regular grammar examples

Thursday, September 26, 2024 11:57 AM

Regular grammar : $G_R = (V, T, S, P)$

right linear { P: $A \to xB$ or $A \to x$ — $A, B \in V$, $x \in T^*$

left linear { P: $A \to Bx$ or $A \to x$ — $A, B \in V$, $x \in T^*$

right linear $\equiv$ left linear

* $\forall$ regular language, L_R, $\Leftrightarrow$ $\exists$ a regular grammar, G_R, $\ni$ $L(G_R) = L_R$

ex

Create a grammar for $L = \{a^n : n \geq 0\}$

$G = (\{S, A\}, \{a, b\}, S, P)$

P: $S \to aA \mid \lambda$
$A \to aA \mid \lambda$
2. 1.

$S \to aA \to a\lambda \to a$

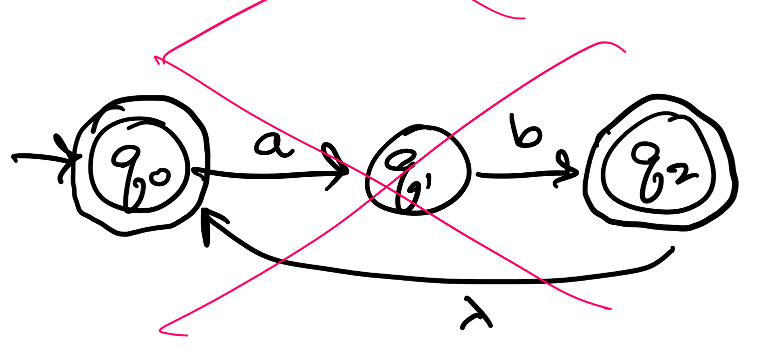
$S \to aA \to aaA \to aa\lambda \to aa$

$\therefore$ G is regular grammar
$L(G) = L$ $\therefore$ L is regular language.

or P: $S \to aS \mid \lambda$

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

~~P: $S \to \lambda \mid aSb$~~ not a regular grammar



$\Rightarrow L = \{(ab)^n : n \geq 0\}$

~~$r = a^* b^*$~~

~~$[G_N]$ P: $S \to aA \mid bB \mid \lambda$~~
~~$A \to \ldots$~~

yes- regular grammar
$L(G_N) = \{\lambda, a$
$S \to aA$

if $L = L_1 \cup L_2$
create nfa/dfa/r.e./r.g.
2nd

is L regular?

$L = L_1 \cup L_2$

create nfa for L_1 $\therefore$ L_1 is regular
" re for L_2 $\therefore$ L_2 is regular

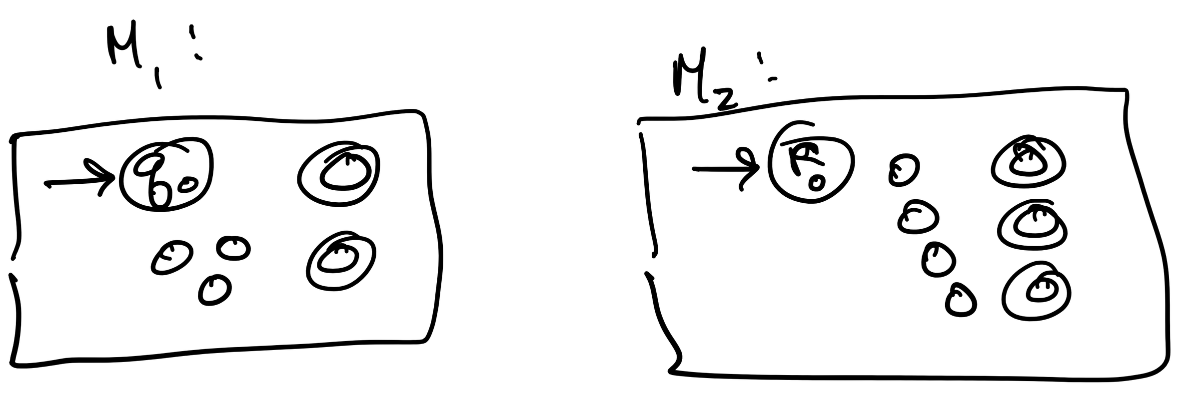
[$\Rightarrow$ L must be regular.]

$\therefore$ <u>need</u> if L_1 is regular and L_2 is regular
$\Rightarrow L_1 \cup L_2$ is regular.

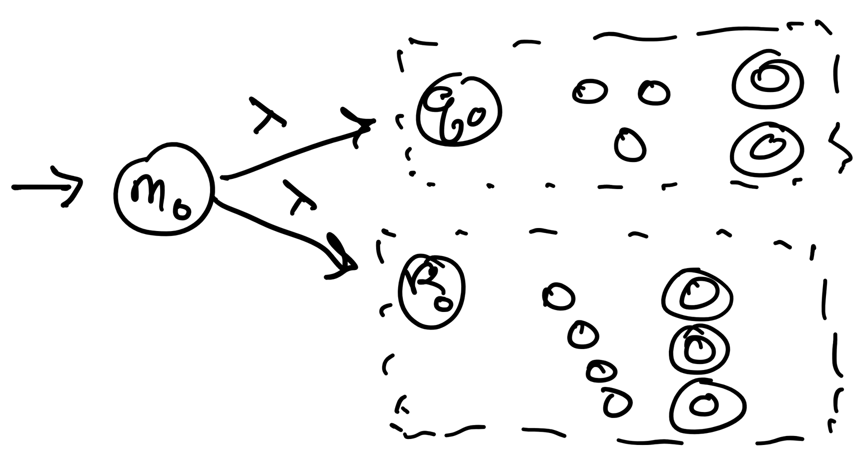
closure properties of regular languages :

prove that regular languages are closed under union operator.

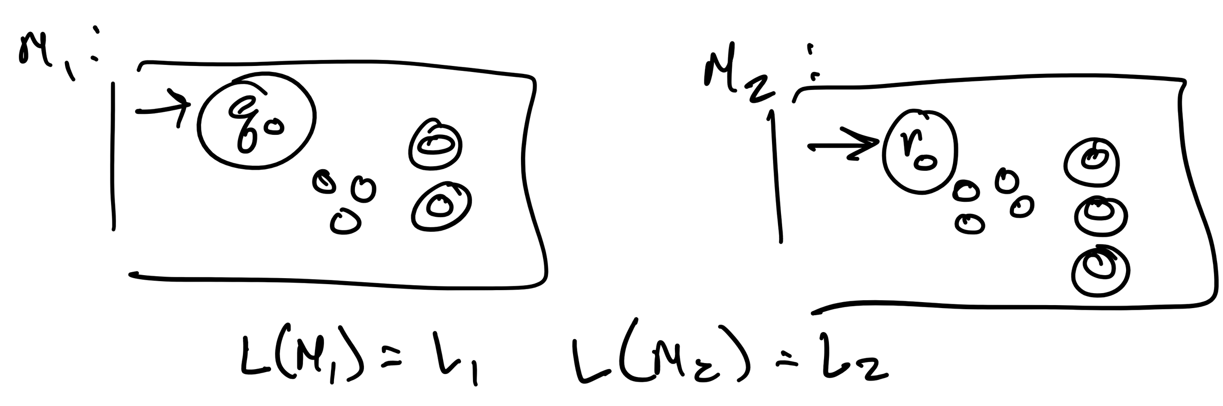
Assume L_1 and L_2 are regular. $\Rightarrow$ Since L_1 and L_2 are regular $\exists$ a nfa, M_1, $\ni$ $L(M_1) = L_1$ and $\exists$ a nfa, M_2, $\ni$ $L(M_2) = L_2$.



create a new nfa, M :

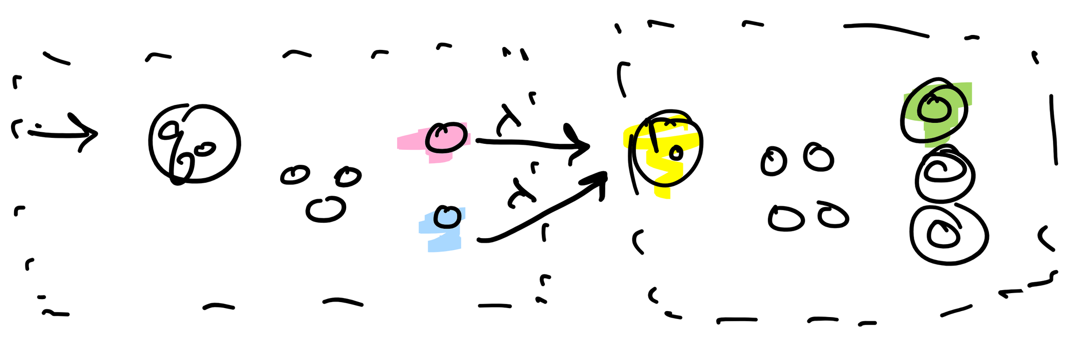


$L(M) = L_1 \cup L_2 = L_m$ and L_m must be regular since $\exists$ a nfa, M, where $L(M) = L_m$.



$L(M_1) = L_1$ $L(M_2) = L_2$

M: $L(M) = L_1 L_2$



$L_1 = \{a, b\}$ $L_2 = \{\lambda, bb\}$

$L_1 L_2 = \{a, b, abb, bbb\}$

✓ $L_1 = \{a, b\}$ $L_2 = \{bb\}$

$L_1 L_2 = \{abb, bbb\}$

Look @ * closure also.

pumping lemma proofs.

proving a lang. is not regular

proof by contradiction.

Assume L is regular.

[pumping for regular languages lists characteristics that are guaranteed for regular languages.

$\Rightarrow$ the p.l. for regular langs holds.

pick a string from L. [with constraints]

pump up or down

$\Rightarrow$ new string is not $\in$ L.

$\therefore$ L must not be regular.