# CS 682 Homework #5
# Due March 7, 2001

1. If NP $\neq$ PSPACE prove that there exist under $\leq_m^p$-reductions PSPACE-incomplete languages in PSPACE - NP.

2. Let NPr denote nondeterministic polynomial-time machines that can ask only polynomially many different questions to its oracle, counting the queries over all possible nondeterministic computation paths for a given input. Let $NPR^A$ denote the family of languages accepted by such machines with oracle A. Prove that

$$P \;=\; NP \iff (\forall A)\;[P^A \;=\; NPR^A].$$

3. Prove that there exists a recursive oracle A such that

$$P^A \;\neq\; NP^A \;\neq PSPACE^A$$