1) Find a match in the following instance of the PCP: \[ \left\{ \left[ \begin{array}{c} a \\ b \\ \hline ab \end{array} \right] , \left[ \begin{array}{c} b \\ a \\ \hline aba \end{array} \right] , \left[ \begin{array}{c} b \\ a \\ \hline a \end{array} \right] \right\}.

2) Show that \( A_{\text{TM}} \) is not mapping reducible to \( E_{\text{TM}} \).

3) Let \( S = \{ <M> \mid M \text{ is a TM that accepts } w^R \text{ whenever it accepts } w \} \). Show that \( S \) is undecidable.

4) Consider the problem of testing whether a Turning machine \( M \) on an input \( w \) ever attempts to move its head left at any point during its computation on \( w \). Formulate this problem as a language and show that it’s decidable.

5) Show that the PCP is decidable over a unary alphabet, that is, over the alphabet \( \Sigma = \{1\} \).

Bonus Question) Show that the PCP is undecidable over a binary alphabet, that is, over the alphabet \( \Sigma = \{0, 1\} \).