npda (pda)

Tuesday, October 29, 2024 11:55 AM

$M_{npda} = (Q, \Sigma, \Gamma, \delta, q_0, z, F)$

- Q - finite set of internal states
- Σ - input alphabet (finite set of symbols)
- Γ - stack alphabet (finite set of symbols)
- δ - finite set of transition fnc(s)

$$(Q \times \{\Sigma \cup \{\lambda\}\} \times \Gamma) \to (Q \times \Gamma^*)$$

required to pop

can be a string or λ or 1 symbol

- q_0 - initial state, $\in Q$
- z - stack start symbol, $\in \Gamma$
- F - finite set of internal final state(s), $\subset Q$

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npda : $\delta(q_i, a, b) = \{\underset{1.}{(q_j, d)}, \underset{2.}{(q_k, \lambda)}\}$

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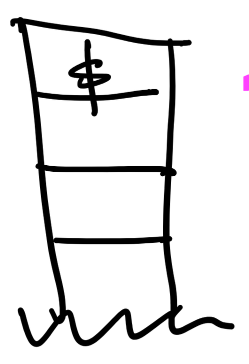
ex $L = \{n_a(w) = n_b(w) : w \in \{a,b\}^*\}$

~~$[(q_0, \lambda, \lambda) = (q_1, \$)]$~~ $\Rightarrow$



$\downarrow$

$(q_1, a, \$) = (q_1, a\$)$

$(q_1, a, a) = (q_1, aa)$

$(q_1, a, b) = (q_1, \lambda)$

$(q_1, b, \$) = (q_1, b\$)$

$(q_1, b, b) = (q_1, bb)$

$(q_1, b, a) = (q_1, \lambda)$

$(q_1, \lambda, \$) = (q_f, \lambda)$

instantaneous description:

$s = aabb$

$(q_1, aabb, \$) \vdash (q_1, abb, a\$) \vdash (q_1, bb, aa\$)$

$\vdash (q_1, b, a\$) \vdash (q_1, \lambda, \$) \vdash (q_f, \lambda, \lambda)$

try: $s = a$; $baab$; b; bba; λ; $aabbab$; ...

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ex $L = \{a^n b^n : n \geq 1\}$

$(q_0, a, \$) = (q_0, a\$)$ // 1st 'a'

$(q_0, a, a) = (q_0, aa)$ // subsequent a's

$(q_0, b, a) = (q_1, \lambda)$ // 1st 'b'

$(q_1, b, a) = (q_1, \lambda)$ // subsequent b's

$(q_1, \lambda, \$) = (q_f, \lambda)$

wait!

$\cancel{(q_0, a, \$) = (q_0, a\$)}$

$\cancel{(q_0, a, a) = (q_0, aa)}$

$\cancel{(q_0, b, a) = (q_0, \lambda)}$

$\cancel{(q_0, \lambda, \$) = (q_f, \lambda)}$

$s = aabb$

$(q_0, aabb, \$) \vdash (q_0, abb, a\$) \vdash (q_0, bb, aa\$)$

$\vdash (q_0, b, a\$) \vdash (q_0, \lambda, \$) \vdash (q_f, \lambda, \lambda)$ ✓

$s = \lambda$

$(q_0, \lambda, \$) \vdash (q_f, \lambda, \lambda)$ ✗

$s = aabbab$

$(q_0, aabbab, \$) \vdash (q_0, abbab, a\$) \vdash (q_0, bbab, aa\$)$

$\vdash (q_0, bab, a\$) \vdash (q_0, ab, \$) \vdash (q_0, b, a\$)$

$\vdash (q_0, \lambda, \$) \vdash (q_f, \lambda, \lambda)$ ✗

wait wait!

$(q_0, a, \$) = (q_1, a\$)$

$(q_1, a, a) = (q_1, aa)$

$(q_1, b, a) = (q_1, \lambda)$

$(q_1, \lambda, \$) = (q_f, \lambda)$

$s = aabbab$

$(q_0, aabbab, \$) \vdash (q_1, abbab, a\$) \vdash (q_1, bbab, aa\$)$

$\vdash (q_1, bab, a\$) \vdash (q_1, ab, \$)$ ✗

try:

$L = \{a^n b^n : n \geq 0\}$

$L = \{a^n b^{n+1} : n \geq 0\}$