Complexity Theory

Homework Set No. 5

Date Due: Dec 9th 2004

1. What can you say about P^{PSPACE} and NP^{PSPACE}

2. Show that if $NP \subset P/\log$ then $P = NP$

3. Let Odd TSP be the problem: given an integer weighted graph G, is the length of the shortest TSP tour in G odd? Show Odd TSP is in $\Delta_2 P$

4. To prove $BPP \subseteq \Sigma_2 P$ we considered a game between an $\exists$ and $\forall$ players.

- The $\exists$ player wants to prove $x \in L$.
- The $\forall$ player wants to prove $x \notin L$.

In the $\Sigma_2 P$ setting first the $\exists$ player makes a move and then the $\forall$ player (based on $\exists$s move). What if both players should move simultaneously? We want strategy where:

- The $\exists$ player wins whenever $x \in L$ even if $\forall$ player makes its move after the $\exists$ player.
- The $\forall$ player wins whenever $x \notin L$ even if $\exists$ player makes its move after the $\forall$ player.

Your tasks:

1. Phrase the above requirements in terms of a polynomial time relation R(x,y,z).
2. Show that for all $L \in BPP$ such a strategy exists.