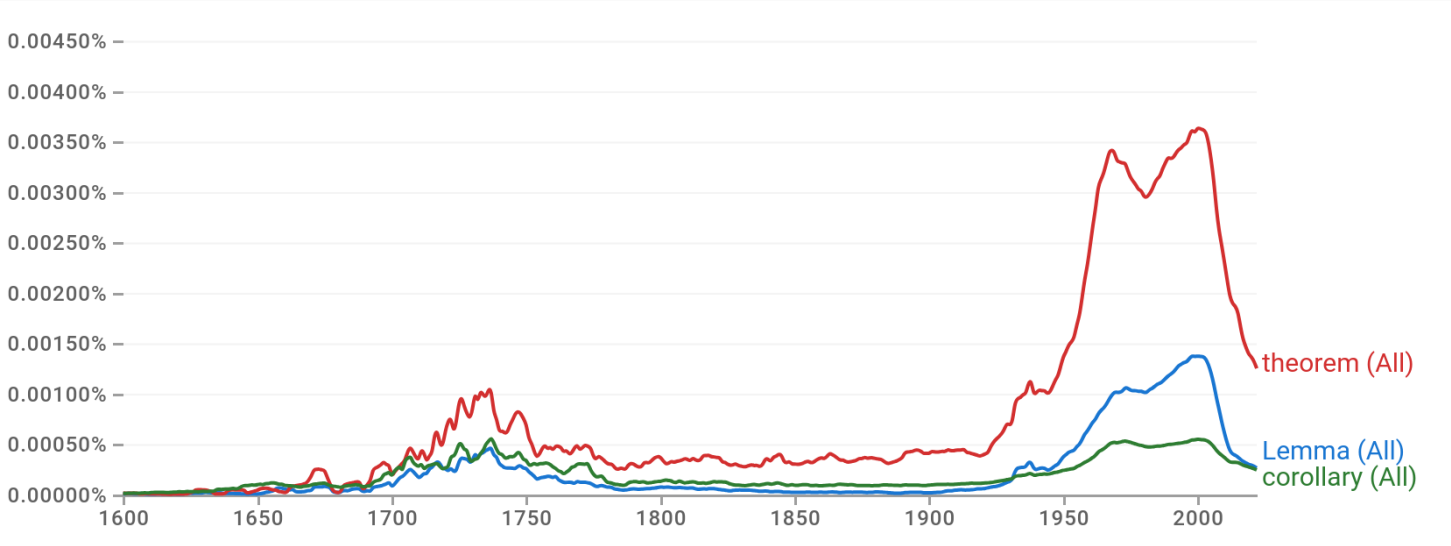
Games, graphs, and machines



October 2, 2024

Pumping lemma 1

Use the pumping lemma to show that $L = \{0^n 1^n \mid n \geq 0\}$ is not regular.

How to think about the pumping lemma?

Machine I can recognise L.

You How many states do you have?

Machine 212

You What would you do to $0^{300}1^{300}$?

Long

Confusing

↳ to machine

not to you

Machine Accept, obviously.

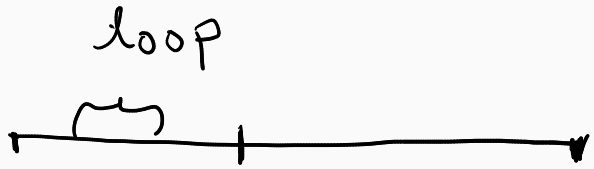
You And as you are reading that, you loop in the first 212 bits?

Machine Of course.

You If you double that loop, do you still accept?

Machine Yes, I guess.

You Checkmate!



Pumping lemma 2

Use the pumping lemma to show that $L = \{\text{Palindrome}\}$ is not regular.

010 , 11, 001100, ...

$w = w^{rev}$

M : 500 states

Y : Consider 00...0 (600) → dud

does not elicit a wrong response.

Y : $0^{600}\,11\,0^{600}$

$0^{600}\,1\,0^{600}$

01010.....010

Pumping lemma 3

Use the pumping lemma to show that $L = \{0^n 1^m \mid n \geq m\}$ is not regular.

① $0^{100}1^{150}$ reject; but repeat loop many times ⇒ accept.

② $0^{100}1^{100}$ accept; delete loop ⇒ reject.

accept

③ $0^{100}1^{100}$ repeat ⇒ reject

④ L^{rev} not reg $= \{1^m 0^n \mid m \leq n\}$

Pumping lemma 4

Use the pumping lemma to show that $L = \{ww \mid w \text{ any string}\}$ is not regular.

M : 500 states.

Y :