CSE 431 Spring 2006
Assignment #7

Due: Friday, May 26, 2006

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

Problems:


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