

Oct 12

COMPSCI 3331

Fall 2022

# What's next?

- ▶ Assignment 2: due Oct 26.
- ▶ Quiz 4: up to end of Lecture 8.
- ▶ Midterm: October 25.

# Showing languages aren't regular

- ▶  $L_1 = \{a^n b^m : n \neq m\}$ . *pumping lemma.*
- ▶  $L_2 = \{w \# y : w, y \in \{a, b\}^*, |w| < |y|\} (\subseteq \{a, b, \#\}^*)$
- ▶  $L_3 = \{w \# y : w, y \in \{a, b\}^*, |w|_a = |y|_b\}$ .
- ▶  $L_4 = \{w \# y : w, y \in \{0, 1\}^*, w < y \text{ as binary numbers.}\}$ .

*English is not a regular language; it needs too much memory.*

$110 \# 111 \in L_4$

$11 \# 1 \notin L_4$ .

$z = 1^n \# 1^{n+1}$

*it is in language.*

*we can write  $z$  as  $uvw$*

*pumping*  
↳ *with  $|uv| \leq n, |v| > 0$ .*

$u = 1^i, v = 1^j, w = 1^{n-i-j} \# 1^{n+1}$

$k \geq 2$ .

$uv^k w = uv^2 w = 1^{n+j} \# 1^{n+1}$

*now  $uv^k w$  is not in  $L_4$ .*

*Therefore,  $L_4$  is not a regular language by using pumping lemma*

# Showing languages aren't regular

- ▶  $L_5 = \{w \in \{a, b, c, d\}^* : \forall x \in \{a, b, c, d\}, |w|_x = 0 \text{ or } |w|_x \geq 5\}$
- ▶  $L_6 = L^*$  where  $L = \{a^n b^n : n \geq 0\}$
- ▶  $L_7 = \{w \in \{a, b\}^* : |w|_a \equiv |w|_b \pmod{10}\}$
- ▶  $L_8 = \{w \in \{a, b\}^* : \exists u \in \{a, b\}^*, w = uu^R\}$ .

# CFGs

Context Free  
Grammar.

Grammar 1

$$V = \{S\}$$

$$\Sigma = \{a, b, \#\}$$

$S$  is the start symbol

$$S \rightarrow aSb$$

$$S \rightarrow aSbb$$

$$S \rightarrow \#$$

Grammar 2

$$V = \{S\}$$

$$\Sigma = \{a, b\}$$

$S$  is the start symbol

$$S \rightarrow aSa$$

$$S \rightarrow bSb$$

$$S \rightarrow \varepsilon$$