Due: November 14

1. Let $M_1$ be the Turing machine whose description is given in Example 3.9. Give the sequence of configurations that $M_1$ enters when started on the following input strings.
   (a) 01#01.
   (b) 01#010.

2. Exercise 3.7.

3. (a) Give an implementation-level description of a one-tape Turing machine that decides the language
   $$\{w_1#w_2#w_3 | w_1, w_2, w_3 \in \{a, b\}^* \text{ and } |w_1| = |w_2| = |w_3|\}.$$  
   (b) Give a more efficient multi-tape Turing machine to decide the language from Part (a).


5. Problem 3.11.

6. In our definition of Turing machine, if the machine tries to move left from the first tape cell, then it stays put. An alternative definition would be that if the Turing machine tries to move left from its first cell, then it halts and rejects. (So in the alternative definition, there are two ways to reject - going to the reject state and trying to move left from the first cell.) Show how to transform a Turing machine $M$ using this alternative definition into a Turing machine $M'$ of the type we defined in class in such a way that $M$ and $M'$ recognize the same language.

7. Problem 3.15 d,e.

8. Problem 3.16 b, d.