TEACH YOUR NEIGHBORS. $a^* b^*$

Show that $\{ww : w \in \{a, b\}^*\}$ is nonregular. $L = \{\lambda, aa, bb, abab, aaaa, \ldots\}$

- Assume that L is regular, then we must have an FA with N states.

And by Pumping Lemma,

consider $\underbrace{w}_{ww} = \underbrace{a^N b^N}_{xy} \cdot \underbrace{a^N b^N}_{z} \in L$,

$w = xyz$, i.e., $y \neq \lambda$, $|xy| \leq N$, then $y = a^k (1 \leq k \leq N)$

consider $xy^0z = a^{N-k} b^N a^N b \notin L = ww$ ⋈

$n_a(w_1) \neq n_a(w_2)$

This breaks Pumping Lemma, because at least one pump string is not in the language, which is a contradiction to Pumping Lemma.

consider $xy^\ell z = a^{N+(\ell-1)k} b^N a^N b^N \notin L$

$(\because n_a(xy^\ell z) = N + (\ell-1)k > N = n_b(xy^\ell z)$ if $\ell > 1$) ⋈

$\therefore L$ is nonregular

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