Regular Languages

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 requires memory.

⇒ when a language not recognized by any FSM?
Ans:- when a language requires memory.

Because of,
- memory of FSM is very limited.
→ It cannot store or count strings

Eg. abababbabb

store required

$a^N b^N$
aaabbb [count required]
aaaabbbb

NOT REGULAR

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

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

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

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

Theorem 1: The class of Regular languages is closed under UNION.

Theorem 2: The class of Regular languages is closed under CONCATENATION.

DFA (Excercise)

⇒ For each of the following language, construct a DFA that accepts the language, In all cases alphabet is $\{0, 1\}$.

① $\{w : w$ is a binary string containing an odd number of 1's$\}$

② $\{w : w$ is a binary string containing 101 as substring$\}$

③ $\{w :$ the length of w is divisible by three$\}$

④ $\{w :$ 110 is not a substring of $w\}$

⑤ $\{w : w$ contains the substring 1011$\}$

⑥ $\{w : w$ contains an even number of 0's or exactly two 1's$\}$