CompSci 162
Spring 2023 Lecture :
More Pumping Lemma Practice
Supplemental #2

\[ L_2 = \{ a^{n^2} | n \geq 0 \} \]

Assume FSOC \( L_2 \) is regular. Let \( p \) be the pumping length.

Let \( w = a^p \in L_2 \). So \( w = xyz \)

\[ |xy| \leq p \quad |y| > 0 \]

// What if pump? \( w' = xyzyz \quad |y| \leq p \) so \( |xyyz| \leq p^2 + p \) but \( > p^2 \) (\( |y| > 0 \))

\[ w' \notin L_2 \]
Supplemental #3

$L_3 = \{ a^i b^k | i > k \}$

Assume ... let $p$ be pumping length.

Let $w = a^p b^{p-1} \in L_3$ ... because ...

\[ |xy| \leq p \text{ and } |y| > 0 \]

$XZ$ is $p-1$ (or fewer) as then $b^{p-1}$

$XZ \notin L_3$
Supplemental #4

\{ a^{10^n} | n \geq 0 \}
Supplemental #5

\[ \{ a^n b^n c^n | n \geq 0 \} \]
Supplemental #6

Let $L_6$ be the set of odd-length strings in which the first, middle, and last symbols are the same.

Assume FSOCC $L_6$ is regular. Let $p$ be the pumping length. Let $w = baba^*b$.

$|xy| \leq p$ and $|y| > 0$.

If $|x| \neq 0$, $xyzz$ "shifts the middle" $\notin L_6$.

If $|x| = 0$, $y = ba^*$, set $i = 0$ and

at most $p-1$ as

$x^2$ starts a ends b

$\notin L_6$.
Challenge

The set of odd-length strings where the middle symbol also appears elsewhere in the string.