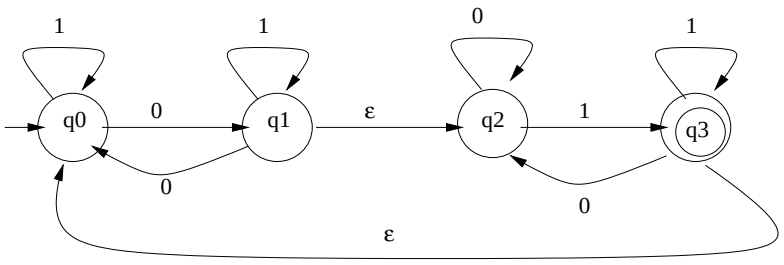
CSE 322
Winter Quarter 2001
Assignment 3
Due Friday, January 26

All solutions should be neatly written or type set. All major steps in proofs and algorithms must be justified.

1. (10 points) For this problem you will practice converting a NFA to a DFA. Convert the following NFA to a DFA. Show only the reachable states of the DFA. The transition function should be given in a table.



2. (10 points) For this problem you will have practice in showing that regular languages are closed under more operations using finite automata contructions. We define the *interleaving* of two languages A and B over Σ by

$$A \| B = \{x_1 y_1 \cdots x_n y_n : x_i, y_i \in \Sigma^*, x_1 x_2 \cdots x_n \in A, \text{ and } y_1 y_2 \cdots y_n \in B\}.$$

   For example if $A = \{a, ab\}$ and $B = \{01\}$ then $A \| B = \{a01, 0a1, 01a, ab01, a0b1, a01b, 0ab1, 0a1b, 01ab\}$. Show that if A and B are regular then so is $A \| B$. Start with DFA's M_1 and M_2 that accept A and B, respectively. Then construct an NFA that accepts $A \| B$.

3. (10 points) For this problem you should design algorithms in the style of problem 3 of the first assignment to decide properties of deterministic finite automata. In particular given a DFA $M = (Q, \Sigma, \delta, q_0, F)$ there is a natural directed graph G_M that models the transitions. The set of vertices of G_M is Q and (q, p) is an edge in G_M if $\delta(q, \sigma) = p$ for some $\sigma \in \Sigma$. The graph G_M is the transition diagram of M with the labels on the edges removed. You should use G_M in your algorithms.

   (a) Design an algorithm to decide whether a DFA accepts any strings at all. That is, the algorithm given a finite automaton M determines if $L(M) = \phi$.

   (b) Design an algorithm to decide whether a DFA accepts infinitely many strings.