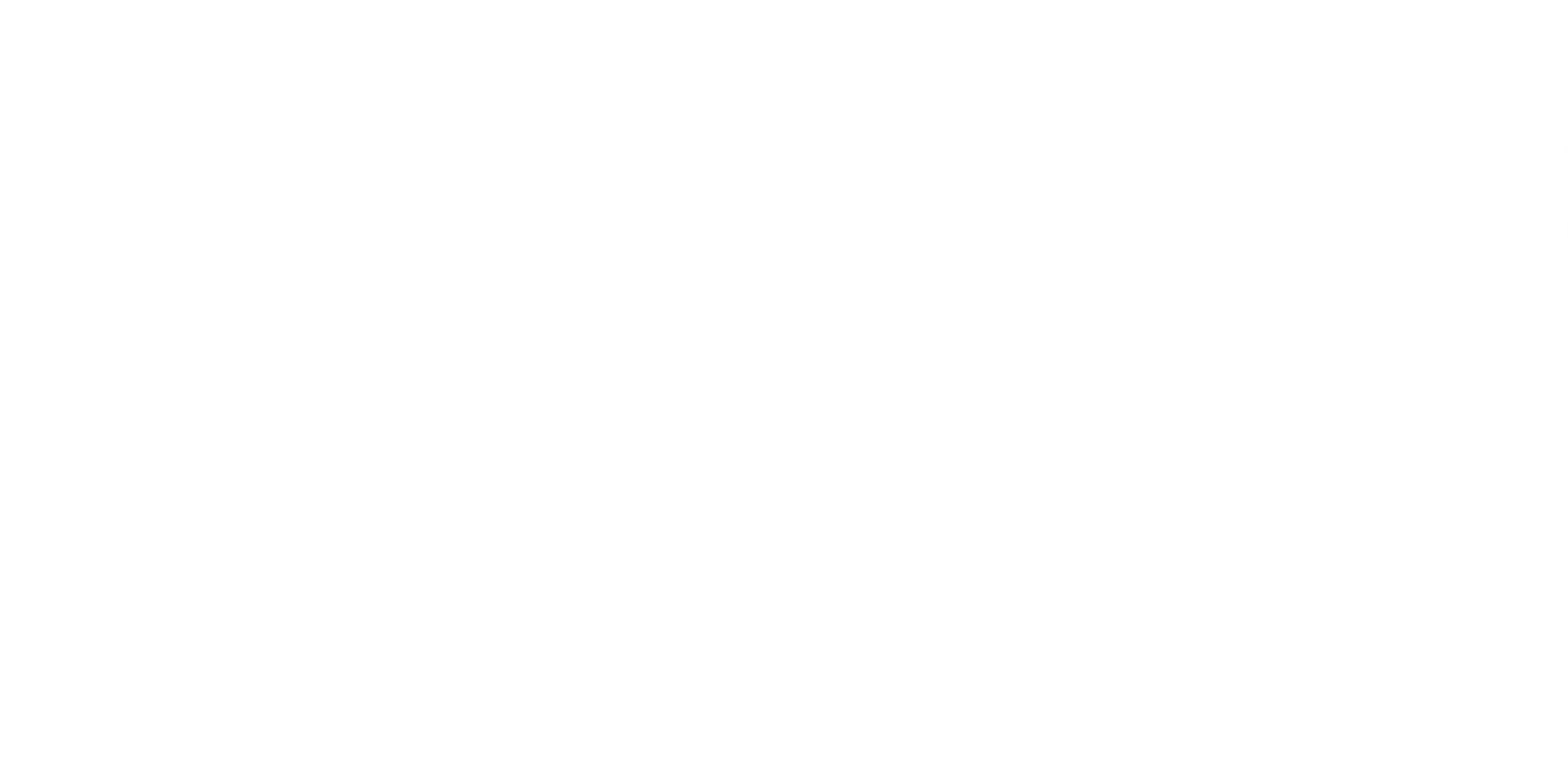
Pumping Lemma

The **Pumping Lemma** is a theorem which can be used to prove that a language is **not regular**. However, it cannot be used to prove that a language is regular.

Suppose we have a language where has an infinite number of possible strings, such as . Such languages require machines which contain **cycles**. Suppose we divide the strings into the form , where is the section being repeated times.



If a language is regular, there has to be a section we can pump. Here, is that section. There are a few rules to this:

* , meaning that there is a pumpable section
* , where is the pumping length,

The pumping length depends on the language, not the machine.

For the language above, suppose we have the word . If , and , then is part of the language, but is not. If , and , then is part of the language, but is not. In fact, we cannot find any manner of splitting the string into three sections such that is always part of the language. Thus, this language is not regular.

Let , and . This is the only division in which . However, for several values of , can be created without it being part of the language (i.e., is not prime). Thus, this is not a regular language.

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Let . Thus, . Suppose , and . For this division, if is used, , which is not a part of the language. Thus, this is not a regular language.