

Lab 6

Regex  $\rightarrow$  NFA  $\rightarrow$  DFA  $\rightarrow$  minDFA

$\exists$  un limbaj regulat,  $\exists$  un DFA unic care acc. limbajul și are un nr. minim de stări.

2 stări  $q_1, q_2$  nu pot fi distinse între ele dacă

$$\text{fwr}, (q_1 w) \vdash^* (q_2, \epsilon) \Leftrightarrow (q_2 w) \vdash^* (q_1, \epsilon)$$

2 stări  $q_1, q_2$  pot fi distinse între ele dacă  $\text{fwr}, (q_1 w) \vdash^* (q_2, \epsilon) \wedge (q_2 w) \vdash^* (q_1, \epsilon)$

$\rightarrow$  Alg: pt. a găsi toate perechile de stări care nu se disting între un DFA

- 1: tabel cu toate perechile de stări
- 2: mărcăm perechile (stare finală, stare non-finală)
- 3: inducție: luăm fiecare perche mărcată și pt.  $\forall$  simbol, mărcăm predecesorii

- $\rightarrow$  Grupăm stăriile care nu se disting între ele  $\Rightarrow P_1, P_2, \dots, P_m$
- $\rightarrow$  Fiecare  $P_1, \dots, P_m$  devine o stare minDFA.
- $\rightarrow$  Starea initială = aceea  $P$  care include  $q_0$ .
- $\rightarrow$  Stare finală = cele  $P$  care includ stări finale.

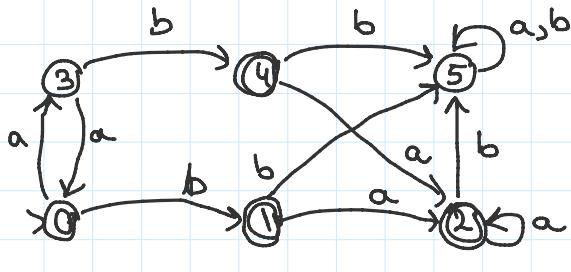
State Elim. Alg.  
DFA  $\rightarrow$  Regex

6.1.1. Operări indiziț.

$(0,3)$

$(1,2) \rightarrow (1,4)$

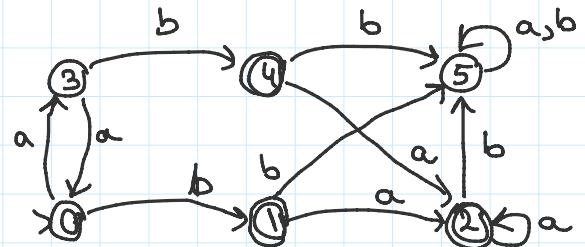
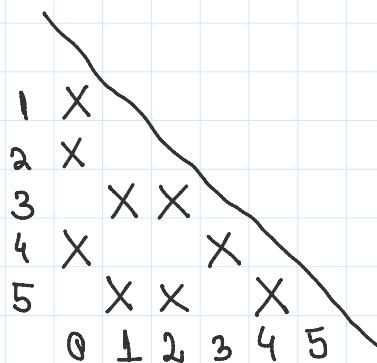
$(2,4)$



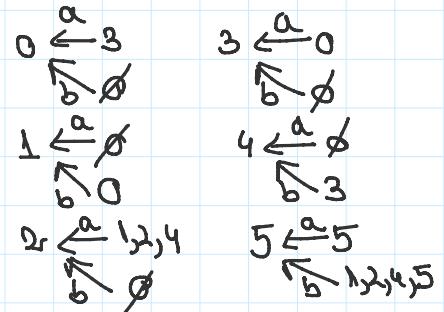
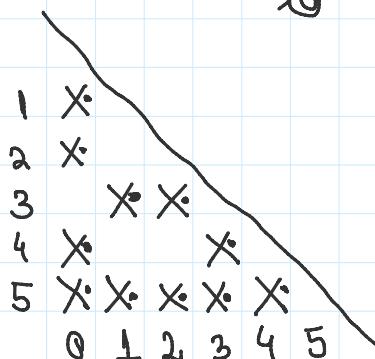
6.1.2: 0 perchè distingu.  
 $(0,5)$   
 $(3,5)$

6.1.3.

X (finali, non-finali)  
 $\{1,2,4\}$        $\{0,3,5\}$



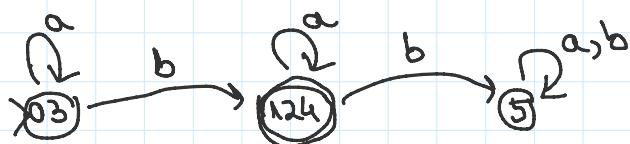
$(0,1) \rightarrow \emptyset$   
 $(0,2) \rightarrow (1,3), (2,3), (3,4)$   
 $(0,4) \rightarrow \emptyset$   
 $(1,3) \rightarrow \emptyset$   
 $(1,5) \rightarrow (0,1), (0,2), (0,4), (0,5)$   
 $(0,5) \rightarrow (3,5)$   
 $(2,3) \rightarrow (0,1), (0,2), (0,4)$   
 $(2,5) \rightarrow (1,5), (2,5), (4,5)$   
 $(3,4) \rightarrow \emptyset$   
 $(3,5) \rightarrow (0,5)$   
 $(4,5) \rightarrow (1,3), (2,3), (4,3), (5,3)$



→ Pari che distingu.:  $(0,3), (1,2), (1,4), (2,4)$

→ Paritile:  $\{(0,3), (1,2,4), (5)\}$

6.2.1. min DFA



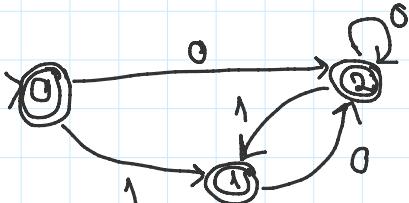
6.2.2:

$$E_1 = (1 \cup \epsilon) (00^*)^* 0^*$$

$$E_2 = (10 \cup 0)^* (01 \cup 1)^* (0 \cup \epsilon)$$

$E_1 \text{ eq. } E_2?$

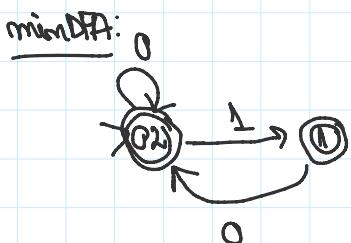
$E_1 \rightarrow \text{NFA } N_1 \rightarrow \text{DFA } A_1: \Rightarrow \text{minimiza?}$



$(0,1)$  re distinct? DFA,  $w=1$   
 $(0, "1") \vdash (1, \epsilon)$  ACCEPT  
 $(1, "1") \vdash ?$  REJECT

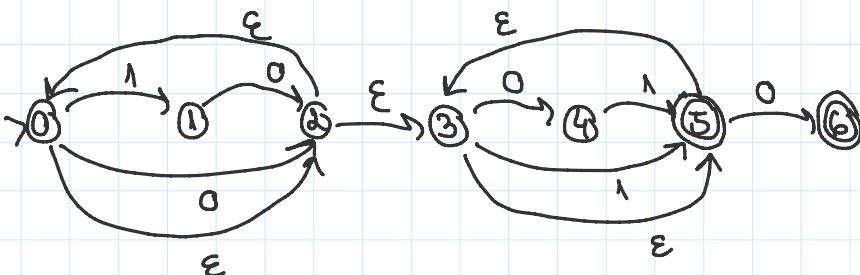
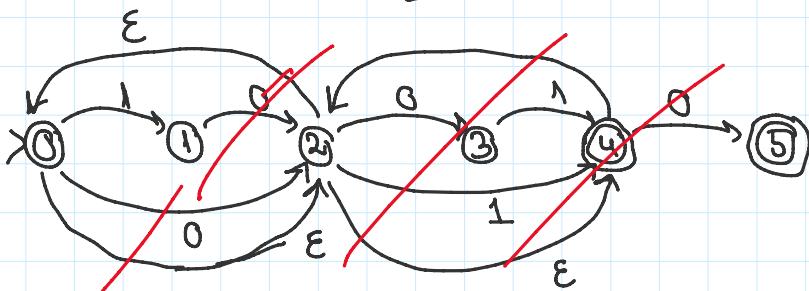
$(0,2)$  re distinct? NU.

$(1,2)$  re distinct? DFA,  $w=1$

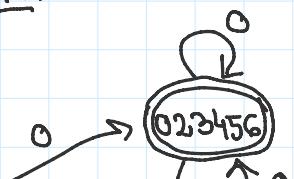


$E_2 \rightarrow N_2$

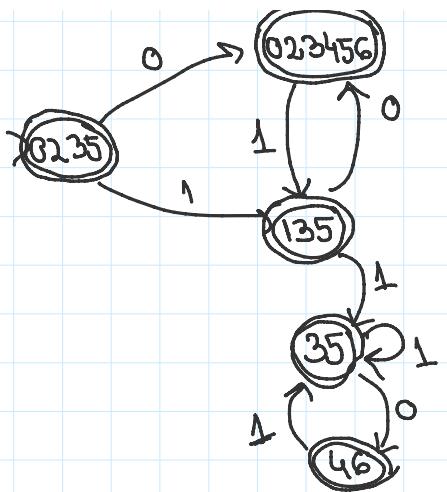
$$(1000)^* (01\cup 1)^* (0\cup \epsilon)$$



NFA  $\rightarrow$  DFA



$$\begin{aligned} \epsilon\text{-closures}(0) &= 0235 \\ \epsilon\text{-closures}(1) &= 1 \\ \epsilon\text{-c}(2) &= 0235 \\ \epsilon\text{-c}(3) &= 35 \\ \epsilon\text{-c}(4) &= 4 \\ \epsilon\text{-c}(5) &= 35 \\ r - r(\epsilon) &= r \end{aligned}$$

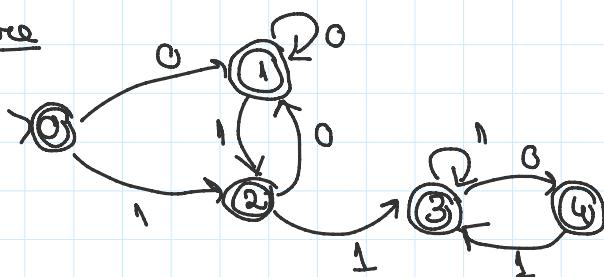


$\vdash \text{c}(5) = 7$   
 $\text{c}(5) = 35$   
 $\text{c}(6) = 6$

$(023456, 1) \rightarrow 135$   
 $(135, 0) \rightarrow 023546$   
 $(135, 1) \rightarrow 35$   
 $(35, 0) \rightarrow 46$   
 $(35, 1) \rightarrow 35$

$(0235, 0) \rightarrow 460235$   
 $(0235, 1) \rightarrow 135$   
 $(023456, 0) \rightarrow 023546$   
 $(46, 0) \rightarrow 1 /$   
 $(46, 1) \rightarrow 35$

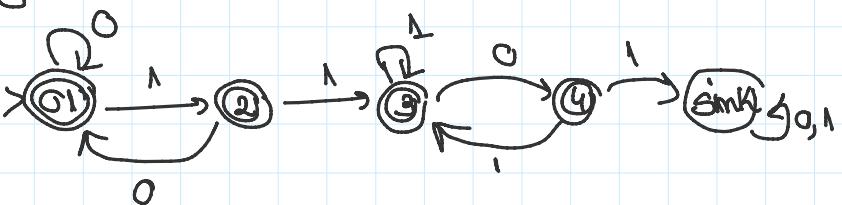
$\Rightarrow$  minimizare



$(0, 1)$  nu se disting

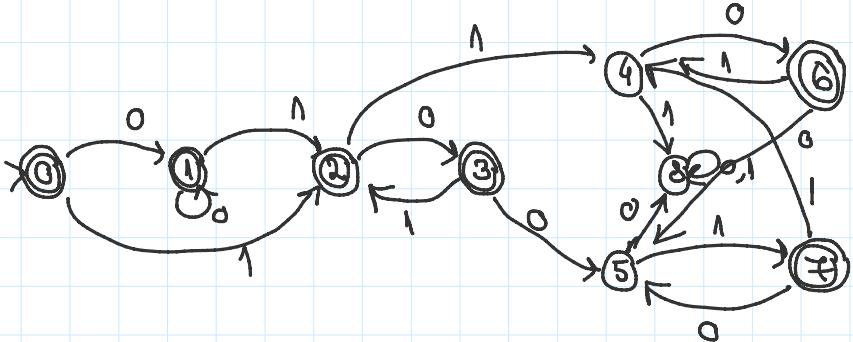
?

minDFA:

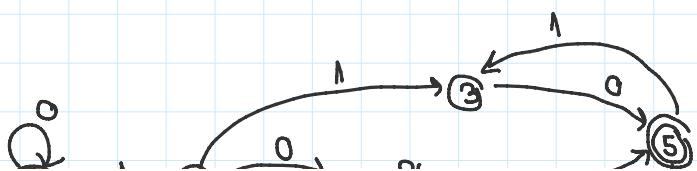


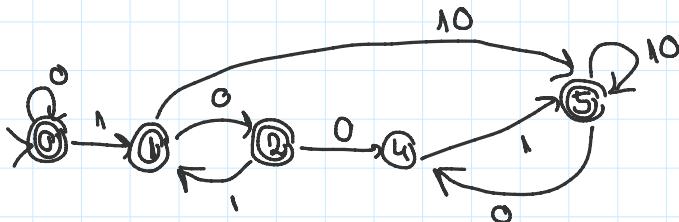
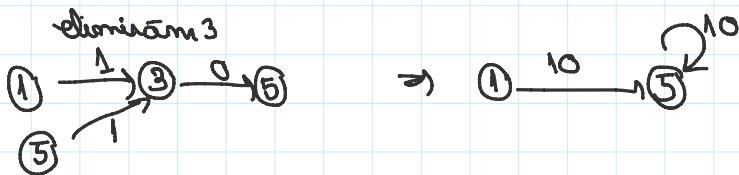
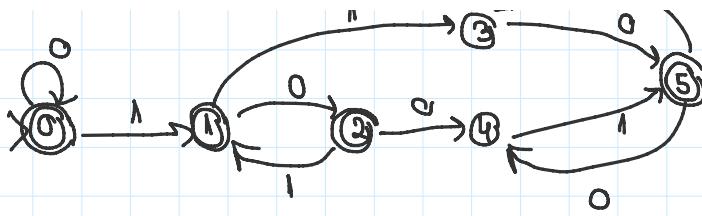
$\text{minDFA}(E_1) \neq \text{minDFA}(E_2) \rightarrow E_1$  nu e echivalent cu  $E_2$ .

63.1.

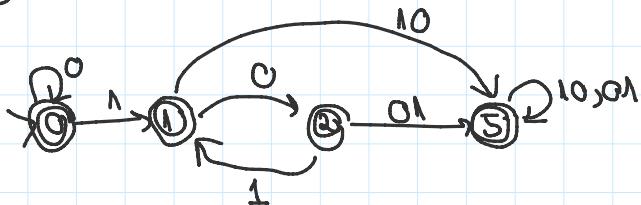


$\downarrow$  minimizare





eliminación 4



$\times 5 \xrightarrow{10,01} (10,01)^*$

$\times 0 \xrightarrow{01} 5 \xrightarrow{10,01}$

$\underbrace{\varepsilon \cup (01(10,01)^*)}_{e_1}$

$\times 1 \xrightarrow{0} 2 \xrightarrow{01} 5 \xrightarrow{10,01} (01)^*(\varepsilon \cup 0(e_1))$

$\times 5 \xrightarrow{10} 5 \xrightarrow{10,01}$

$\underbrace{\varepsilon \cup (10(10,01)^*)}_{}$

$$t = 0^* \left( \varepsilon \cup 1 \left( (01)^* (\varepsilon \cup 0(e_1)) \right) \cup \left( \varepsilon \cup (10(10,01)^*) \right) \right)$$