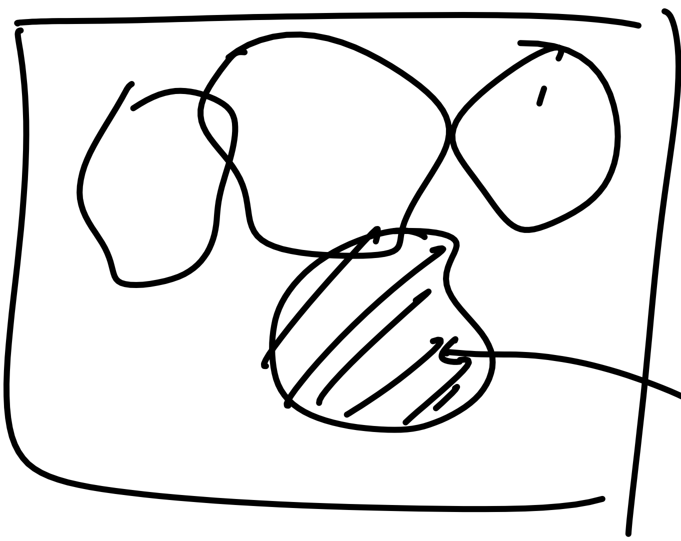
COL 352 Lecture 9 Jan 21

The languages accepted by Finite Automaton (DFA or NFA) are called "regular languages"

Σ^*



2^{Σ^*} : all possible language

If L can be recognized by FA then it is regular

$(010)^i \quad i \geq 0$

$\varepsilon, 010, 010\,010, (010)^i$

$(01)^i \cup (010)^j \quad i, j \geq 1$

The class of regular expressions (r.e.)

Base cases : (i) ϕ : empty set

(ii) ε : $\{\varepsilon\}$

(iii) $a \in \Sigma$ $\{a\}$

If r_1 and r_2 are r.e. then representing sets R_1 R_2 resp.

(i) $r_1 + r_2$ is also a r.e. representing

$$R_1 \cup R_2$$

(ii) $r_1 \cdot r_2$ represents the set of strings $R_1 \cdot R_2$

$$R_1 \cdot R_2 = \{ w_1 \cdot w_2 \mid w_1 \in R_1 \ \ w_2 \in R_2 \}$$

(iii) (r_1) represent R_1

and $(r_1)^*$ represent $R_1^* = \varepsilon \cup \bigcup_{i \geq 1} (R_1)^i$

Nothing else is a r.e.

(iv) r^+ is $\bigcup_{i \geq 1} (R)^i$

$\Sigma : \{0, 1\}$

Examples : $01 + 100$

(1)

0 is r.e. 1 is r.e.

$\Rightarrow$ 0.1 is r.e.

Similarly 100 is r.e.

Then $01 + 100$ is r.e.

(2) $\left(10 + (101)^* 10\right)^*$ is a r.e.

(3) $(011)^+ = 011(011)^*$

$+ 10$ ✗

1. Regular languages represent some subsets of strings

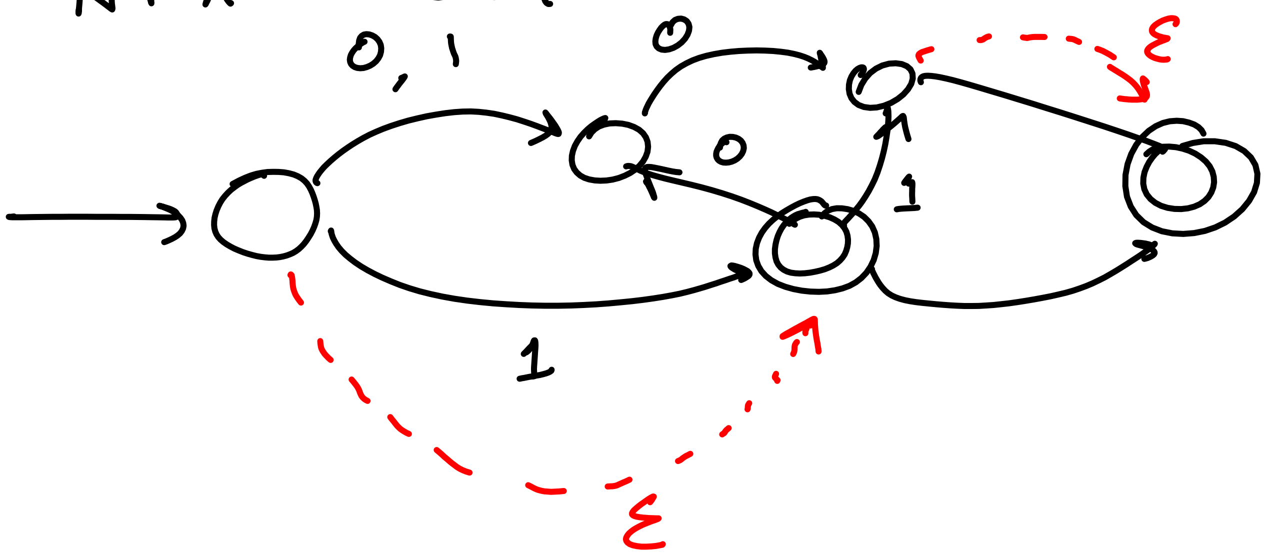
2. Reg Expr also represent some subsets of strings

(1) and (2) are identical

- If L can be recognized by a FA then there is a reg exp r s.t r represents L
- If r is a re corresponding to L, then we can design a FA M s.t $L(M) = L$

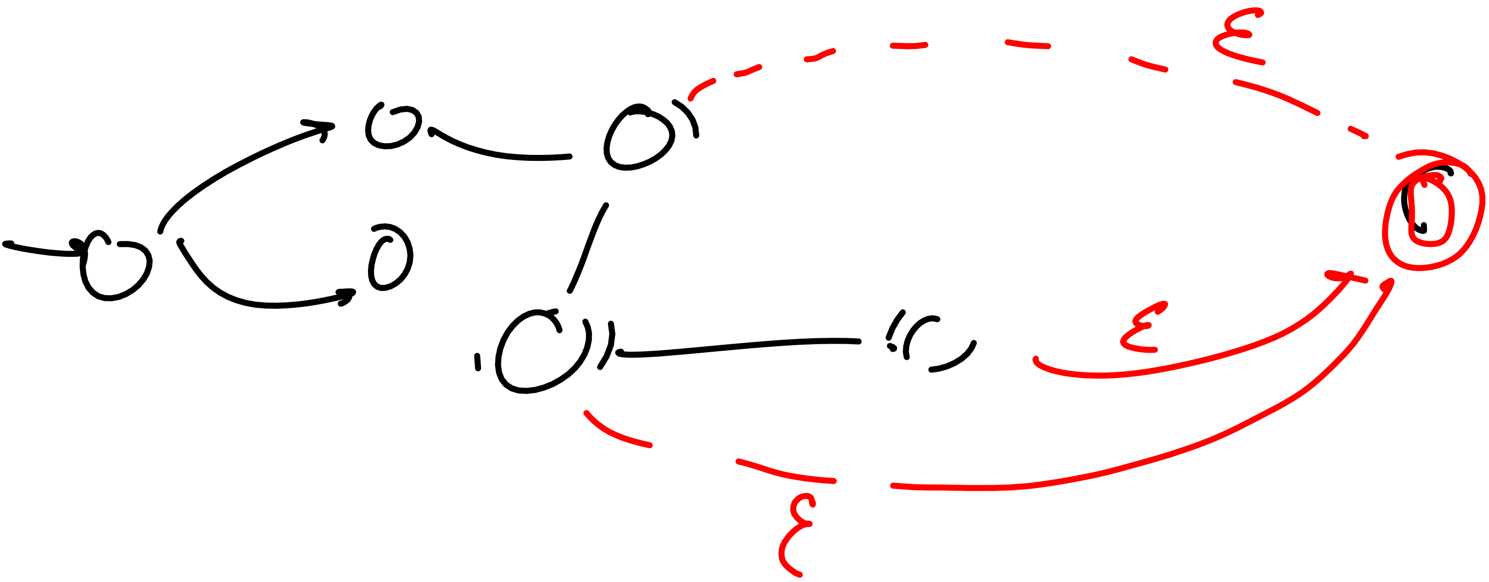
FA : DFA / NFA

NFA that uses ε transitions



For every NFA with ε transition, there is an NFA w/o ε-transitions

Observation: Using ε transitions we can build NFA (with ε tran) having exactly one Final state.



First Question

3 + 3 + 4