Automata Lecture 1

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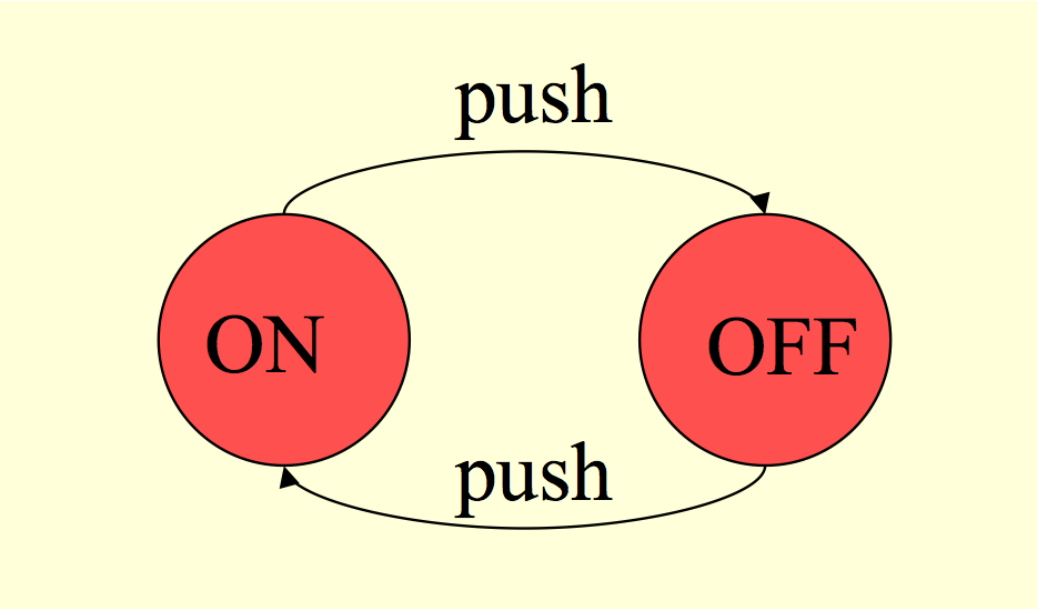
Contents

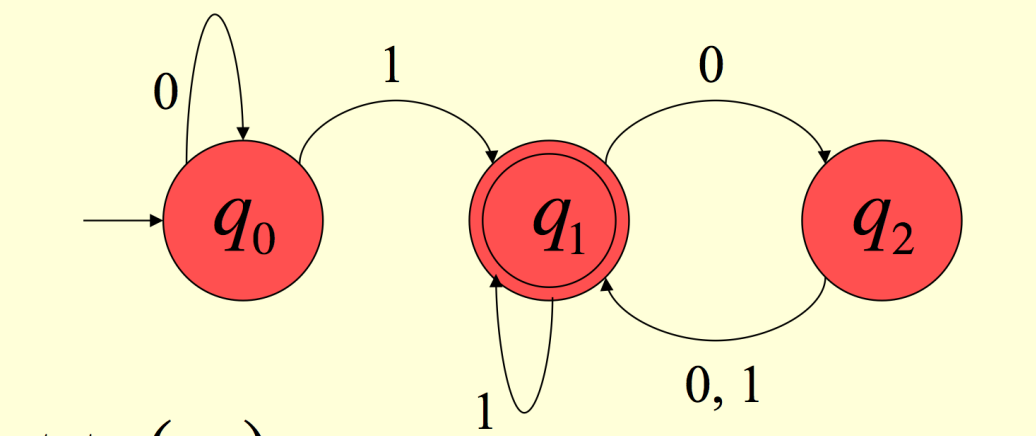
1 Finite state Machines FA (finite Automaton)

1.1 Example light switch



- It captures, using a finite number of states, the behaviour of a system
- When designing an FA, you must remember only the important parts, and discard the unimportant

1.2 Example 2



- The above picture is called a state transition diagram
- Start state q(0)
- finish or accept state q(1)
- Input characters trigger transitions between states
- The automaton receives a string , processes it, and produces an output: accept or reject

if we put 1101:
q0 – q1 – q1 – q2 – q1
Accepted

2 Sets

A set is a **group** of objects represented as a unit.
Objects are called its elements or members.
`Example:` {1,5,4} {1,3,2,...} {a,b,c,d}

3 Tuples and sequences

- A sequence is a list of **objects** in some **order**.
- example (1,2,6)
- a tuple is a finite sequence
- **k-tuple** sequence of k objects
  - (1,2,6) is a 3 tuple
  - (1,3) is a pair is a pair (2 tuple)
- The cartesian product of A and B. AxB.
  is the set of all pairs where the first element is a member of A and the second is a member of B.

4 Function

A function is an object that sets an imput output relationship.
f(a)= b.
Domain The set of possible inputs to the function.
Range The outputs of a function.

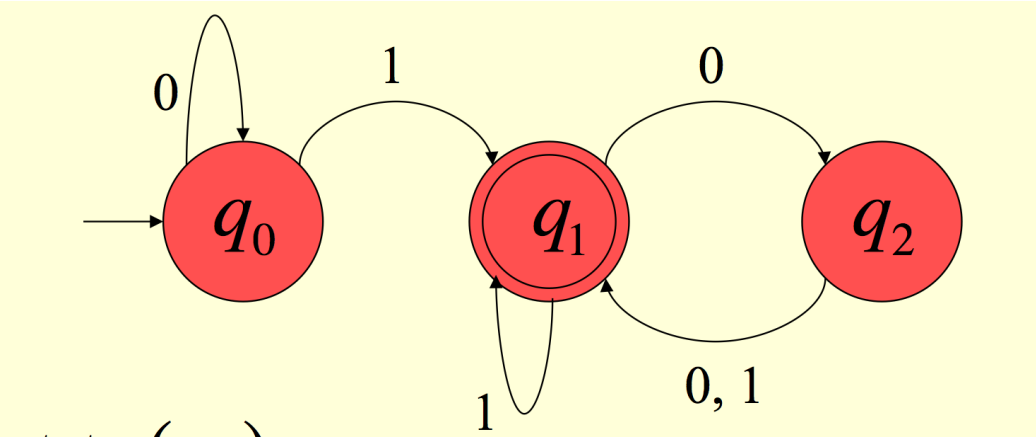
5 Strings and Languages

An aplhabet is a **finite set** and its elements are called symbols.
A string over an alphabet is a finite sequence of symbols from the alphabet
length of a string is the number of symbols that it contains.

$|w| = n$ if w contains n symbols

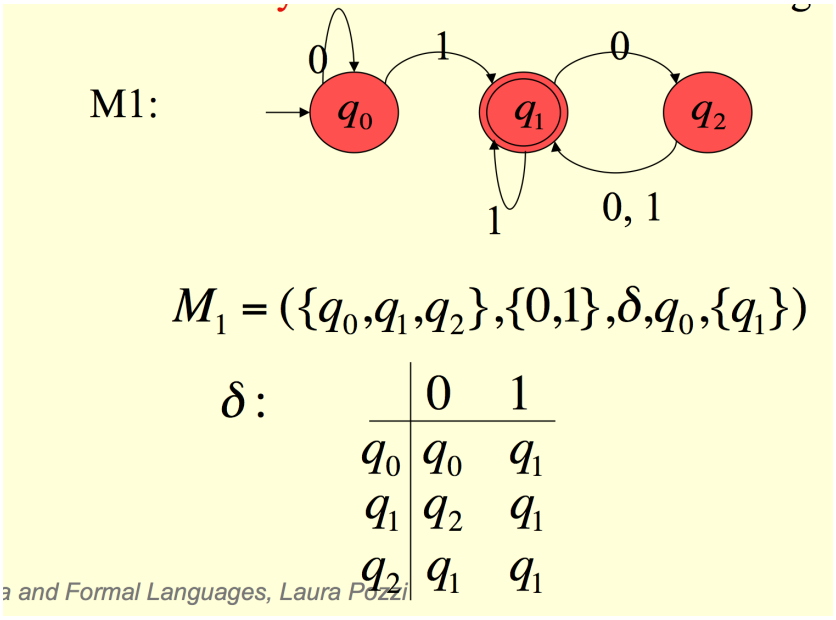
and a **language** is a set of strings.
`Example:` Language E (english) belongs to te set alphabet {a,b,c,d,e,f,....x,y,z}
$\sum^k$ is the set of strings of length k, eache of whose symbols are in $\sum$
$sum = \{1, 2\}$
$\sum^2 = \{00, 01, 10, 11\}$
$\sum^1 = \{0, 1\}$
$\sum^0 = \{\varepsilon\}$
ε is the string of lenght 0. the set of all strings over alphabet $\sum$ is
$\sum^* = \sum^1 + \sum^2 + ... + \sum^n$

Back to FA



5.1 Formal Definition of Finite Automaton

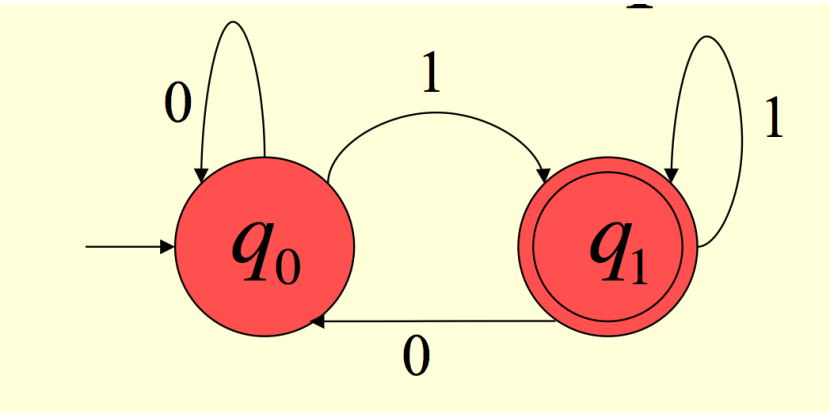
- 5 tuple (Q,$\sum$,δ, q_0, F)
- $\sum$ is an **alphabet** (the set of input characters).
- $\delta : Qx\sum \rightarrow Q$ is the **transition function**
- $q_0 \in Q$ is the start state and
- $F \subseteq Q$ is the set of **accept states**



5.2 Language of machine M

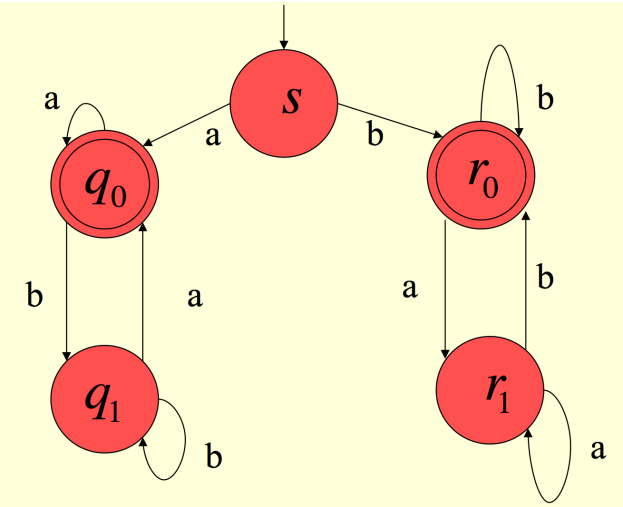
- If A is the set of all strings that machine M accepts, we say that A is the language of machine M
- We say that M recognises A
- A machine may accept several strings, and it recognises one language

5.2.1 Other Example M2



It accepts only strings which doesn't end with 0.

5.2.2 M4



accepts only string which begin and ends with same element.