CS 360: Assignment 1

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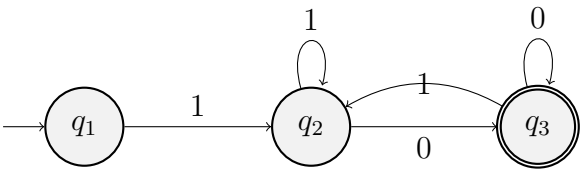
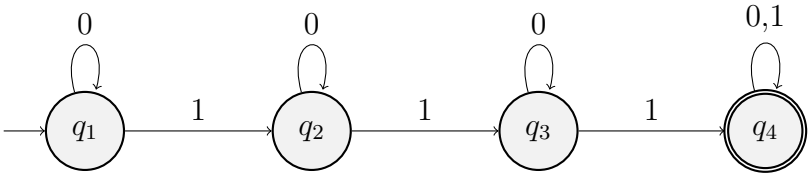
September 6, 2024

1. Give the state diagrams of the DFAs recognizing the following languages. In all parts the alphabet $\sum = \{1, 0\}$:

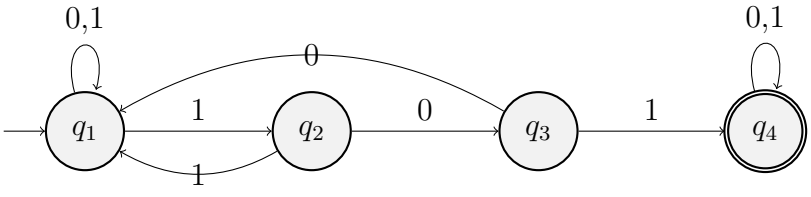
   (a) {w | w begins with a 1 and ends with a 0} [4 pts]



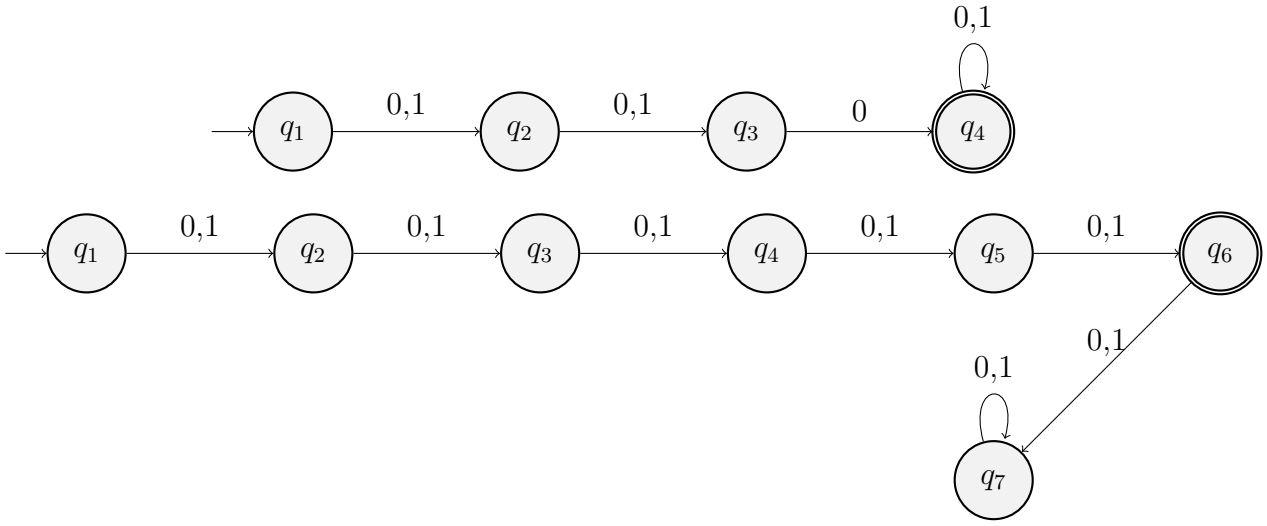
   (b) {w | w contains at least three 1s} [4 pts]



   (c) {w | w contains the substring 101} [4 pts]



   (d) {w | w has length at least three and the third symbol is 0} [4 pts]



(e) {w | the length of w is at most 5} [4 pts] Above question, Latex positioned wrong.

Demonstrate the computations of these machines formally on the following strings. Please point out which strings are accepted by which of these finite machines. [10 pts]

(a) 10001

a) $q1(1) -> q2(0) => q3(0) -> q3(0) -> q2(1) -> q2 - -NO$
b) $q1(1) -> q2(0) => q2(0) -> q2(0) -> q3(1) -> q3 - -NO$
c) $q1(1) -> q2(0) => q3(0) -> q1(0) -> q1(1) -> q2 - -NO$
d) $q1(1) -> q2(0) => q3(0) -> q4(0) -> q4(1) -> q4 - -YES$
e) $q1(1) -> q2(0) => q3(0) -> q4(0) -> q5(1) -> q6 - -YES$

(b) 010011

a) $q1(0) -> q1 - -NO$
b) $q1(0) -> q2(1) -> q2(0) => q2(0) -> q3(1) -> q4(1) -> q4 - -YES$
c) $q1(0) -> q1(1) -> q2(0) => q3(0) -> q1(1) -> q2(1) -> q1 - -NO$
d) $q1(0) -> q2(1) -> q3(0) => q4(0) -> q4(1) -> q4(1) -> q4 - -YES$
e) $q1(0) -> q2(1) -> q3(0) => q4(0) -> q5(1) -> q6(1) -> q7 - -NO$

Consider the alphabet σ = 1, 2, 3. Write down the members of the set $\sum^2$. [2 pts]

Answer: $\sum^2 = \{11, 12, 13, 21, 22, 23, 31, 32, 33\}$

A finite automaton is a 5-tuple (Q, $\sum$,δ, q0, F). Consider the finite automaton that recognizes and empty language. Write down F (the set of accepting states) for this finite automaton.

Answer: F = {q0},$F \subseteq Q$

Every deterministic finite autmaton is also a non-deterministic finite automaton. Justify the statement.

Answer: NFA has multiple options for acceptance as well as unable to determine which final state as there might be more than one. DFAs are a subset of a possible NFA and only have one final state.