Due: April 19

1. Let $S = \{ f : \mathbb{N} \to \mathbb{N} | f(n) \text{ is divisible by } n, \text{ for all } n \}$. Use diagonalization to show that $S$ is uncountable.

2. $HALT_T M$ is defined as $\{ \langle M, w \rangle | M \text{ is a Turing machine, and } M \text{ halts on } w \}$. Prove that $HALT_T M$ is Turing recognizable.

3. In class we showed that $HALT_T M$ is not decidable by reducing $A_T M$ to $HALT_T M$. For this problem, you are asked to show that $HALT_T M$ is undecidable by using diagonalization instead of using a reduction. Your proof should be similar to but not the same as the proof that $A_T M$ is not decidable.