CS 473U: Undergraduate Algorithms, Fall 2006
Homework 5

Due Tuesday, October 24, 2006 in 3229 Siebel Center
Remember to turn in in separate, individually stapled solutions to each of the problems.

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1. Makefiles:
   In order to facilitate recompiling programs from multiple source files when only a small number of files have been updated, there is a UNIX utility called 'make' that only recompiles those files that were changed after the most recent compilation, *and* any intermediate files in the compilation that depend on those that were changed. A Makefile is typically composed of a list of source files that must be compiled. Each of these source files is dependent on some of the other files that must be compiled. Thus a source file must be recompiled if a file on which it depends is changed.

   Assuming you have a list of which files have been recently changed, as well as a list for each source file of the files on which it depends, design and analyze an efficient algorithm to recompile only the necessary files. DO NOT worry about the details of parsing a Makefile.

2. Consider a graph G, with n vertices. Show that if any two of the following properties hold for G, then the third property must also hold.

   - G is connected.
   - G is acyclic.
   - G has $n - 1$ edges.

3. The weight of a spanning tree is the sum of the weights on the edges of the tree. Given a graph, G, describe an efficient algorithm (the most efficient one you can) to find the k lightest (with least weight) spanning trees of G.

   Analyze the running time of your algorithm. Be sure to prove your algorithm is correct.