Homework II: (8 problems) Due Friday, October 12 by 4pm in the CS138 HW box in HFH 2108.

1. Prove that \((L_1^* L_2^*)^* = (L_1 \cup L_2)^*\).

2. Determine the following languages: a) \((ab)^* / b\), b) \((ab)^* / a^*\), c) \((ab)^* / a^+\).

3. Describe the languages accepted by the automata whose transition diagrams are given below (\(q_1\) is the initial state): For each of these automata construct an equivalent DFA.

4. Determine the languages accepted by the automata whose transition diagrams are given below (\(q_1\) is the initial state):

5. For each one of the NFA below, construct a DFA accepting the complement of the language accepted. The start state is \(q_1\).

6. Construct the transition diagrams of DFA \(M_1\) and \(M_2\) with \(L_1 = L(M_1)\) and \(L_2 = L(M_2)\):
   a) \(L_1 = \{ababab\}\),
   b) \(L_2 = \{aba, abb, baa\}\).

7. Convert the NFA \(N = (\{q_0, q_1, q_2\}, \{a, b\}, \delta, q_0, \{q_1\})\) where \(\delta\) is given by
into an equivalent DFA.

8. Let $\Sigma = \{0, 1\}$. We can view a $\Sigma$–string $w$ which starts with the letter 1 as a binary number (where the rightmost character of the string is the least significant digit of the number). Construct transition diagrams of NFA accepting the following languages:

(a) $\{w \in \Sigma^+ \mid w > 4\}$
(b) $\{w \in \Sigma^+ \mid w \text{ is a power of } 2\}$,
(c) $\{w \in \Sigma^+ \mid w \text{ is even}\}$. 