B501 Assignment 6

Due Date: Friday, April 13, 2012
Due Time: 11:00pm

For the following questions, $\Sigma = \{0, 1\}$

1. (10 points) Let $T = \{\langle M \rangle | M$ is a TM that accepts w^R whenever it accepts $w\}$. Use reduction to show that T is undecidable. (w^R is the reverse of w)

2. (10 points) A useless state in a Turing machine is one that is never entered on any input string. Consider the problem of determining whether a Turing machine has any useless states. Formulate this problem as a language and use reduction to show that it is undecidable.

3. (30 points) For each of the following languages, determine whether it is decidable and prove your statement. You can use Rice's theorem.

   (a) $\{\langle M \rangle |$ TM M visits the 10th cell of its tape while processing input string '01'$\}$

   (b) $\{\langle M \rangle | M$ is a TM and '111' $\in L(M)\}$

   (c) $All_{TM} = \{\langle M \rangle | M$ is a TM and $L(M) = \Sigma^*\}$