Regular Languages

- A language is said to be a REGULAR LANGUAGE if and only if some Finite State Machine recognizes it

So what languages are NOT REGULAR ?

The languages

» Which are not recognized by any FSM

» Which require memory

- Memory of FSM is very limited
- It cannot store or count strings

Eg. $\underbrace{ababb}\underbrace{ababb}$.

Eg. $a^N b^N$.

aaabbb

$\underline{aaaa}\,\underline{bbbb}$

Operations on Regular Languages

UNION — $A \cup B = \{ x \mid x \in A \text{ or } x \in B \}$

CONCATENATION — $A \circ B = \{ xy \mid x \in A \text{ and } y \in B \}$

STAR — $A^* = \{ x_1 x_2 x_3 \ldots x_k \mid k \geq 0 \text{ and each } x_i \in A \}$

Eg. $A = \{ pq, r \}$, $B = \{ t, uv \}$

$A \cup B = \{ pq, r, t, uv \}$

$A \circ B = \{ pqt, pquv, rt, ruv \}$

$A^* = \{ \epsilon, pq, r, pqr, rpq, pqpq, rr, \underbrace{pq\,pq\,pq}_{x_1 x_2 x_3}, rrr, \ldots \}$

STAR $A^* = \{x_1 x_2 x_3 \ldots\ldots x_k \mid k \geq 0 \text{ and each } x_i \in A\}$

Eg $A = \{pq, r\}$, $B = \{t, uv\}$

$A \cup B = \{pq, r, t, uv\}$

$A \circ B = \{pqt, pquv, rt, ruv\}$

$A^* = \{\epsilon, pq, r, pqr, rpq, pqpq, rr, pqpqpq, rrr, \ldots\}$

Theorem 1: The class of Regular Languages is closed under UNION

if A,B are regular Languages, then A U B will produce regular languages.

Theorem 2: The class of Regular Languages is closed under CONCATENATION

if A,B are regular Languages, then A.B will also produce regular languages.