

CS 3530: Assignment 8d

Fall 2014

Problems

Problem 7.17 (20 points)

Problem

Show that, if $P = NP$, then every language $A \in P$, except $A = \emptyset$ and $A = \Sigma^*$, is NP-complete.

Solution

Theorem 7.27(Cook-Levin): $SAT \in P$ iff $P = NP$

Theorem 7.31: If $A \leq_p B$ and $B \in P$, then $A \in P$

According to the Cook-Levin theorem SAT is in P iff $P = NP$. If we combine this with theorem 7.31 then if every language A reduces to SAT then A is in P , it is also in NP since $P = NP$. In either case since A can be verified in polynomial time making it NP-complete.