CSE 431 Spring 2006
Assignment #7

Due: Friday, May 26, 2006

phReading assignment: Read Sections 7.5 to 8.2 of Sipser's text.

Problems:

1. Sipser's text: Problem 7.22 (1st Edition); Problem 7.24 (2nd Edition).

2. Sipser's text: Problem 7.23 (1st Edition); Problem 7.25 (2nd Edition).

3. For any k, define
   DEG-k-SPANNING-TREE=$\{\langle G\rangle \mid G$ has a spanning tree of maximum degree at most $k\}$.

   (a) Show that DEG-2-SPANNING-TREE is NP-complete.

   (b) Use a reduction from DEG-2-SPANNING-TREE to show that DEG-3-SPANNING-TREE is NP-compelte.

   (c) Generalize part (b) to show that for any k, DEG-k-SPANNING-TREE is NP-complete.

4. Consider the following scheduling problem called JOB-SCHEDULING which consists of all
   $$\langle L_1, \ldots, L_m, R_1, \ldots, R_m, D_1, \ldots, D_m\rangle$$
   where

   - each L_i is a positive integer representing a *length* of job i,
   - each R_i is an integer *release time* for job i, and
   - each D_i is a deadline for job i,

   and the the input as in the language if and only if there is a set $S_1, \ldots, S_m$ of integer *start times* such that for every i,

   - the job doesn't start until it is released: $R_i \leq S_i$,
   - the deadline is met: $S_i + L_i \leq D_i$, and
   - jobs don't overlap, i.e. for all $i \neq j$, $S_i + L_i \leq S_j$ or $S_j + L_j \leq S_i$.

   Show that JOB-SCHEDULING is NP-complete by reduction from SUBSET-SUM.

5. (Bonus) Sipser's text: Problem 9.16 (1st Edition); Problem 9.25 (2nd Edition)

6. (Bonus) Sipser's text: Problem 9.17 (1st Edition); Problem 9.26 (2nd Edition)