Automat finit (www)

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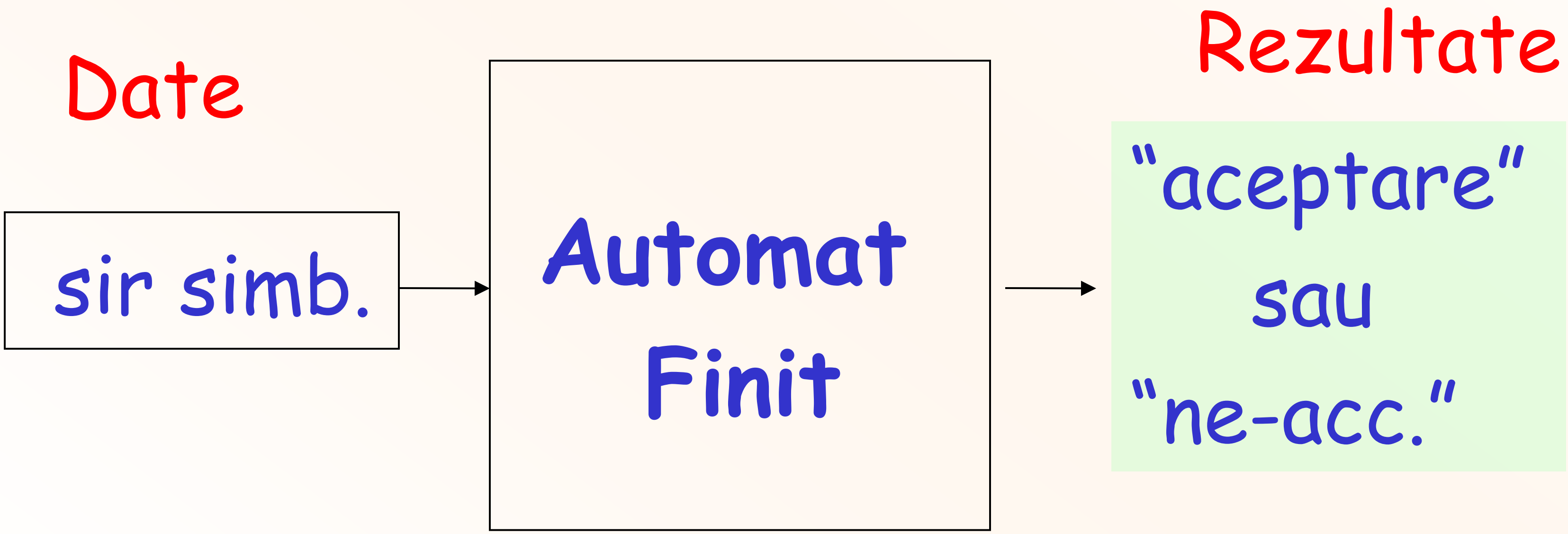
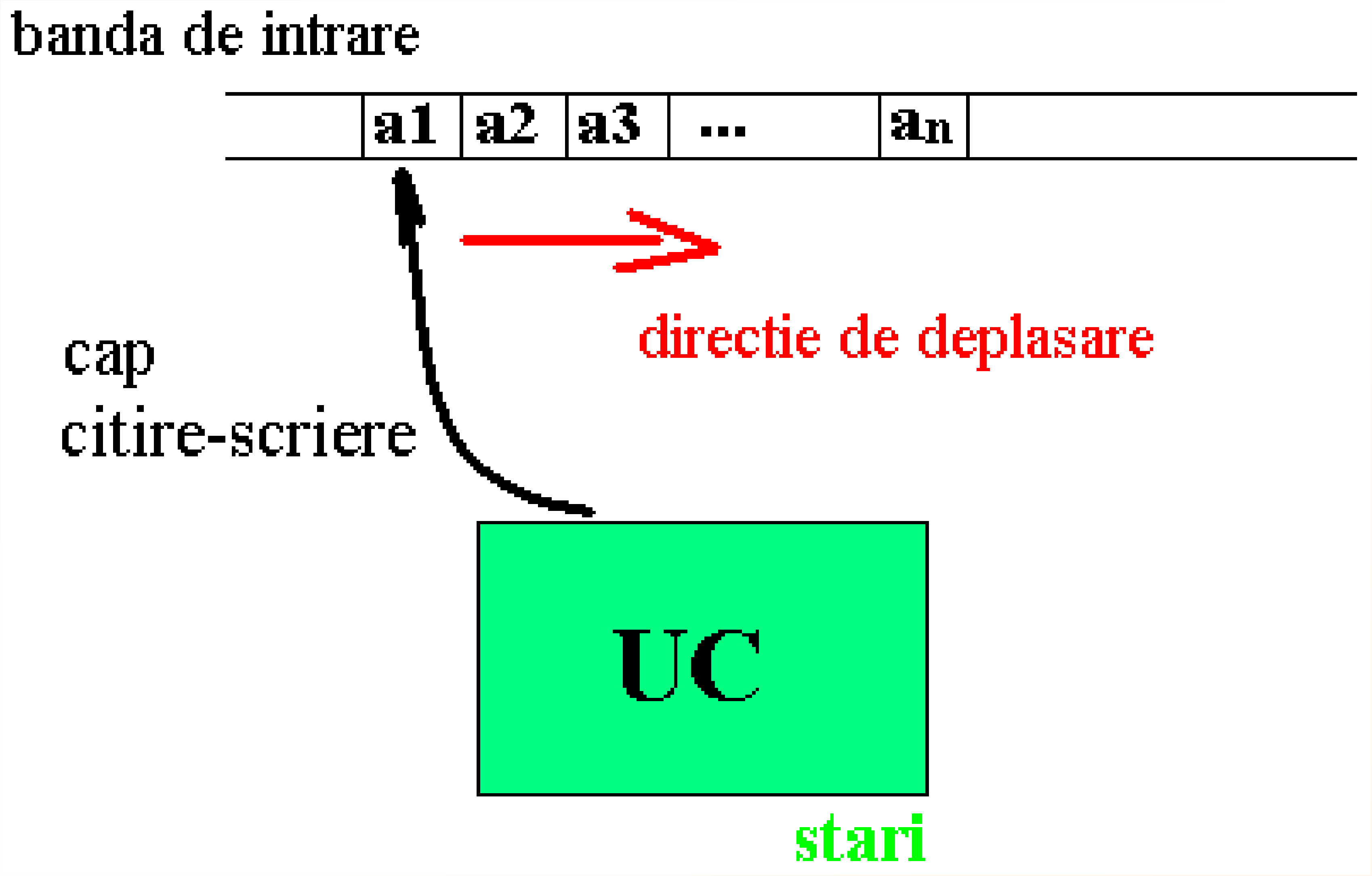


Automat finit: model fizic



Automat finit: model matematic

- Un ***automat finit*** este un ansamblu

  $M = (Q, \Sigma, \delta, q_0, F)$:
- Q – alfabetul starilor
- Σ – alfabet de intrare
- $\delta : Q\text{x}\Sigma \rightarrow \mathcal{P}(Q)$ functie de tranzitie
- $q_0 \in Q$ - stare initialã
- $F \subseteq Q$ multimea stãrilor finale

AF – reprezentare tabelara

δ		a_j		

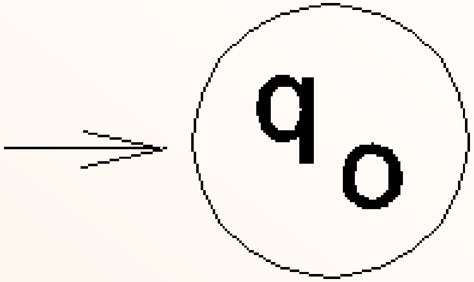
$z_i =$ 0 daca q_i nu e stare finala
1 daca q_i este stare finala

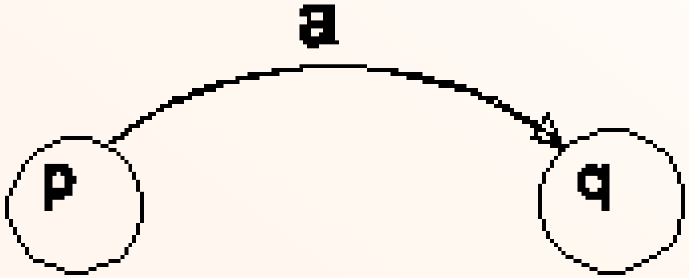
δ	**0**	**1**	
p	q	p	0
q	r	p	0
r	r	r	1

AF reprezentat tabelar; exemplu

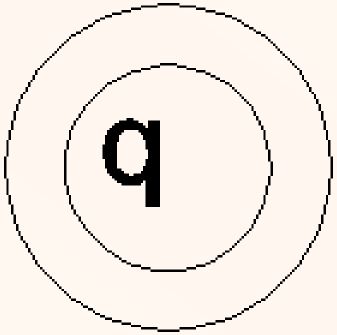
AF – reprezentare sub forma de graf

- graf orientat
- cu noduri si arce etichetate





- (graf de tranzitii)



Configuratii si relatii de tranzitie

$M = (Q, \Sigma, \delta, q_0, F)$.

configuratie: $(q,x) \in \mathbf{Q x \Sigma^*}$

tranzitie: element din $\mathbf{(Q x \Sigma^*) \; x \; (Q x \Sigma^*)}$

- $\vdash$ tranzitie directa
- $\vdash^{k}$ k-tranzitie
- $\vdash^{+}$ +-tranzitie
- $\vdash^{*}$ *-tranzitie

$(p,aw) \vdash (q,w) \Leftrightarrow \delta(p,a) \ni q;$

$p,q \in Q,\ a \in \Sigma,\ w \in \Sigma^*$

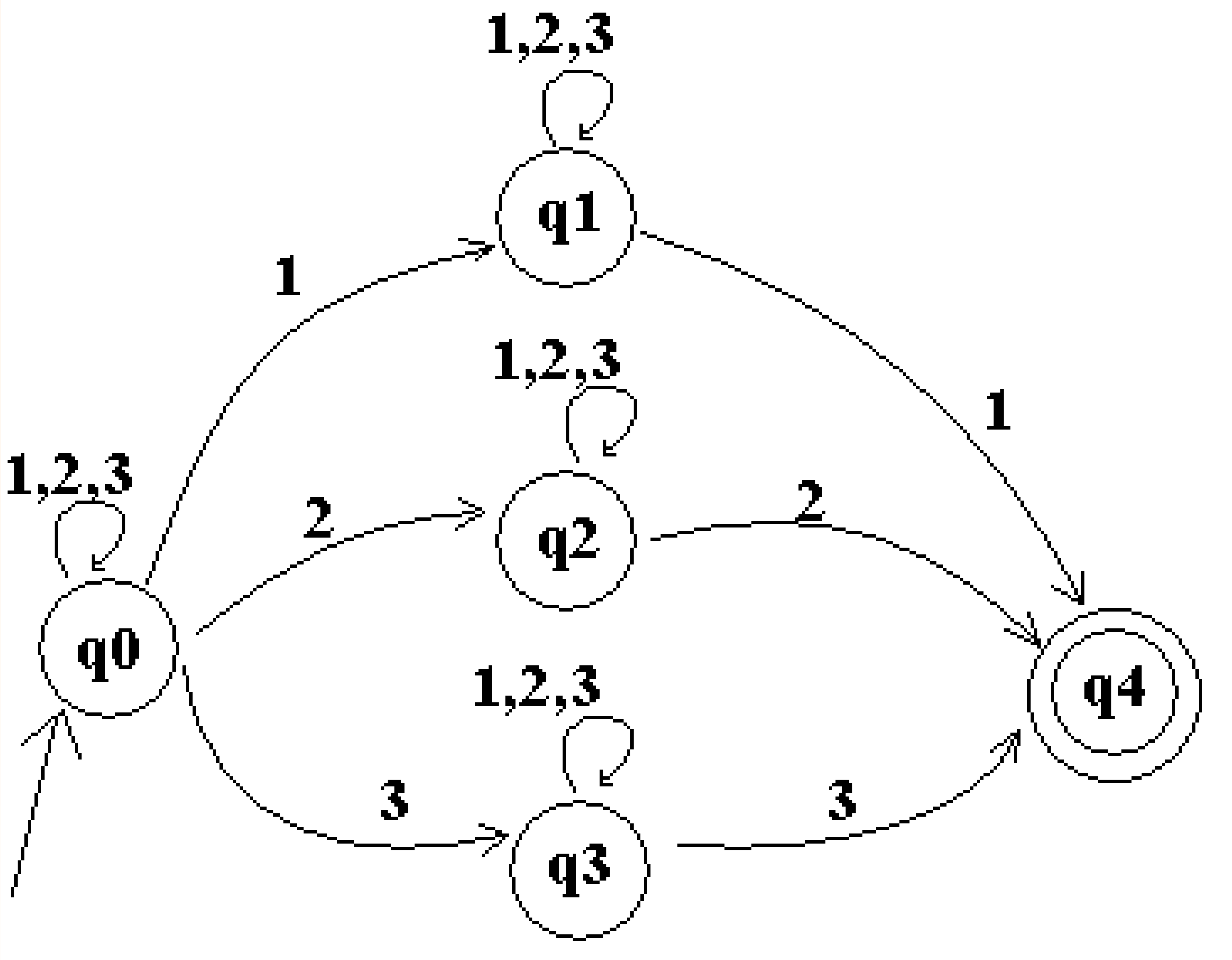
Limbaj acceptat; autom. echivalente

- Limbaj acceptat de automat

  $\mathbf{L(M) = \{w \mid w \in \Sigma^*, (q_0,w) \vdash^* (q_f,\varepsilon), q_f \in F\}}$

- Automate echivalente

  M_1 echivalent cu M_2 daca: $L(M_1) = L(M_2)$



Automat finit - exemplu

Determinism

- Automat finit determinist (AFD)

  $|\delta(q,a)| <= 1 \quad \forall\, q \in Q,\ a \in \Sigma$

- Automat finit nedeterminist (AFN)

  $\exists\, q \in Q,\ a \in \Sigma$ astfel incat $|\delta(q,a)| > 1$

- Automat finit determinist complet definit

  $|\delta(q,a)| = 1 \quad \forall\, q \in Q,\ a \in \Sigma$

Echivalenta dintre AFD si AFN

Teorema:

- $\forall$ M_1 – AFN $\exists$ M_2 – AFD echivalent

Constructie (nu demonstratie!):

- Pornim cu: $M_1=(Q_1,\Sigma_1,\delta_1,q_{01},F_1)$ – AFN oarecare
- Construim: $M_2=(Q_2,\Sigma_2,\delta_2,q_{02},F_2)$ – AFD

  pe baza lui M_1

  a.i. $L(M_1) = L(M_2)$

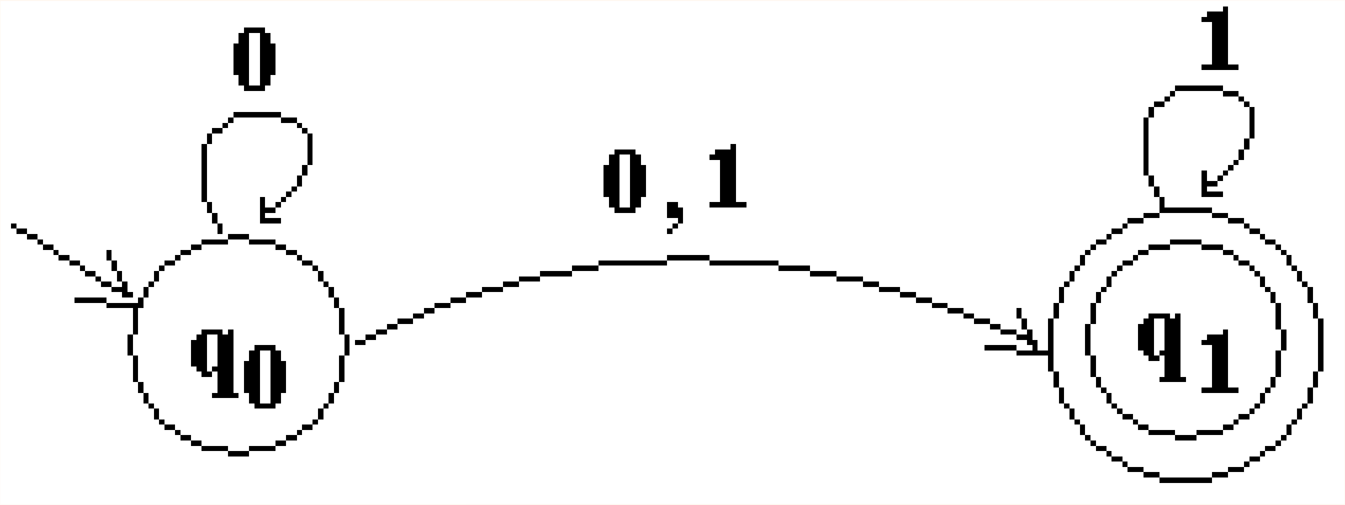
Teor: $\forall$ M_1 – AFN $\exists$ M_2 – AFD echivalent

- $\Sigma_2 = \Sigma_1$
- $Q_2 = \mathcal{P}(Q_1)$
- $q_{02} = \{q_{01}\}$
- $F_2 = \{S \in \mathcal{P}(Q_1) \mid S \cap F_1 <> \Phi\}$
- $\delta_2(q,a) = \{r \in Q_1 \mid \exists\, q_1 \in q \text{ a.i. } r \in \delta_1(q_1,a)\}$

$$= \bigcup_{q1 \in q} \delta(q_1,a)$$

M_2 – determinist (?)

Problema: determinati AFD echiv. pt.



AF – stari care nu contribuie la acceptarea unui cuvant

- stare neproductiva – (nu e stare productiva)
- stare inaccesibila – (nu e stare accesibila)

- stare productiva: $q \in Q$ a.i.

  $\exists\, w \in \Sigma^*$ si $q_f \in F$ a.i. $(q,w) \vdash^* (q_f,\varepsilon)$
- stare accesibila: $q \in Q$ a.i.

  $\exists\, w \in \Sigma^*$ a.i. $(q_0,w) \vdash^* (q,\varepsilon)$