The Pumping Lemma

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The Pumping Lemmas say:

If L is a regular/context-free language

Then strings in L have a pattern

Using the Pumping Lemma

If there is a string in L without a pattern

Then L is NOT a regular/context-free language

The Pumping Lemma for Regular Language

If L is a regular language

Then every long string in L has a repeatable segment

Using Pumping Lemma for Regular Language

Proof by contradiction: Suppose it is regular and then exhibit one long string in L without a repeatable segment.

The Pumping Lemma for Regular Language

If L is a regular language

Then there is constant k such that
every string in L of length at least k can be written as uvw such that
uv^iw is in L for $i = 0, 1, 2, \ldots$

To use: provide one explicit string and show that it transgresses

The Template

Suppose L is regular.
Let k be the constant of the PL.
Let $z =$
Then z is long enough and in L. Consider split uvw. Then

So z does not have a repeatable segment. A contradiction.

Examples

$\mathtt{0}^n\mathtt{1}^n$: **use** $z = \mathtt{0}^k\mathtt{1}^k$

The language of a's, b's, c's where the numbers of each char are different: use $z = \mathtt{a}^k\mathtt{b}^{k+1}\mathtt{c}^{k+2}$

Binary palindromes: needs stronger Pumping Lemma