Homework due Monday, December 4

1. In Lecture 28, the book gives a recursive oracle $B$ such that $\text{NP}^B \neq \text{P}^B$. Since $B$ is recursive, there must be some time bound $T$ such that $B \in \text{DTIME}(T(n))$. Present a time bound $T$ such that there is an oracle $B \in \text{DTIME}(T(n))$ such that $\text{NP}^B \neq \text{P}^B$. (You can either analyze the construction given in the textbook, or else present and analyze your own construction.)

2. Show that if there is such a set $B \in \text{PSPACE}$, then $\text{PSPACE}$ is not equal to $\text{P}$.

3. Present a computable oracle $A$ such that $\text{NP}^A \neq \text{coNP}^A$. (This is Miscellaneous Exercise 58 in the text.)

4. Show that if $\text{NP}$ is contained in $\text{BPP}$, then $\text{NP} = \text{RP}$. (Hint: Consider the problem of constructing a satisfying assignment.)