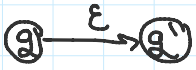
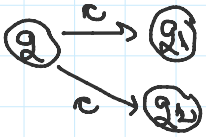
Lab 5

NFA (Automate Finite Nedeterministe)

$N = (K, \Sigma, \Delta, q_0, F)$, $\Delta \subseteq K \times \Sigma^* \times K$

permite:

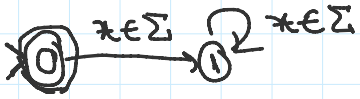
1) ε-tranziții 

2) mai multe tranziții pe același simbol din-o stare 

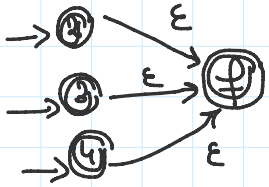
Conversia Expr. Reg. => NFA

Cazuri de bază:

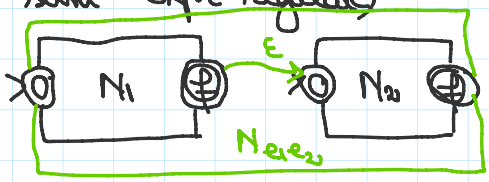
$\emptyset$ 

ε
$\mathcal{L}(\varepsilon) = \{\varepsilon\}$ 

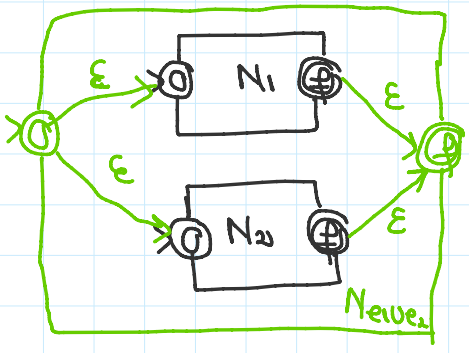
$c \in \Sigma$
$\mathcal{L}(c) = \{c\}$ 



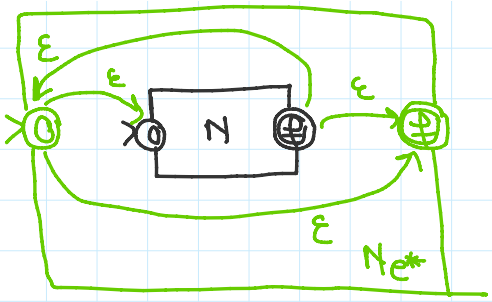
Cazuri compuse: (e, e_1, e_2 sunt expr. regulate)

$e_1 e_2$ 

$\mathcal{L}(e_1) = \mathcal{L}(N_1)$
$\mathcal{L}(e_2) = \mathcal{L}(N_2)$

$e_1 \cup e_2$ 

e^*



Conversia NFA => DFA

$N = (K, \Sigma, \Delta, q_0, F) \Rightarrow A = (K', \Sigma, \delta, Q_0, F')$

$\mathcal{L}(N) = \mathcal{L}(A)$

$K' = 2^K$

$\delta(Q, c) = \bigcup_{(q', c, q) \in \Delta,\ q' \in Q} E(q)$

$Q_0 = E(q_0)$

$F' = \{Q \in K' \mid Q \cap F \neq \emptyset\}$

ε - closure

$E(q) = \{ q' \in K \mid (q, \varepsilon) \vdash_N^* (q', \varepsilon) \}$

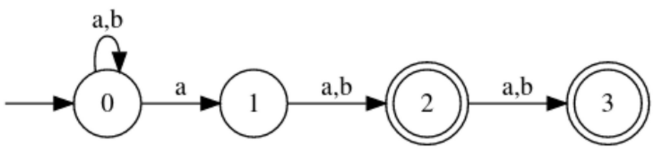
Limbaj regulat = limbaj generat de o expr. reg. sau acceptat de un DFA sau NFA.

Configuratie pt. DFA/NFA : (q, w)

Ex.

1.1.

N_1:



$\vdash (1, \varepsilon)$ ✗

$(0, abba) \vdash (0, bba) \vdash (0, ba) \vdash (0, a) \vdash (0, \varepsilon)$ ✗

$\vdash (1, bba) \vdash (2, ba) \vdash (3, a)$ se blocheaza ✗

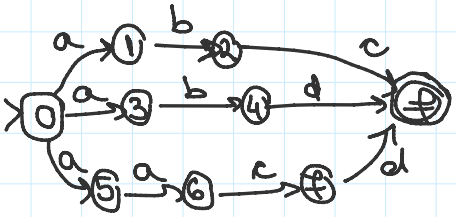
(1.2.) $\mathcal{L}(N_1) = \mathcal{L}\left((a \cup b)^* a\,(a \cup b)(a \cup b \cup \varepsilon)\right)$

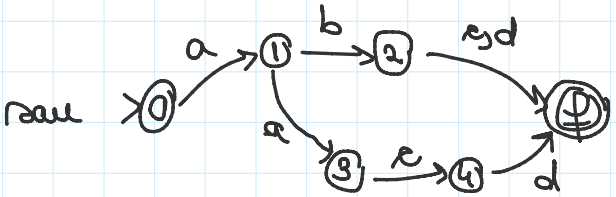
a^*b^* _ _ X_ aabb_ _ _ √ babba_X_

$(a \cup b)+$ _ _ _ X _ _ _ _ X

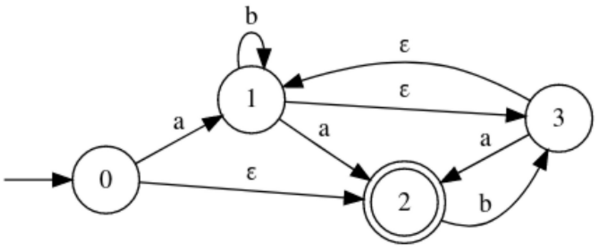
(1.3.) $\mathcal{L} = \{abc, abd, aacdy\}$

N_{2i}:





(1.4.)



$\vdash (2, bbb) \vdash (3, bb) \vdash \_\_$

$\vdash (1, abbb) \vdash (3, abbb)$

$\vdash (1, babbb) \vdash (3, babbb)$

$(0, abbabbb) \vdash (1, bbabbb) \vdash (3, bbabbb)$

$\vdash (2, abbabbb)$

(2.1.) $E = (1 \cup \varepsilon)(00^*1)^* 0^*$ ← nu poti avea 2 de 1 consecutiv

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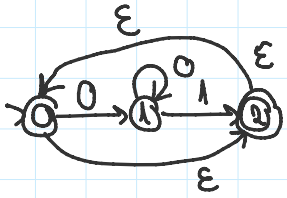
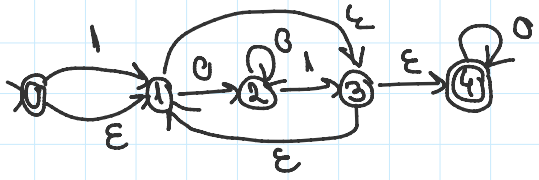
(2.2.) $E \rightarrow$ NFA

$1 \cup \varepsilon$

0^*

$(00^*1)^*$

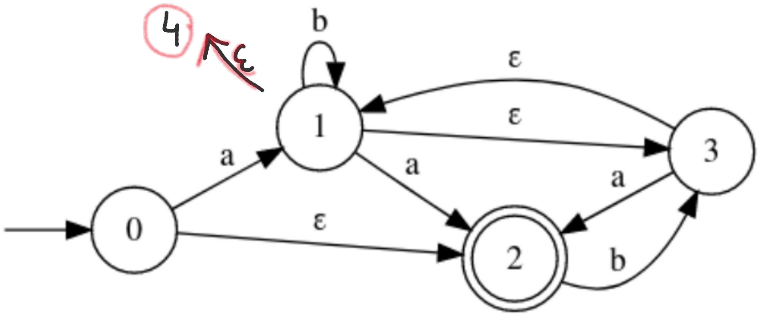




11001100111 ✗

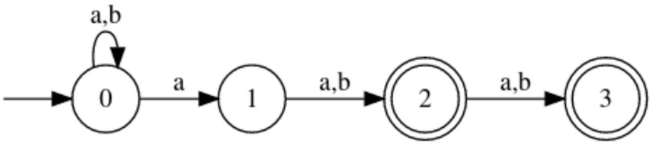
3.1. ε- closure:

$E(0) = \{0,2,4\}$ ✗4
$E(1) = \{1,3\}$ ✗4
$E(2) = \{2\}$
$E(3) = \{1,3\}$ ✗4



3.2.

N:

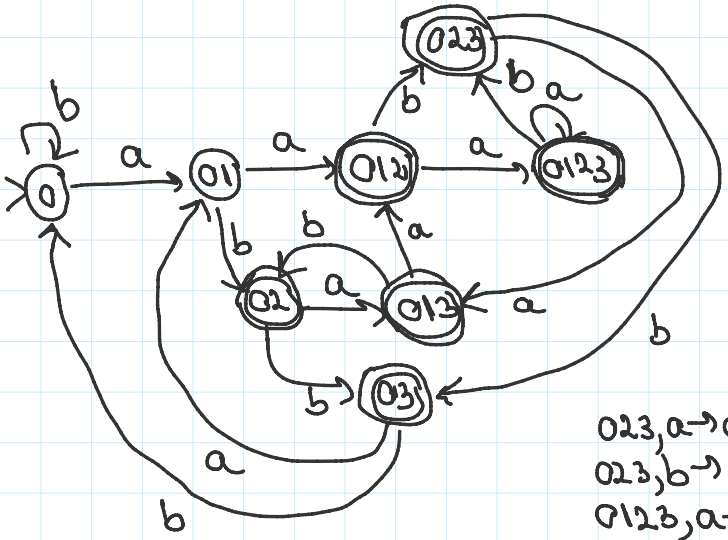


$\Sigma = \{a,b\}$

δ:

0, a → {0,1}
0, b → {0}
01, a → {0,1,2}
01, b → {0,2}
02, a → {0,1,3}
02, b → {0,3}
03, a → {0,1}
03, b → {0}
012, a → {0,1,2,3}
012, b → {0,2,3}
013, a → {0,1,2}
013, b → {0,2}

⇒ D:

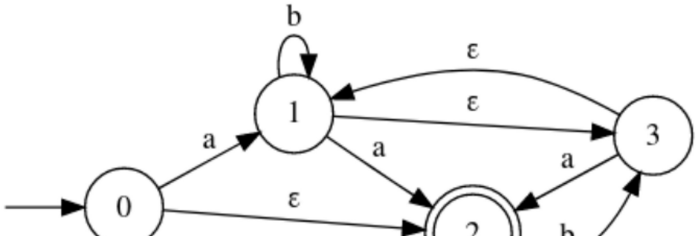


023, a → 013
023, b → 03
0123, a → 0123
0123, b → 023

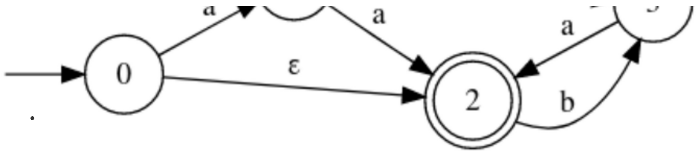
3.3.

$E(0) = \{0,2\}$
$E(1) = \{1,3\}$
$E(2) = \{2\}$

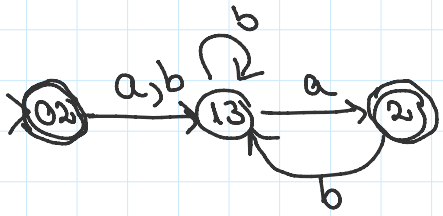
N:



$E(1) = \{1,3\}$
$E(2) = \{2\}$
$E(3) = \{1,3\}$



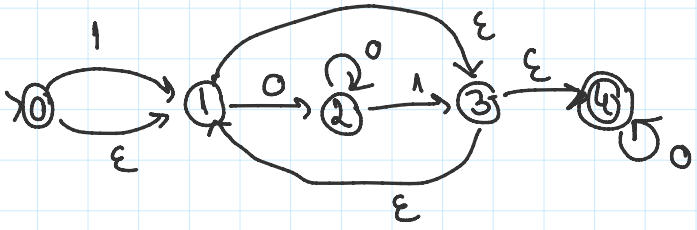
⇒ DFA:



02, a → 13
02, b → 13
13, a → 2
13, b → 13
2, a → X (eventual SINK STATE)
2, b → 31

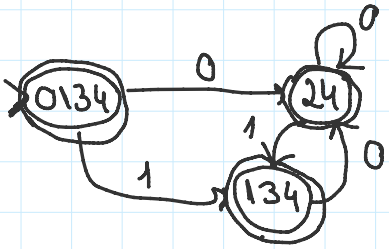
3.4.

NFA:



⇒ DFA:

$E(0) = \{0,1,3,4\}$
$E(1) = \{1,3,4\}$
$E(2) = \{2\}$
$E(3) = \{1,3,4\}$
$E(4) = \{4\}$



0134, "0" → 24
0134, "1" → 134

24, "0" → 24
24, "1" → 134

134, "0" → 24
134, "1" → X