1. For each of the languages below, find the largest distinguishable set. If it is finite, draw the DFA with the corresponding number of states.
   (a) $L = \{w \mid \text{ ends with } 1111\}$.
   (b) $L = \{1^k x \mid x \in \{0,1\}^* \text{ and } \#1(x) \geq k, k \geq 1\}$.
   (c) $L = \{1^k x \mid x \in \{0,1\}^* \text{ and } \#1(x) \leq k, k \geq 1\}$.
   (d) $L = \{w \mid \exists\, x, y \in \{0,1\}^* - \varepsilon \text{ such that } w = xyx\}$.
   (e) $L = \{a^i b^j c^k \mid i, j, k \geq 0 \text{ and } i = 1 \Rightarrow j = k\}$.
   (f) $L = \{w \mid w \neq w^R\}$.
   (g) $L = \{cabc \mid a, b, c \text{ are non-empty strings}\}$.

2. Consider the following language that we discussed in detail in class.

$$L = \{w \mid \exists x, y \in \{0,1\}^* - \varepsilon \text{ s.t } w = xy, \text{ and } \#1(y) > \#1(x)\}.$$

   Draw two non-isomorphic DFAs with the same number of states for L, and write down the equivalence classes of the Myhill-Nerode relation corresponding to the DFAs.

3. Given a DFA $M = (Q, \Sigma, \delta, q_0, F)$ accepting L, recall the quotient automata $M/\approx$ defined in class. Verify the following properties mentioned in class.
   (a) Show that $L(M/\approx) = L(M)$.
   (b) Show that $\equiv_L \subseteq \equiv_{M/\approx}$, and hence conclude that $M/\approx$ is the minimal automata.

4. Let $S, L \subseteq \Sigma^*$ be two infinite sets. Suppose that for any two strings $x, y \in S$, there exist strings $w, z \in \Sigma^*$ such that $wxz \in L$ and $wyz \notin L$. Show that L is not regular.