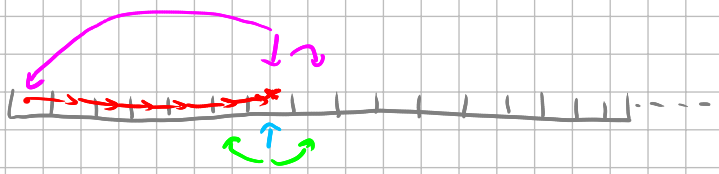
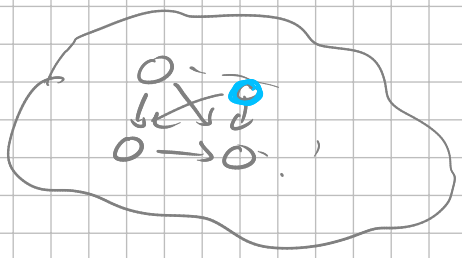
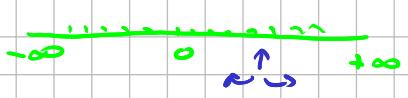
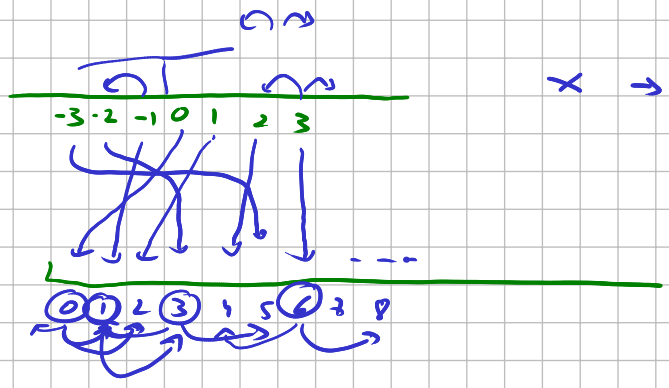


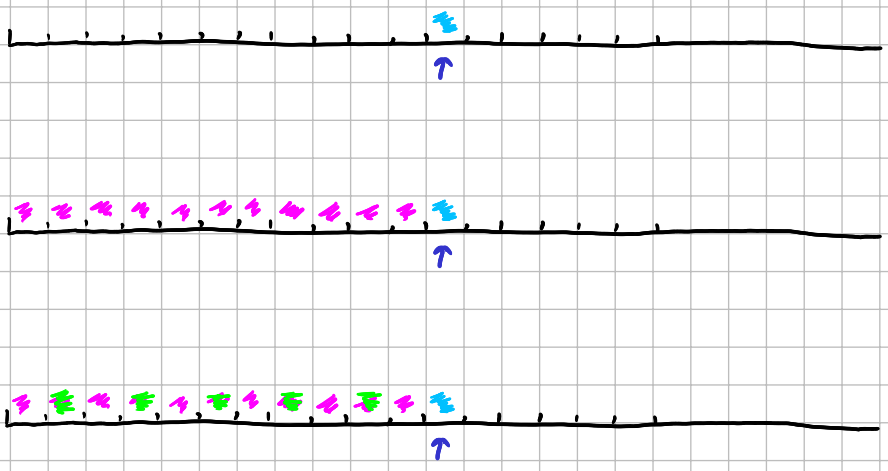


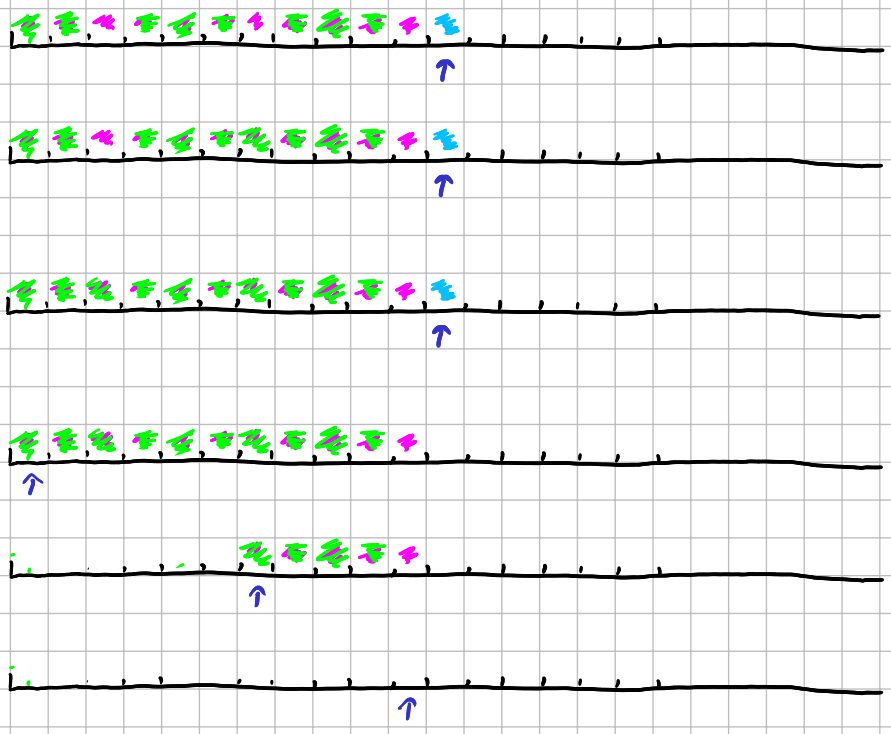
TM infinita ⇒ TM semi-infinita

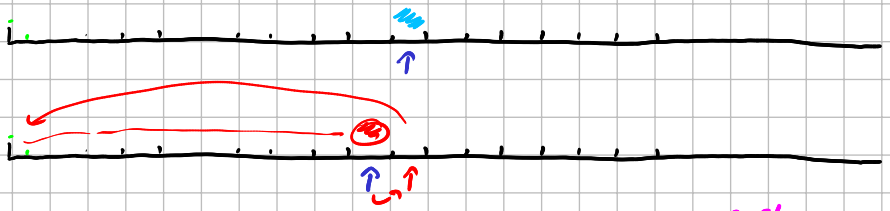


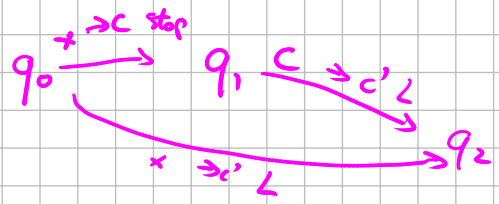


$$x \rightarrow \begin{cases} 2x+1 & x \geq 0 \\ -2x-1 & x < 0 \end{cases}$$









$$M = (Z, \Sigma, \Gamma, \delta, z_0, F)$$ determinista

$B \in \Gamma$

$B \notin \Sigma$

$$\delta : Z \times \Gamma \to Z \times \Gamma \times \{L, R\}$$

δ partial definită

Stop

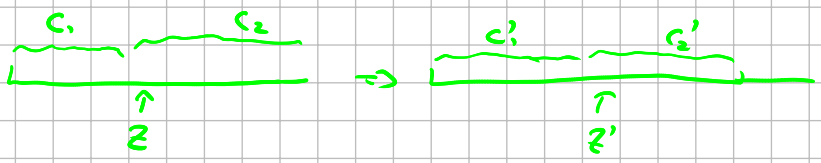
$\delta(z, c)$

$$\delta : Z \times \Gamma \times Z \times \Gamma \times \{L, R\}$$

$(z, c, z', c', L) \in \delta$

$(z, c, z'', c'', R) \in \delta$

$P: \Gamma^* Z \Gamma^* \to \Gamma^* Z \Gamma^*$

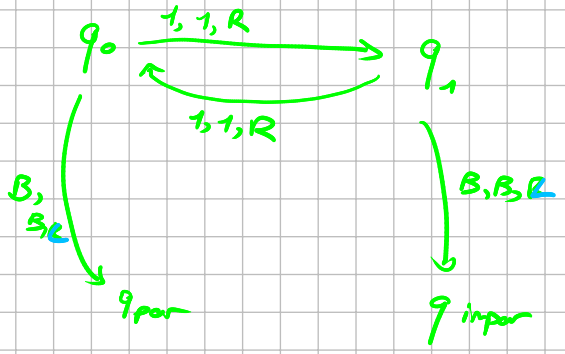


$c_1 Z c_2$

$S \to aSb$
$S \to x$

$a^n x a^n$

input w → stare inițială → $q_0 w$



$A q_0 1 \to A 1 q_1$
$A q_1 1 \to A 1 q_0$
$A q_0 \square \to q_{par} A \square$
$A q_1 \square \to q_{impar} A \square$

$A \Rightarrow xA$

$q_0 111 \square \vdash 1 q_1 11 \vdash 11 q_0 1 \square \vdash 111 q_1 \square \vdash 11 (q_{impar} 1) \square$

$a \to b$

$\bar{a} \vee b$

$\overline{(a \vee b)} = \bar{a} \wedge \bar{b}$

$(a \vee b \vee c) \wedge (\bar{a} \vee d \vee \bar{c}) \wedge \dots$

$$P = \{ L \mid \exists \underbrace{\text{MT determinista } M}_{L(M) = L}, \forall w \in L, \exists T \; time_M(w) = Poly(|w|) \}$$

$|w| = n \Rightarrow n^7$

2^n

$L(M) = Q \iff M(w) = \begin{cases} 1 & w \in Q \\ 0 / \text{nedefinit} & w \notin Q \end{cases}$

NP ——— , ———

$\exists$ MT nedeterministă N

3-SAT $\underbrace{(x_{11} \vee x_{12} \vee x_{13}) \wedge (x_{21} \vee x_{22} \vee x_{23}) \wedge \dots}_{N}$

1 0 , 1 0 1 — — —

3-SAT $\in$ NP

$\in$ NP-hard

$\exists f$ a.i. $x \in L' \iff f(x) \in L$

$X\text{-hard} = \{ L \mid \forall L' \in X, \; L' \text{ se poate reduce la } L \}$

$L \in X\text{-complet} \iff \begin{matrix} L \in X \\ L \in X\text{-hard} \end{matrix}$

PROB

— NP

$(x_{11} \vee x_{12} \vee \dots x_{1k_1}) \wedge (x_{21} \dots x_{2k_2}) \wedge \dots$

— NP-hard $3\text{-SAT} \leq \text{PROB}$

$f: (3\text{-SAT}) \Rightarrow (\text{PROB})$

$x \in 3\text{-SAT} \Leftrightarrow f(x) \in \text{PROB}$

$\Rightarrow (x_{11} \vee x_{12} \vee x_{13}) \wedge \dots \wedge (x_{n1} \vee x_{n2} \vee x_{n3})$

$\Downarrow$

min 2 sau 0 $\Rightarrow (x_{11} \vee x_{12} \vee x_{13}) \wedge \dots \wedge (x_{n1} \vee x_{n2} \vee x_{n3}) \wedge (y \vee \bar{y})$

$\Rightarrow (x_1 \vee x_2 \vee x_3 \vee x_4 \vee x_5)$

$\Rightarrow (x_1 \vee x_2 \vee y_1) \wedge (\bar{y}_1 \vee x_3 \vee y_2) \wedge (\bar{y}_2 \vee x_4 \vee x_5)$

L recursiv enumerabil

↳ $\exists f: \mathbb{N} \to L$ a.î. $L = \{ f(n) \mid n \in \mathbb{N} \}$

$\Leftrightarrow \exists$ MT M a.î.

$M(\omega) = \begin{cases} 1 & \text{dacă } \omega \in L \\ 0 \text{ / redefinit} & \text{dacă } \omega \notin L \end{cases}$

$a \leftarrow 0$

L_1: $b \leftarrow f(a)$

if $b = x$ GOTO E

$a \leftarrow a+1$

goto L_1

$\langle a,b \rangle = 2^a(2b+1)-1$ $\quad \mathbb{N} \to \mathbb{N}^2$

left(x) = ...

right(x) = ...

$f(x)$: $\langle a,b \rangle = x$

Simulăm M pe input-ul a maxim b paşi

DA $\to f(x) = a$

NU $\to f(x) =$ ← un element hardcodat din L

L recursiv $\Rightarrow \exists f$ a.î. $f(x) = \begin{cases} 1 & / \ x \in L \\ 0 & / \ x \notin L \end{cases}$

L recursiv $\Leftrightarrow \exists M$ a.î. $L(M) = L$

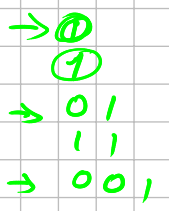
M se oprește pe ficare intrare

L recursiv $\Leftrightarrow$ L enumerabil

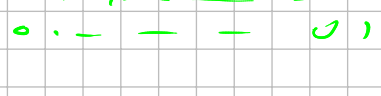
L (recursiv enumerabil)

MT OFF-line

Read-only



$n \cdot \left(1 + \frac{1}{2} \cdot \left(1 + \frac{1}{2} \cdot (1 + \dots)\right)\right)$



$n \cdot \sum_k \frac{k}{2^k} = 2$

B_1 OFF-LIMIT

B_2 N_2

B_3 K

$k < N \rightarrow B_1[k] \neq B_1[N-k-1] \Rightarrow$ accept

$\lambda\lambda \Rightarrow$ Reject

P palindrom $\Leftrightarrow \forall k,\ P(k) = P[|P|-k-1]$

P palindrom $\Leftrightarrow \exists k,\ P(k) \neq P[|P|-k-1]$

0 00 00 0 00

$\Gamma' = \Gamma \times \Gamma$