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CNC - Formal Languages
Assignment 1

Chapter 6

14. Use the pumping lemma to show that each of the following sets is not regular.

(a) The set of palindromes over {a, b}.

To Prove: the set of palindromes over {a,b} is not regular

Let L = the set of palindromes over {a,b}, assume L is regular
Let k be the number from the pumping lemma
Let s = $a^{k+1}ba^{k+1}$

By the pumping lemma s = uvw where v ≠ λ and |uv| ≤ k

Since |uv| ≤ k, uv must consist of a
Since v ≠ λ, v must consist of one or more a and u is the empty string
Suppose we pump

By the pumping lemma

s = uvvw, u = λ, vv = aa, w = ba, s= aaba
aaba IS NOT a palindrome
Contradiction! L is not regular

(b) {a^nb^m | n < m}

To Prove: {a^nb^m | n < m} is not regular

Let L = {a^nb^m | n < m}, assume L is regular
Let k be the number from the pumping lemma
Let s = a^kb^m where k < m^i

By the pumping lemma s = uvw where v ≠ λ and |uv| ≤ k

Let u = λ and v = a^k and w =so that |uv| ≤ k and v ≠ λ
Suppose we pump once starting from s = abb

By the pumping lemma

s = aabb
The number of a's is not less than the numbers of b's. Contradiction! L is not regular.

(c) $\{a^i b^j c^{2j} \mid i \geq 0, j \geq 0\}$

To Prove: $\{a^i b^j c^{2j} \mid i \geq 0, j \geq 0\}$ is not regular

Let $L = \{a^i b^j c^{2j} \mid i \geq 0, j \geq 0\}$, assume L is regular
Let k be the number from the pumping lemma
Let s = abcc

By the pumping lemma s = uvw where $v \neq \lambda$ and $|uv| \leq k$

Let $v = a^i b^j c^{2j}$
Suppose we pump once

By the pumping lemma

s = abccabcc

Contradiction! L is not regular.