CS 254: Computability and Complexity	**Anonymous submission**
Problem Set #03	*October 1, 2019*

6. Want to show that the language:

   D = $\{w \in \sum_2^* \mid$ the bottom row of w is the reverse of the top row of w $\}$

   Proof: by contradiction

   Assume D is a regular language with a pumping length p. To prove that D is a regular language under the pumping lemma we will use string s to prove that it holds for three cases at the same time:

   i. xy^{i}z in L for every $i \geq 0$

   ii.|y| > 0

   iii. |xy| $\leq$ p

   s = $\begin{bmatrix} 1 \\ 0 \end{bmatrix}^p \begin{bmatrix} 0 \\ 1 \end{bmatrix}^p$

   Under the definition of the pumping lemma we know we can split s into xy^{i}z and because |s| $\geq$ p we know s can be pumped. To prove that s is regular there exists a way to write s = xy^{i}z s.t. it follows the 3 conditions of pumping lemma:

   since s can be broken up:

   We can set x = ϵ y = $\begin{bmatrix} 1 \\ 0 \end{bmatrix}^p$ and z = $\begin{bmatrix} 0 \\ 1 \end{bmatrix}^p$

   We consider the case where xy^{2}z

   we get: $\begin{bmatrix} 1 \\ 0 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \end{bmatrix} \notin$ D but this is a contradiction of case i which states that i. xy^{i}z in L for every $i \geq 0$. Therefore by the pumping lemma, D is not a regular language