Tutorial 2

1. Give a DFA which accepts the following language.

   $\{w \mid w = a_1b_1a_2b_2 \ldots a_nb_n$, for some n, where $a_i, b_i \in \{0,1\}$ and $a_1a_2 \ldots a_n > b_1b_2 \ldots b_n$ (interpreted as binary numbers) $\}$.

   In other words, DFA can decide whether $a_1a_2 \ldots a_n > b_1b_2 \ldots b_n$, if the inputs are given in a specific format.

2. For a DFA $A = (Q, \Sigma, \delta, q_0, F)$, let $\hat{\delta}$ be as defined in class. Show that $\hat{\delta}(q, xy) = \hat{\delta}(\hat{\delta}(q, x), y)$, for all strings x, y over Σ^*, and all states $q \in Q$.

3. Give an NFA which accepts the set of strings which end in bba. Use your NFA to construct a DFA which accepts the same language, using the method of converting NFA's to DFA's done in class (do not construct a DFA directly, but only via the method discussed in class).

4. For the NFA with ϵ-transitions as given in Figure 1:

   (a) give the transition table

   (b) find Eclose(q), for each state q.

   (c) find $\hat{\delta}(q_2, a)$ and $\hat{\delta}(q_2, b)$.

   (d) find a DFA which is equivalent to the given automata (you need not go through the formal method discussed in class).

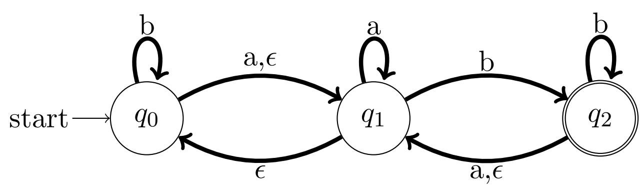

Figure 1: NFA for Q4

5. Prove or disprove the following:

   (a) $L((R + S)^*) = L((R^*S^*)^*)$, for all regular expressions R and S.

   (b) $L(S(R + S)^*S) = L((SR^*S)^+)$, for all regular expressions R and S.

6. Use the method discussed in class to give a regular expression for the language accepted by the DFA $(\{q_1, q_2\}, \{0, 1\}, \delta, q_1, \{q_2\})$, where δ is defined as follows.

   $\delta(q_1, 1) = q_1$. $\delta(q_1, 0) = q_2$. $\delta(q_2, 1) = q_2$. $\delta(q_2, 0) = q_1$.

7. Consider the DFA given in Figure 2. Give the minimal DFA which accepts the same language as accepted by the DFA in figure 2.

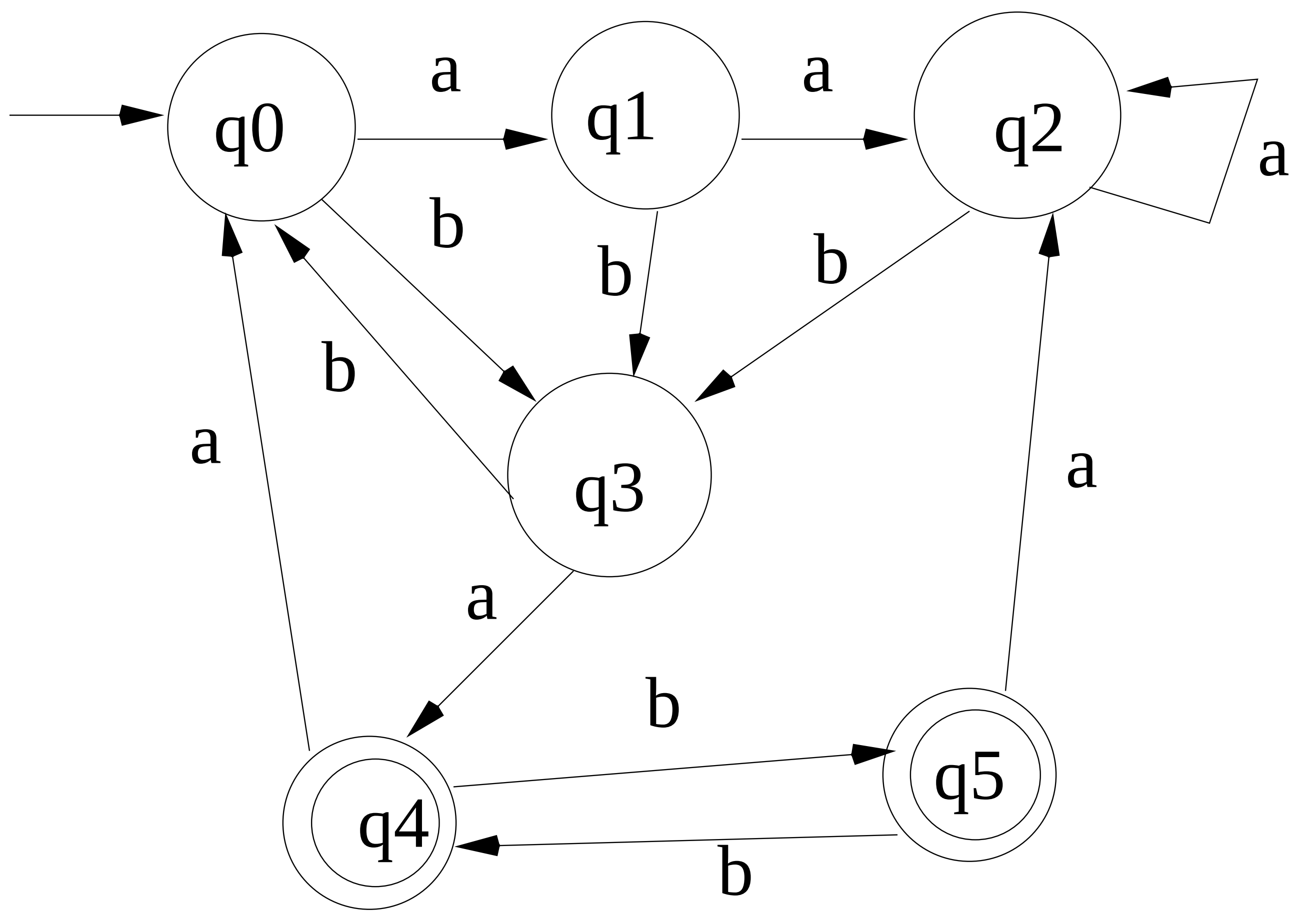

Figure 2: DFA for Q7