HW 4 due
Mon. 2/14
Prove \( B = \{0^n1^n | n \geq 0 \} \) is not regular.

Suppose \( B \) is regular. Let \( p \) be the pumping length.

Choose \( s = 0^p1^p \)

Since \( s \in B \) and \( |s| = p \) by the pumping lemma, \( s \) can be split into 3 pieces \( s = xyz \) such that for \( i \geq 0 \) \( xy^iz \in B \)

\[ 3 \text{ cases:} \]

1. \( y \) is all 0's

   \[ \text{so } xyyz \text{ has more 0's} \]

   Then 1's so is not in \( B \).

   e.g. \( s = \overline{00001111} \)

   \[ \overline{x \ y \ z} \]

   \[ xyyz = 000001111 \]

2. \( y \) is all ones - see above

3. \( y \) has both 0's and 1's

   \( xyyz \) will have 0's and 1's out of order. \( \notin B \)

   e.g. \( s = \overline{00111} \)

   \[ \overline{x \ y \ z} \]

   \[ xyyz = 00010111 \]

   \( \notin B \)

   so \( s \) can't be "pumped"

\( \therefore B \) is not regular.
\[ C = \{ w \mid w \text{ has an equal # of 0's and 1's} \} \]

Choose a string \( s \) of length \( \geq p \).

\[ s = 0^p 1^p \]

Since \( |xy| \leq p \) (by the pumping lemma),

so \( y \) must be all 0's.

so \( xyyz \) will have more 0's than 1's,

\[ xyyz \notin C \]

therefore \( C \) is not reg.

\[ C \cap (0^*1^*) = 0^n 1^n \]

is not regular.
\[ D = \{ w w^r | w \in \{0,1\}^* \} \]

\[ s = 0^p 0^p \quad \in D \quad \text{but} \]

\[ s = 0^p 110^p \quad \text{no } p. \]

\[ s = 0^p 110^p \quad \frac{1 \times y \leq p}{y \text{ must be}} \]

\[ s = 0^p 10^p \quad \not\in D \quad \text{all 0s} \]