SEMINAR 1

$a \cdot b \neq b \cdot a$

↑ operația de concatenare

$\Sigma \cdot \Sigma = \{ x_1 x_2 \mid x_1 \in \Sigma_1, x_2 \in \Sigma_2 \}$

$\Sigma_1 = \{0, 1, 2, \dots, 9\}$

$\Sigma_1 \cdot \Sigma_2 = \{00, 01, \dots 99\}$

$\Sigma^{k+1} = \Sigma^k \cdot \Sigma = \{ x_1 x_2 \dots x_{k+1} \mid x_i \in \Sigma \}$

$\Sigma^* = \underbrace{\Sigma^0}_{\{\lambda\}} \cup \Sigma^1 \cup \Sigma^2 \cup \dots = \bigcup_{k \geq 0} \Sigma^k$

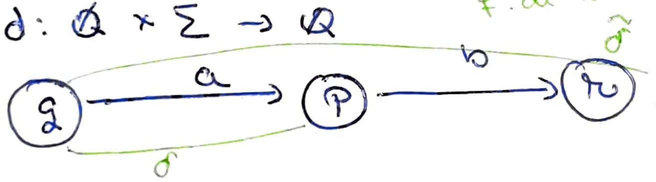
$\lambda \cdot a = a \cdot \lambda = a$

AFD - automat finit determinist

$A = (\underset{\text{stări}}{Q}, \underset{\text{alfabet}}{\Sigma}, \underset{\text{stări init.}}{q_0}, \underset{\text{f. de tranziție}}{\delta}, \underset{\text{mulțime de stări finale}}{F})$

finite

$\delta : Q \times \Sigma \to Q$



δ extins: $\tilde{\delta} : Q \times \Sigma^* \to Q$

$\tilde{\delta}(q, \lambda) = q$

$\tilde{\delta}(q, \alpha \cdot a) = \delta(\underbrace{\tilde{\delta}(q, \alpha)}_{p}, a)$

$\tilde{\delta}(q, a\alpha) = \tilde{\delta}(\underbrace{\delta(q, a)}_{p}, \alpha)$

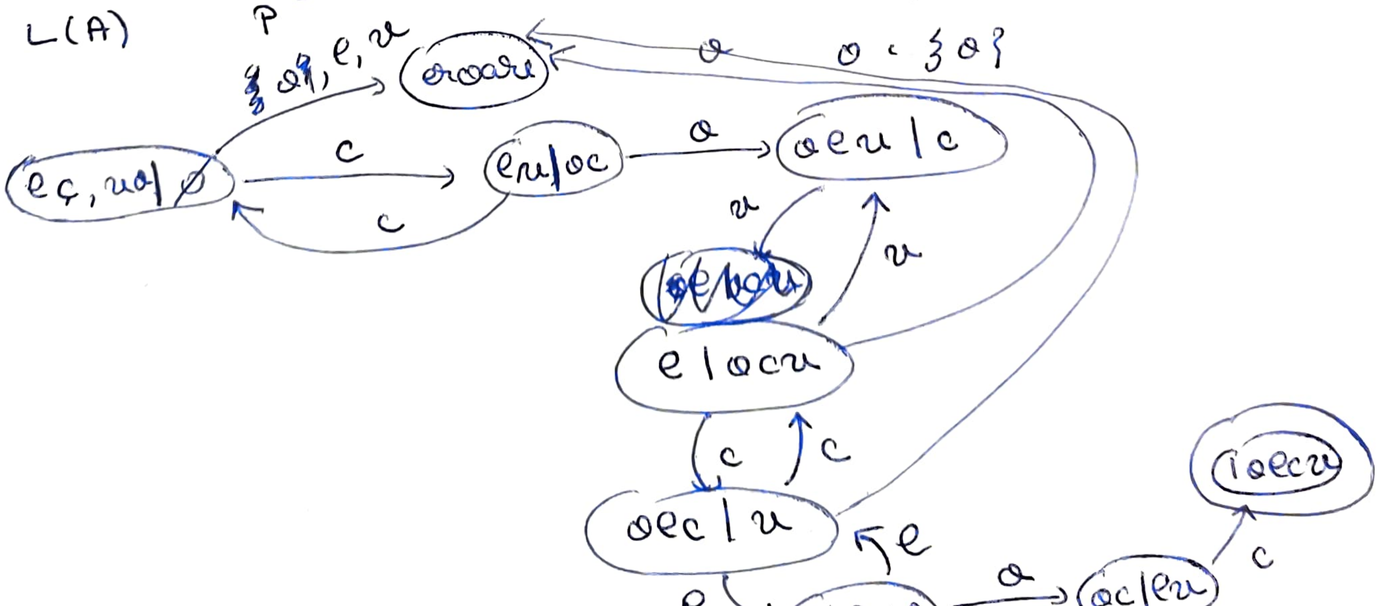
$L(A)$

$a = \{o, e\}$

$c = \{o, c\}$

$u = \{o, u\}$

$o = \{o\}$



$\Sigma = \{o, e, c, u\}$

$Q = \{ (o, e, c, u \mid \emptyset), \dots \}$

$F = \{ (\emptyset, oecu) \}$

$\tilde{\delta}((oecu \mid \emptyset), coe) = (e, ocu)$ ~~$= \delta((oecu), e)$~~

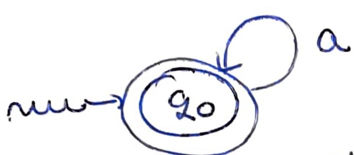
~~$= \delta(\delta(oeu, c)$~~ $= \delta(\delta(\delta(oecu, \emptyset), c), o), u)$

$L(A) = \{ w \in \Sigma^* \mid \tilde{\delta}(q_0, w) \in F \}$

starea inițială

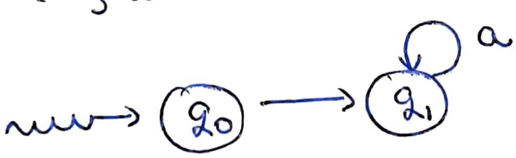
$L(A) = \{ couceoc, cceouceoc, \dots \}$

$L(A) = \{ a^n \mid n \geq 0 \} = \{ \lambda, a, a^2, \dots \}$

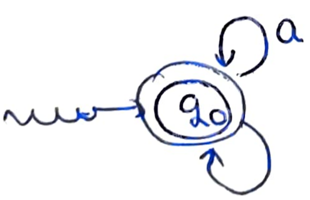


$$\boxed{\begin{aligned} \lambda \in L(A) &\Leftrightarrow \tilde{\delta}(q_0, \lambda) \in F \\ &\Leftrightarrow q_0 \in F \end{aligned}}$$

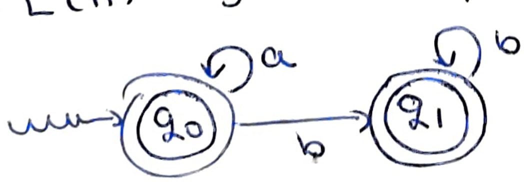
→ $L(A) = \{ a^n \mid n \geq 1 \}$



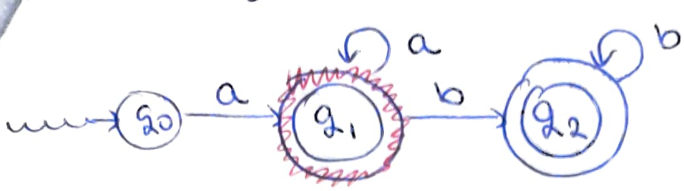
→ $L(A) = \{a, b\}^* = \{ \lambda, ab, ba \dots \}$



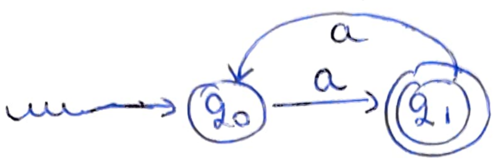
→ $L(A) = \{ a^n b^m \mid n, m \geq 0 \} = \{ \lambda, a, b, ab, \dots \}$



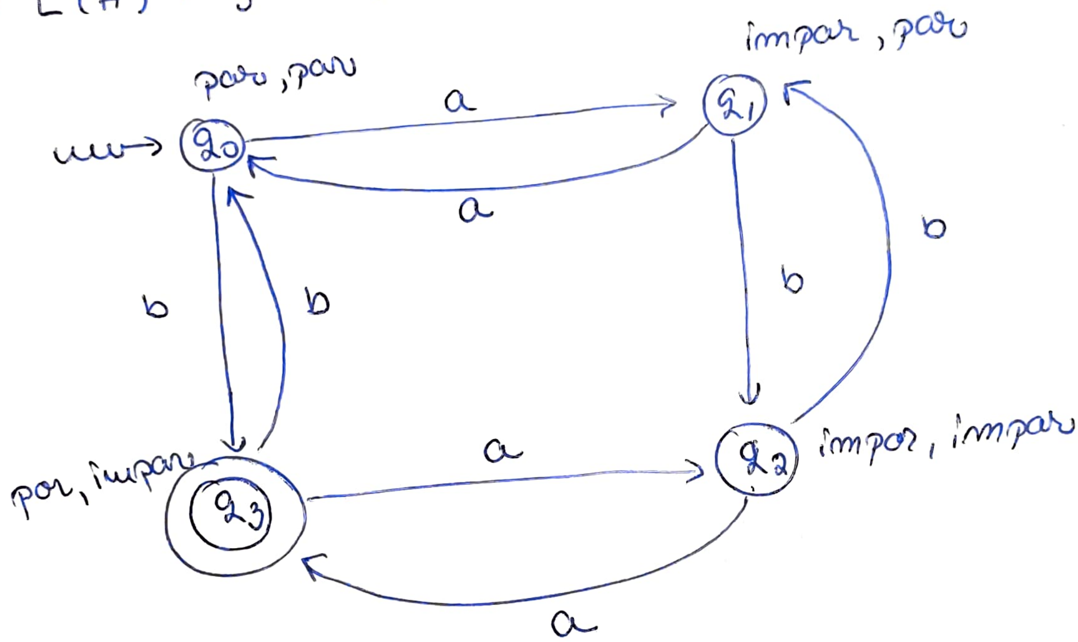
→ $L(A) = \{a^m b^m \mid m, n \geq 1\}$



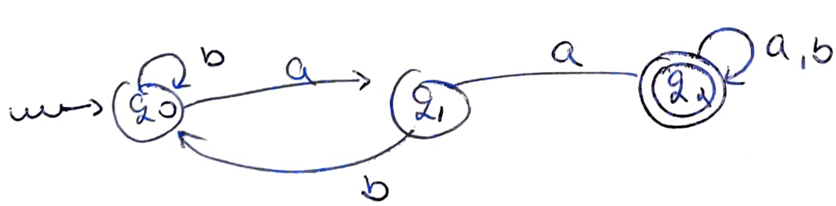
→ $L(A) = \{a^{2k+1} \mid k \geq 0\} = \{a, a^3, \ldots\}$



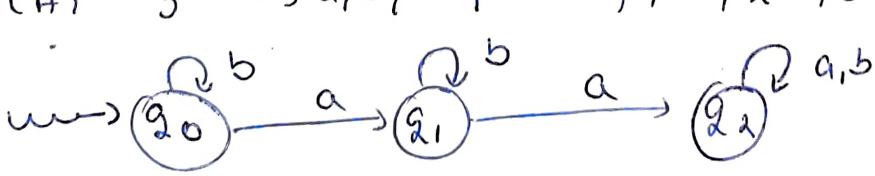
→ $L(A) = \{\alpha \in \{a,b\}^* \mid M_a(\alpha)$ par și $M_b(\alpha)$ impar$\}$



→ $L(A) = \{\alpha \in \{a, b\}^* \mid \alpha = \beta_1 a a \beta_2$
$\beta_1, \beta_2 \in \{a,b\}^*\}$



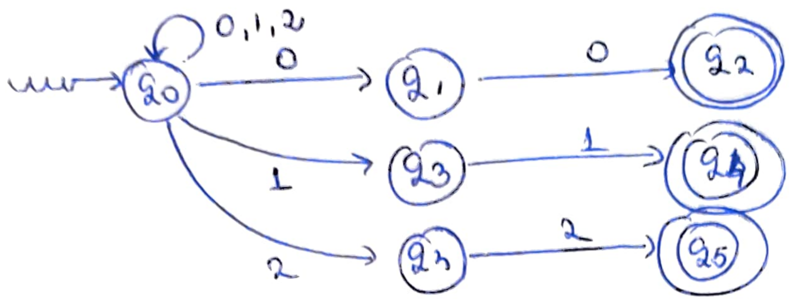
→ $L(A) = \{\alpha \in \{a,b\}^* \mid \alpha = \beta_1 a \beta_2 a \beta_3\}$



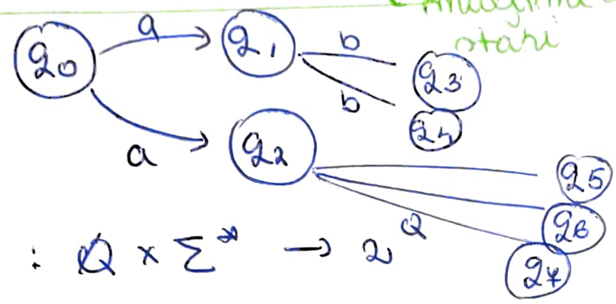
$\rightarrow L(A) = \{ \alpha \in \{0,1,2\}^* \mid \alpha = \alpha_1 aa,\ \alpha_1 \in \{0,1,2\}^*,\ a \in \{0,1,2\} \}$

AFN

$= \{00, 11, 22, 011, 111, 211 \ldots\}$



AFN: $\boxed{\delta : Q \times \Sigma \rightarrow 2^Q}$ ← mulțime de stări



$\tilde{\delta} : Q \times \Sigma^* \rightarrow 2^Q$

$\tilde{\delta}(q_0, ab) = \{q_3, q_4, q_5, q_6, q_7\}$

$\tilde{\delta}(q, \lambda) = \{q\}$

$\tilde{\delta}(q, a\alpha) = \tilde{\delta}(\underbrace{\delta(q,a)}, \alpha)$

$\tilde{\delta}(q, \alpha \cdot a) = \bar{\delta}(\underbrace{\tilde{\delta}(q,\alpha)}_{P}, a)$ = mulțime

$\bar{\delta} : 2^Q \times \Sigma \rightarrow 2^Q$

$\bar{\delta}(P, a) = \bigcup_{q_i \in P} \delta(q_i, a)$

$\tilde{\delta}(q, ab) = \bar{\delta}(\underbrace{\delta(q,a)}_{\{q_1, q_2\}}, b) = \bigcup_{q_i \in \{q_1, q_2\}} \delta(q_i, b) =$

$= \{q_3, q_4, q_5, q_6, q_7\}$

$\cancel{L(A) = \{ w \in \Sigma^* \mid \tilde{\delta}(q_0, w) \in F \}}$

$L(A) = \{ w \in \Sigma^* \mid \underbrace{\tilde{\delta}(q_0, w)}_{P} \cap F \neq \emptyset \}$

$\mathcal{L}_3 < \mathcal{L}_2 < \mathcal{L}_1 < \mathcal{L}_0$

$\mathcal{L}_3$ ↑ limbaje regulate

$\mathcal{L}_2$ ↑ independente de context

$\mathcal{L}_1$ ↑ dependente de context

dependența înc: putem folosi o variabilă abia după ce o declarăm

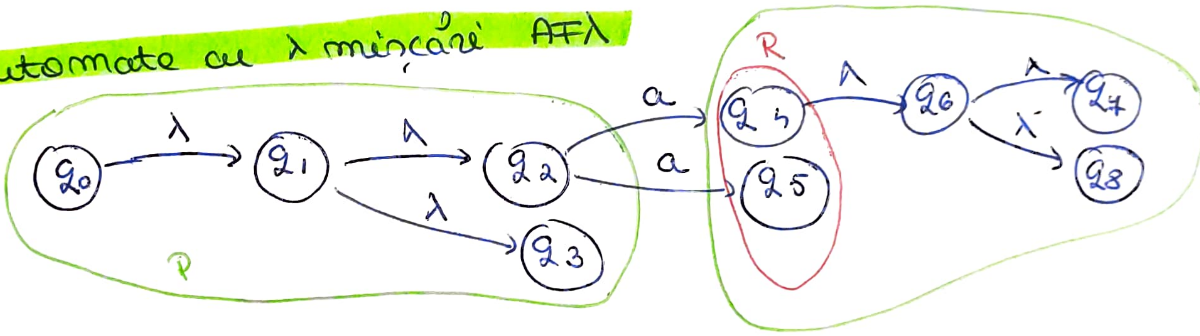
AF:
- AFD
- AFN
- AFλ

$\mathcal{L}_2$ – APD

$$\tilde{\delta}(q_0,100) = \cancel{\{\delta(q_0}\ \underbrace{\delta(\underbrace{\delta(\underbrace{\delta(q_0,1)}_{\{q_0,q_3\}},0)}_{\{q_0,q_1\}},0)}_{\{q_1,q_0,q_2\}}$$

↑ 100 este acceptat

Automate cu λ mișcări AFλ



$\delta : Q \times \Sigma \cup \{\lambda\} \to 2^Q$

$\cancel{\langle q_i \rangle = \{q_i \mid \exists q_1\ \delta(q_{i-1},\lambda) \ni q_i\}}$

$\langle q_i \rangle = \{q_n \mid (\forall)\ i \in \overline{2,n}\ \delta(q_{i-1},\lambda) \ni q_i\}$

$\langle q_0 \rangle = \{q_1, q_2, q_3, q_0\}$

$\hat{\delta} : Q \times \Sigma^* \to 2^Q$

$\hat{\delta}(q,\lambda) = \langle q \rangle$

$\cancel{\hat{\delta}(q,a)} = \quad \lambda^{i}$

$\hat{\delta}(q,a) = \hat{\delta}(q, \lambda^i \circ a \circ \lambda^j) = \langle \underbrace{\delta(\underbrace{\langle q \rangle}_{P}, a)}_{E} \rangle$

$\hat{\delta}(q_0, a) = < \delta(<q>, a) >$

$\hat{\delta}(q_0, a) = < \bar{\delta}(\{q_0, q_1, q_2, q_3\}, a) > =$

$= < \{q_4, q_5\} > = \{q_4, q_5, q_6, q_7, q_8\}$