

Pumping Lemma

if a language $L \subseteq \Sigma^*$ is regular, then there exists a constant $n > 0$ such that for any string $z \in L$, $|z| \geq n$, z can be factorized as $z = uvw$ with the following properties:

- i) $|uv| \geq n$ (loop is in the beginning)
- ii) $|v| \geq 1$ (loop isn't empty)
- iii) $\forall i \geq 0, uv^i w \in L$

v can be repeated any number of times, and string is still in the language

"if L is regular(p), then q is true" which implies if q is not true, then L is not regular

5 steps to prove language isn't regular given a language $L \subseteq \Sigma^*$

- 1.) Pick an arbitrary constant $n > 0$
- 2.) choose a string z s.t. $z \in L$
- 3.) consider a factorization of $z = uvw$ s.t. $|uv| \geq n$ and $|v| \geq 1$
- 4.) find an integer i s.t. $z' = uv^i w \notin L$
- 5.) conclude that L is not regular

Closure Properties of Regular languages:



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Page 2 of 2.

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