

$$L = \{w \# x \# y \# z \mid w, x, y, z \in \{a, b\}^* \wedge |w| = |y| \wedge |x| = |z|\}$$

Tandem-Pumping Recipe:

1. Assume  $L$  context-free  $\rightarrow$  tandem-pumpable

2. Choose  $w = (a^p \#)^3 a^p$

3. Consider all splits  $w = uvxyz$  s.t.

$$> |vy| \geq 1$$

$$> |vxy| \leq p$$

$$\xrightarrow{TP} uv^i xy^i z \in L \quad \forall i \geq 0$$

4. Note

aaaa...a # aa...aa # aa...aa # aa...aa

1.  $v$  and  $y$  cannot contain  $\#$ .

because otherwise  $uxz \notin L$ .  $\leftarrow$

2.  $vxy$  can only contain symbols of neighboring "parts" of the word.

$$|vy| \geq 1 \quad \text{and} \quad \# \notin vy$$

$$\Rightarrow vy \in a^+$$

If we remove any  $a$ 's from (at most two neighboring parts of) the word (i.e.  $uxz$ )

we obtain a word  $uxz \notin L$ .

5.  $L$  is not context-free.  $\leftarrow$