

Regular Languages

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

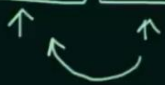
So what languages are NOT REGULAR?

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. ababbbababb



Eg. $a^n b^n$
aaabbb
aaaa, 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

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

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

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

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

$$\underline{A^*} = \{\epsilon, \underline{pq}, \underline{r}, \underline{pq}, \underline{rpq}, \underline{rpqr}, \underline{rpqr}, \underline{rpqr}, \underline{rpqr}, \dots\}$$

x_1, x_2, x_3

STAR

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

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

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

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

$$A^* = \{\epsilon, pq, r, pq r, r pq, pq pq, rr, pq pq pq, rrr, \dots\}$$

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

if A, B are regular Languages, then $A \cup B$ will produce regular languages.

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

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