Problem Set 1

Ms. Asma Sanam Larik

1. Let $L = \{ w \in \{0,1,2\}^* \mid w$ represents an integer in ternary that is divisible by $7 \}$. Draw a **DFA** for L. Also include the transition table / function.

2. Let $\Sigma = \{ \texttt{\#}, \texttt{!} \}$. Let $L = \{ \texttt{\#}^k u \texttt{\#}^k \mid u \in \Sigma^*$ and $k \geq 1 \}$. Show that L is regular.

3. Construct an **NFA** that is **NOT a DFA** for the following language over $\Sigma = \{ \texttt{a}, \texttt{b} \}$:

$$L = \{ w \mid w \in \Sigma^* \text{ and } |a| \text{ in } w \text{ is a multiple of } 3 \}$$

4. Convert your NFA from the previous question into a **DFA**. Make sure you show **each** step clearly.

5. Let $\Sigma^* = \{ \text{a}, \text{b} \}^*$. Find a regular expression for the following languages:

   a) $A = \{ ab^k w \mid k \geq 3$ and $w \in \{a, b\}^+ \}$.

   b) $B = \{ vwv \mid v, w \in \{a, b\}^*$ and $|v| = 2 \}$.

   c) $C = \{ vwv \mid v, w \in \{a, b\}^*$ and $|v| \leq 3 \}$.

6. The language *DIFFERENCE(A and B)* contains all strings in language A that are not in language B. Formulate this language as a combination of closure properties you have discussed in class ($A \cup B$, $A \cap B$, A^*, $\overline{A}$ etc) to show the class of regular languages is closed under *DIFFERENCE*.