CS 599 (Spring 2007)- Assignment 4
Due: 04/12/2007

1. Exercise 18.7
2. Exercise 19.2.

   Note: you may want to read over Exercise 19.1 to understand what LP this problem refers to. However, you do not need to explicitly write a flow LP and take its dual (i.e., no need to solve Exercise 19.1). Instead, you can simply use the path based LP for multiway cuts we derived in class.
3. Exercise 19.3
4. Derive an $O(\log n)$ approximation algorithm for the node-weighted minimum multicut problem. That is, you are given an undirected graph $G = (V, E)$ where each *node* $v \in V$ has a non-negative cost $c(v)$. In addition, you are given k source-sink pairs (s_i, t_i). The goal is to select a minimum-cost set $S \subseteq V$ of nodes such that the removal of S disconnects each s_i-t_i pair. The set S is allowed to contain sources or sinks (though they might be quite expensive).

   Hint: I am not aware of any approximation-preserving reduction to the edge multicut problem for undirected graphs (for directed graphs, there is an easy reduction). So you will have to come up with an algorithm from scratch. I recommend using the outline of the multicut algorithm from class, that is: (1) Write a suitable IP/LP. (2) Interpret the fractional solution. (3) Use a similar region growing argument as for edge multicut to derive an approximation guarantee. For part (3), it will be important to come up with a good interpretation of "partially including nodes" in a region, much like partially included edges.
5. Exercise 21.6