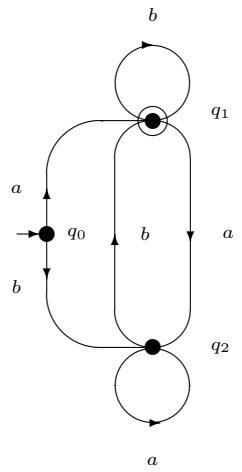

Figure 1: Graph of the Deterministic Finite Automaton $\mathcal{M}$

Homework 1

Due Wednesday, November 9 2011

1. Consider the dfa $\mathcal{M} = (\{a, b\}, \{q_0, q_1, q_2\}, \delta, q_0, \{q_1\})$ whose graph is given in Figure 1. Determine the language accepted by the automaton $\mathcal{M}$.

2. Construct deterministic finite automata that accept the following languages over the alphabet $A = \{a, b, c\}$:

   (a) The set of all words that begin with ab and end with ba.

   (b) The set $\{bab\}$.

   (c) The set $A^* - \{bab\}$.

   (d) The set of all words $x \in A^*$ that contain at least three as.

3. Each of these languages is a regular language over the alphabet $A = \{0, 1\}$. Draw the transition diagram of a deterministic finite automaton that accepts it.

   (a) A^*.

   (b) $\{\lambda\}$.

   (c) $\emptyset$.

4. Let A be an alphabet. If b is a symbol such that $b \notin A$, construct a nondeterministic finite automaton that accepts the language A^*b.

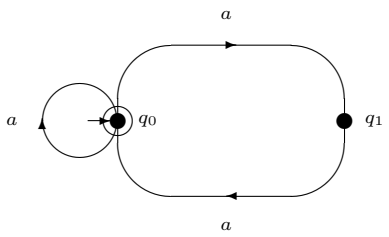

Figure 2: Graph of the Automaton $\mathcal{M}$

5. Let $\mathcal{M} = (A, Q, \delta, q_0, F)$ be a ndfa. Define $\phi(q, w, q')$ as the number of paths in the graph of $\mathcal{M}$ from the state q to the state q' with label w. Prove that for the automaton $\mathcal{M} = (\{a, b\}, \{q_0, q_1\}, \delta, q_0, \{q_0\})$ whose graph is given in Figure 2 we have $\phi(q_0, a^n, q_0) = f_{n+1}$, where f_n is the n^{th} Fibonacci number and $n \geq 0$.