

# Test - Testing whether a language is regular or not

Every finite language is Regular.

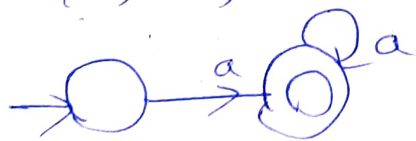
If the language is finite then definitely it is Regular.

If the language is infinite then we don't know whether the language is Regular or not.

Ex  $L = \{ab, abab, ababab, \dots\}$   
→ Infinite Language.

If the language is infinite and a finite Automata is possible for the infinite language then the language is Regular.

Ex  $a^n/n \geq 1$  whether the language is regular or not.  
 $L = \{a, aa, aaa, \dots\}$



Ex  $a^n b^m/n, m \geq 1$

whether the lang is regular or not



Ex

$a^n b^n/n \leq 10^{10}$

The language is finite bcoz  $n$  is bounded.

So the lang is regular.

EX  $a^n b^n / n \geq 1$  Test whether the lang is regular or not.  
 $n$  is unbounded.

1st I have to save all a's or count all a's and then compare them against b's. Then only I can accept it. (One memory element is refused).  
Infinite counting a finite automata can not do.

Therefore the language is not regular.

EX  $WW^R / |W| = 2$  and  $\Sigma = \{a, b\}$   
 $W$  is set of all words of length 2 and bound over a, b

aa	aa
ab	ba
ba	ab
bb	bb

when length of  $w$  is bounded, it will be finite language. So the language is regular.

EX  $WW^R / W \in (a, b)^*$

The language can not be regular. The reason

$\rightarrow$ 

aba	---	aba	---
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~~The~~ we have to read the entire  $w$  and save it in the memory and then we have to compare with the reversal of  $w$ . Then how much

big this word is. This word could be of infinite length. FA does not have the capacity to save infinite length words. Therefore this language is not regular.

EX WW /  $WE(a, b)^*$

W can be of infinite length. We cannot save the infinite length, storing on a finite automata. Therefore this language is not regular.

EX  $a^n b^n c^k / n, m, k \geq 1$

Generate a's independently and forget abt them.

Generate b's independently and forget.

Generate c's independently and forget abt them.

Therefore there is nothing to be counted or stored.

We need not compare anything against anyone.

So the lang is regular.

EX  $a^i b^{2j} / i, j \geq 1$



Generate any no. of a 1st.

Then generate any no. of b.

no comparison, no storing.

So this language is regular.

EX  $a^n b^m c^k / n, m, k \geq 1$

$\begin{matrix} 1^0 & 2^0 & 3^0 \\ \downarrow & \downarrow & \downarrow \\ a a^* & b b^* & c c^* \end{matrix}$

Generate independently.

No storing, no comparison.

So this language is regular.

EX  $a^n b^n c^n / n \geq 1$

Here we need equal no. of a's, b's and c's.

So counting and storing is required and memory element is required.

infinite counting is not possible by FA.  
and comparison is not possible.

So the Lang is not regular.