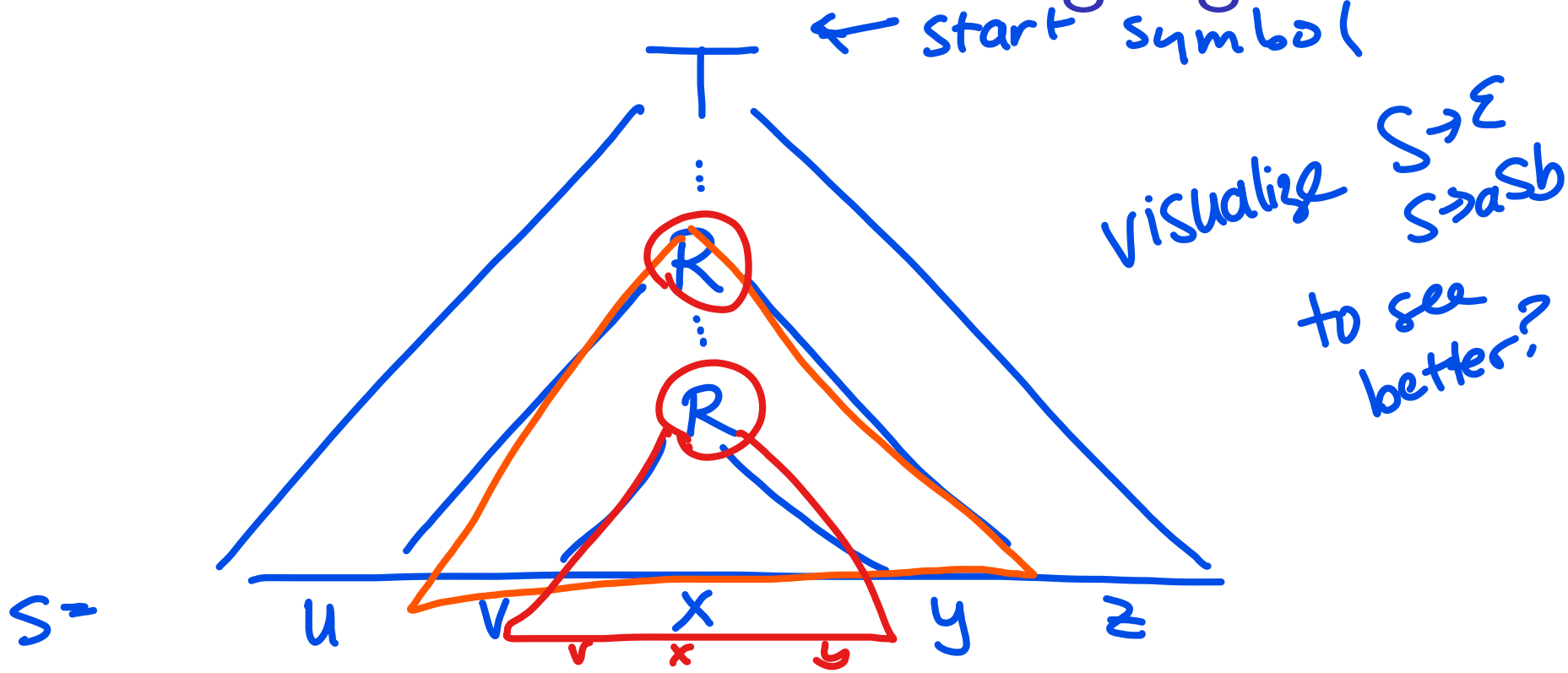
CompSci 162
Spring 2023 Lecture 12:
Non-Context Free Languages



Pumping Lemma for CFL

If A is a CFL, there is a value p where if s is any string in A of length at least p, s can be partitioned into five pieces $s = uvxyz$ such that:

1. $\forall i \geq 0 \quad uv^i xy^i z \in A$
2. $|vy| > 0$
3. $|vxy| \leq p$

$L_1 = \{a^n b^n c^n \mid n \geq 0\}$

- FSOC suppose L_1 is context free
- Let p be the pumping length.
- Select $s = a^p b^p c^p$
  - $s \in L_1$ and also $|s| \geq p$
- Partition $s = uvxyz$ at least one of $v,y \neq \varepsilon$

and v,y at most one char type each? uv^2xy^2z? Then counts not equal anymore. ☹

$v,y > 1$ type? Then uv^2xy^2z has letters out of order (as then bs then as or b/c/b).

$L_2 = \{a^i b^j c^k \mid 0 \leq i \leq j \leq k\}$

- FSOC suppose L_2 is context free
- Let p be the pumping length.
- Select $s =$ $a^p b^p c^p$
  - $s \in L_2$ and also $|s| \geq p$
- Partition $s = uvxyz$

v, y :- no as? uxz has >a than b/c

- no bs? are as in vy? uv^2xy^2z

else: uxz lost cs, not bs.

Not finished! Will finish Wed.

$L_3 = \{ww \mid w \in \{a, b\}^*\}$

at start of Wednesday.

- FSOC suppose L_2 is context free
- Let p be the pumping length.
- Select $s =$
  - $s \in L_3$ and also $|s| \geq p$
- Partition $s = uvxyz$