Exercise 1. Consider the following statement:

> *If A is a nonregular language and B is a language such that $B \subseteq A$, then B must also be nonregular.*

If the statement is true, prove it. If it is not true, give a counterexample.

Solution:

Exercise 2. Prove that the language

$ZerosAndMoreOnes = \{w \in \{0,1\}^* \mid w = 0^i 1^j, i < j\}$ is not regular.

Hint: use the Pumping Lemma.

> ***Hint:***
> Try the Pumping Lemma!

Solution:

Exercise 3. Give context-free grammars for each of the following languages.

(a) $\Sigma = \{0, 1\}$ and $\{w \mid w$ `starts and ends with a different symbol` $\}$

Solution:

(b) $\Sigma = \{0, 1\}$ and $\{w \mid$ `the length of` w `is odd` $\}$

Solution:

(c) $\Sigma = \{a, b, c\}$ and $\{w = a^i b^j c^k \mid i, j, k \geq 0$ `and` $i + j = k\}$

Solution:

Exercise 4. Define push-down automata for each of the languages in Exercise 3.

(a) **Solution:**

(b) **Solution:**

(c) **Solution:**

References