CSE 725 - Problem Set 2
Due lecture on February 24th

Problem numbers are from the second edition of Sipser's book. If unsure about which problem to solve, ask. Collaboration is permitted; looking for solutions from external sources (books, the web, etc.) is prohibited.

1. Prove that the following language is undecidable:

$$A = \{\langle M \rangle : M \text{ is a TM that runs in polynomial time}\}.$$

2. (extra credit) * Prove that there is a language $P_{TM} \in P$ of encodings of TMs (i.e. $P_{TM} \subseteq \{\langle M \rangle : M \text{ is a TM}\}$) such that for any language L: $L \in P$ iff there exists $\langle M \rangle \in P_{TM}$ such that $L(M) = L$ (i.e., can write $P = \{L(M) : \langle M \rangle \in P_{TM}\}$).

3. 7.13

4. * 7.37

5. Let $coNP$ be the class of languages whose complement is in NP. Show that $P \subseteq NP \cap coNP$. Show that if $P = NP$ then $P = coNP$. (Warning: $coNP$ is *not* the complement of NP.)