Complexity Theory

Homework Set No. 3

Date Due: Nov 18th 2004

Please turn in the homework on time. Preferably - printed.

1. (a) Suppose that you have an oracle for $SAT = \{\phi | \phi \text{ is a satsifiable Boolean formula}\}$. Show an polynomial time algorithm (using the oracle) that on input ϕ produces the satisfying assumption (if it exists).
(b)Suppose that you have an oracle for TQBF. Show how to use it to decide on the next move in the pebbling game.

2. Let the depth of a DAG be the distance of the input node and output node that are furthest apart (if they are connected). (a) Show that any DAG G of depth c and maximum indegree $d_{indegree}$ can be pebbled using $O(c \cdot d_{indegree})$ pebbles. (b) Show that any tree can be pebbled using $O(d_{indegree} \log n)$ pebbles.

3. Suggest an interactive scheme for an all powerful prover to convince a verifier that node v is reachable from node u in an implicitly given graph. The properties required are

Efficiency The verifier's work is bounded by polynomial time.

Perfect Completeness If all parties follow the protocol, then the verifier accepts all reachable instances.

Non Trivial soundness For any cheating prover and any instance of non-reachability the verifier has probability larger than 0 of not accepting.

Try and find simple solution understandable to a six year old.