Problem Set 7
CS172 Spring 2005

**Out**: March 16, 2005  
**Due**: March 30, 2005 by 5 PM to CS172 Drop Box

1. *(Sipser 6.16)* Show that the set of incompressible strings is undecidable.

2. *(Sipser 6.20)* Show that $PCP$ is decidable relative to $A_{TM}$. ($PCP$ is the language for the Post Correspondence Problem in Section 5.2).

3. *(Sipser 6.22)* Let

   $$Z = \{\langle M, w \rangle | M \text{ is an oracle TM and } M^{A_{TM}} \text{ accepts } w \}.$$ 

   Use a proof by diagonalization to show that an oracle TM with an oracle for $A_{TM}$ can’t decide $Z$.

4. *(Sipser 7.13)* Show that $P$ is closed under the star operation. (Hint: On input $y = y_1 \cdots y_n$ for $y_i \in \Sigma$, build a table indicating for each $i \leq j$ whether the substring $y_i \cdots y_j \in A^*$ for any $A \in P$.)