

⑧ RV → RG

$$(00+n)^* = A \quad \checkmark$$

$$\frac{dA}{d0} = |0 \cdot (00+n)^* = B| \quad \times$$

$$\frac{dA}{d1} = |1 \cdot (00+n)^* = C| \quad \times$$

$$\frac{dB}{d0} = (00+n)^* = A$$

$$\frac{dB}{d1} = |\phi = D| \quad \times$$

$$\frac{dC}{d0} = \phi = D$$

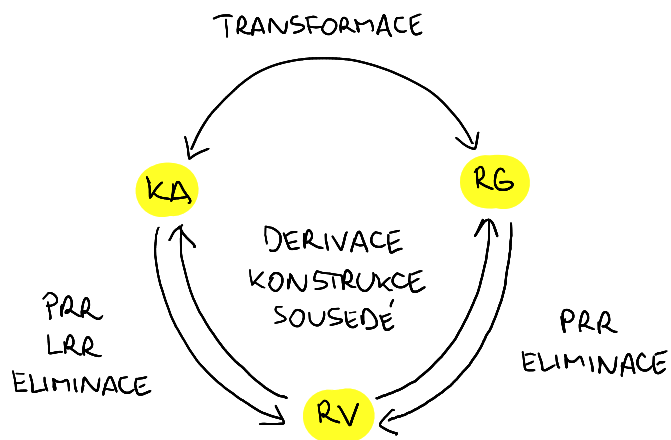
$$\frac{dC}{d1} = A$$

$$\frac{dD}{d0} = \phi = D$$

$$\frac{dD}{d1} = D$$

$$\begin{aligned} &\rightarrow S \rightarrow \boxed{0B \mid 1C} \mid \varepsilon \\ &\times A \rightarrow \boxed{0B \mid 1C} \mid \times \\ &B \rightarrow 0 \boxed{A} \mid \times \mid 0 \\ &C \rightarrow \times \mid 1 \boxed{A} \mid 1 \\ &\times \rightarrow \times \mid \times \mid \times \end{aligned}$$

ZÁVĚR



PL

$$L \text{ je RS} \Rightarrow \begin{matrix} \exists n & \forall u & \exists x, y \in R & \forall k : x y^k \in L \\ n \in \mathbb{N} & u \in L & u = x y^k & k \in \mathbb{N}_0 \\ n \geq 1 & |u| \geq n & |y| \geq 1 & k \geq 0 \\ & & |x y| \leq n & \end{matrix}$$

SPOR: $\square \wedge \neg \square$ } $\Rightarrow L \text{ NENI RS}$
 OBMĚNA: $\neg \square \Rightarrow \neg \square$

$$\begin{matrix} \forall n & \exists u & \forall x, y \in R & \exists k : x y^k \notin L \\ n \in \mathbb{N} & u \in L & u = x y^k & k \in \mathbb{N}_0 \\ n \geq 1 & |u| \geq n & |y| \geq 1 & k \geq 0 \\ & & |x y| \leq n & \end{matrix}$$

1 $a^i b^i$

$n \geq 1$? $u = a^n b^n$
 $\forall v$

$x \mid y \mid R$
 $a^r \mid a^\Delta \mid a^{n-(r+\Delta)} b^n$
 $0 \leq r \leq n-1 \quad 1 \leq \Delta \leq n$

? k $x y^k \in L = a^r \cdot (a^\Delta)^k \cdot a^{n-(r+\Delta)} b^n$ CHCEME $\notin L$
 POČET a POČET b
 $r + k\Delta + n - (r + \Delta)$ n
 $n + \Delta(k-1)$ $\neq n$
CHCEME

$\forall k \Delta \geq 1$
 $k \neq 1 \Rightarrow x y^k \notin L$
 $\Rightarrow L \text{ NENI RS}$

② n, n^R

$n \geq 1$? $u = \underbrace{a^m}_{VV} \underbrace{a^n}_{VV} = a^{2n}$

$x \mid y \mid z$
 $a^r \mid a^\Delta \mid a^{n-(r+\Delta)} a^n$
 $0 \leq r \leq n-1 \quad 1 \leq \Delta \leq n$

? k $x y^k z = a^r \cdot (a^\Delta)^k \cdot a^{n-(r+\Delta)} a^n$ CHCENE $\notin L$

POČET $a \dots$ CHCENE, ABY BYL LICHÝ
 $r + k\Delta + n - (r + \Delta) + n = 2n + \Delta(k-1)$

$\Delta = \text{LICHE}'$
 $2n + \Delta(k-1)$ LICHE' \Rightarrow 2 SUDE
SUDE

$k = 2m, m \in \mathbb{N}_0 \Rightarrow x y^k z \notin L$

$\Delta = \text{SUDE}'$
 $2n + \Delta(k-1)$? Δ
SUDE' } ZÁDNE' & NEEXISTUJE

? $u = \underbrace{a^m}_{VV} b \underbrace{a^n}_{VV}$

... ? $k \neq 1 \Rightarrow \text{NENÍ } R_{\underline{\underline{L}}}$

③ $a^i b^j$: $i \leq j$

$n \geq 1$? $u = a^n b^n$

$x \mid y \mid z$
 $a^r \mid a^\Delta \mid a^{n-(r+\Delta)} b^n$
 $0 \leq r \leq n-1 \quad 1 \leq \Delta \leq n$

? $k \geq 2 \Rightarrow \text{NENÍ } R_{\underline{\underline{L}}}$

④ $a^i b^j$: $i > j$

$n \geq 1$? $u = a^{n+1} b^n$

? $u = \underbrace{a^n}_{VV} b^{n-1}$

$\dots \rightarrow$? $k = 0 \Rightarrow \text{NENÍ } R_{\underline{\underline{L}}}$

~~$a^{n+1} b^n$~~

6) $a^i b^j$: $i \leq 2j$

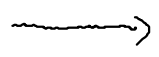
$n \geq 1$ $? u = a^r b^n$
 $\forall r$

$x \mid y \mid z$
 $a^r \quad a^\Delta \quad a^{n-(r+\Delta)} b^n$
 $0 \leq r \leq n-1 \quad 1 \leq \Delta \leq n$

$? k$ $xy^kz = a^r \cdot (a^\Delta)^k \cdot a^{n-(r+\Delta)} b^n$ CHCENE $\notin L$
 POČET a $r + k\Delta + n - (r + \Delta)$ POČET b n
 $n + \Delta(k-1)$ n
 $n + \Delta(k-1) > 2n$ CHCENE n

NEJHORŠI PŘÍPAD $\Delta = 1$:
 $n + 1(k-1) > 2n$ CHCENE $2n$
 $k > n+1$
 $\Rightarrow k \geq n+2 \Rightarrow$ NEVÍ R_L

$\forall n \exists w \forall x, y, z \exists k : xy^kz \notin L$
 $\forall r, \Delta$



7) $a^n w^n$

$n \geq 1$ $? u = a b^r c b^r c$
 \uparrow
 \leftarrow
 n

a) $\varepsilon \quad a b^\Delta \quad b^{n-\Delta} c b^r c$
 $0 \leq \Delta \leq n-1$

b) $a b^r \quad b^\Delta \quad b^{n-(r+\Delta)} c b^r c$
 $0 \leq r \leq n-2 \quad 1 \leq \Delta \leq n-1$

$? k \neq 1$
 $? k \neq 1$
 \Rightarrow NEVÍ R_L