

## Theory of Computation, CSCI 438 spring 2022

### Pumping lemma for context-free languages, pages 123- 127, March 2

Pumping Lemmas:

- The pumping lemma for regular languages captures the “essence” of the limited nature of finite automata.
- The pumping lemma for context-free languages captures the “essence” of the limited nature of context-free grammars.

The pumping lemma for context-free languages says that for every infinite context-free language there is a pumping length such that all strings longer than this length can be “pumped”. That is, the string can be divided into five parts so that the second and fourth parts may be repeated together any number of times and the resulting string still remains in the language.

Pumping Lemma (Theorem 2.34, page 123)

If  $A$  is an infinite context-free language then there exists a  $p$  (the pumping length) where any string  $s \in A$ , where  $|s| \geq p$ ,  $s$  can be divided  $s=uvxyz$  where

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