs of size n to a series of at most n/2 instances of fractional matching. This is a nice property of reducing to Network Flow problems. For such problems the IP and its fractional relaxations always have the same solutions which make the IPs easy.