

2-1 \emptyset $\{x\}$ $A \cup B$ $A \cap B$ A^c $P(A)$

Alphabet Σ
 $\{0, 1\}$

Universe - strings of Σ
 Σ^*

ALL = $P(\Sigma^*)$

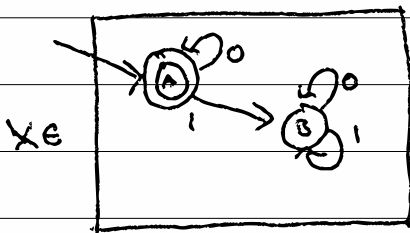
- All strings made of 0s
- All strings that are G.I.F
- All Harry novels
- All algebra problems "x + 3 = 7"
- All true math formulae
"1+1=2" "forall x, x+0=x"

FIN {symbols}

$$\underline{2-2} / \{pen, hblet\} \quad \{\checkmark, \square\}$$

$$= \{pen\} \cup \{hblet\}$$

Only Zeros: DFA - Deterministic Finite Automata



○ - states = {A, B}

◻ - start state = A

⊙ - accepting states = {A}

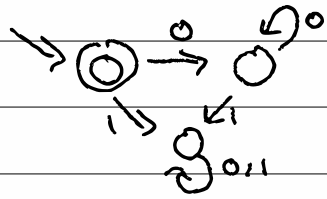
$\overset{x}{0} \rightarrow 0$ - transitions

	0	1
A	A	B
B	B	B

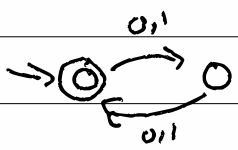
$\epsilon?$ ✓ $0?$ ✓ $10?$ X $000?$ ✓

2-3/

only zeros



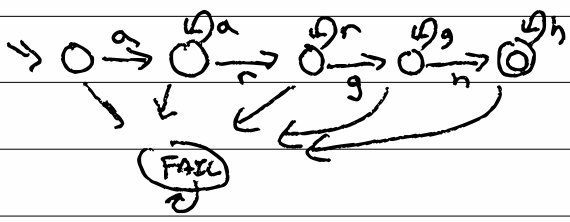
evenly - long



$0^i \checkmark$
 $0^i \times$
 $0^i \checkmark$

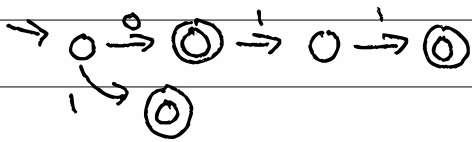
10? \checkmark

Any h



aaargghh

2-4 / {0, 1, 011}



$$\underline{2-5} \quad x \in \text{DFA} = (\underbrace{Q}_{\text{states}}, \underbrace{\Sigma}_{\text{alphabet}}, \underbrace{q_0}_{\in Q \text{ start}}, \underbrace{\delta}_{Q \times \Sigma \rightarrow Q} \text{ transitions}, \underbrace{F}_{\subseteq Q} \text{ accepting states})$$

$$\text{DFA configuration} = \underbrace{Q}_{\text{state}} \times \underbrace{\Sigma^*}_{\text{string}} = [q]w$$

[A] 011

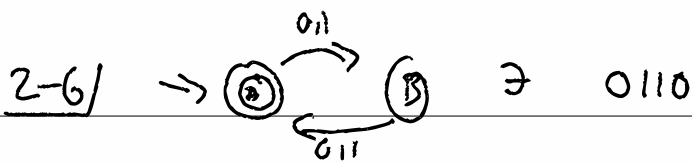
config update rule : $\text{DFA} \times \text{Config} \xrightarrow{\delta} \text{config}$

$$[q]w \rightarrow [q']w'$$

$$[q_i]cx \rightarrow [q_j]x \quad \text{iff} \quad \delta(q_i, c) = q_j$$

$$x \in \text{DFA} \quad \text{iff} \quad [q_0]x \xrightarrow{\delta} \dots \xrightarrow{\delta} [q_f]e$$

where $q_f \in F$



$$S(A, 0) = B$$

[A] 0110 \Rightarrow [B] 110 \Rightarrow [A] 10 \Rightarrow [B] 0 \Rightarrow [A] ϵ

✓

⌈ A F F ? ⌋ ✓

accepts : DFA \times string \rightarrow bool

accepts^{def} $(Q, \Sigma, q_0, \delta, F) \ x = h \rightarrow q_0 \ x$

has DFA \times state \times string = bool

h^{def} $(Q, \Sigma, q_0, \delta, F) \ q_i \ w =$

case w of $\epsilon \rightarrow q_i \in F?$

$c \ x \rightarrow h \ d (\delta(q_i, c)) \ x$

26

26

26

2-7/ class DFA Σ

... $Q, \Sigma, q_0, \delta, F$

public bool accepts (String w) Σ

State $q_i = q_0;$

while (~~! w.empty()~~ ! w.empty()) {

$q_i = \delta(q_i, w.first())$

$w = w.substr(1);$ }

return ~~! F.in(q_i);~~ F.in(q_i); }



