

Problems of the Week – 7, 8, and 9

7. Solving TQBF blindfolded with two oracles

Problem 9.22 of Sipser. Suppose you are given two Turing machines A and B , one of which is known to decide TQBF (i.e., given a QBF formula F , it accepts if F is true, and rejects otherwise), but you don't know which. (You have no information of what the other machine does.) Give an algorithm that access to both A and B and is guaranteed to solve TQBF in polynomial time.

8. Branching programs

- (a) Show that any boolean function over n boolean inputs can be computed by a branching program with $O(2^n)$ nodes.
- (b) Show that if one can test in polynomial time whether two branching programs compute the same function, then $P = NP$. Is the same true for read-once branching programs?

9. Complete problems in PH

Prove that PH has a problem that is complete for PH with respect to polynomial time reductions if and only if there exists $k \geq 0$ such that $PH = \Sigma_k^P$.