**Pumping Lemma**

If *A* is a regular language, then there is a number *p* where if *s* is any string in *A* of length at least *p*, then *s* may be divided into three pieces, *s* = *xyz*, satisfying the following conditions:

1. for each *i* ≥ 0, *xyiz* ∈ *A*.
2. |*y*| > 0, and
3. |*xy*| ≤ *p*.

Proof by contradiction, imagine as a game between you and your opponent. Whenever the pumping lemma says “there is/there exist”, your opponent has the turn. Whenever the pumping lemma says “any/for all” you have the turn

L = anbn is not regular

Assume L is regular

1. “there is some number p > 0”

You opponent’s move, pick a number k > 0

1. “for all w in L” Your move

Let w = akbk

1. “there exist x,y,z” opponent move:

“If there is one possible x,y,z that satisfy I, ii and iii, you lose”

1. Your move:

“OK, let’s see all possible x,y,z then”

Lat akbk = xyz, where:

1. X = ak – m - n, y = am, z = anbk , let i = 2, xyiz = ak-m-n+2m+nbk xy2z is not in A
2. X = ak – m , y = am, z = bk , let i = 2, xyiz = ak-m+2mbk  xy2z is not in A

All possible cases contradiction.