Basic Terminology

Alphabet

$$A = \{a, b, c\}$$

Letters

$$a \in A$$
$$b \in A$$
$$c \in A$$

Words

$$u = ababb$$
$$v = acbacb$$

Empty Word

λ or ϵ

Set of All Words

$$A^* = \{a, aa, ..., abbb\}$$

Length

$|u| = 5$ or $l(u) = 5$

Language

A language is a subset of A^*

$$L_1 = \{a, aa, a^3, a^4, ...\}$$

$$L_2 = \{b, bb, b^3, b^4, ...\}$$

where

$$L_1 \subset A^*$$
$$L_2 \subset A^*$$

Regular Expression

$$(\quad) \quad * \quad \vee \quad \lambda$$

and

$$A_1 = \{a, p, l, e\}$$

Examples

$r = a^*$ includes λ

$$r = aa^*$$

$$r = a \vee b^* = \{a, ab, abb, abbb, ...\}$$

$$r = a^* \vee b^* = b^* \vee a^* = \{ab, ba, aab, aba, bba\}$$

RegEx in Programming

Math	Programming
$*$	{0,}
aa^*	aa{0,}
$a \vee b$	a | b
$a(p \vee l)p^*(l \vee e)(e \vee l)$	`a(p|l)p{0,}(l|e){0,}(e|l){0,}`

Finite State Machine (or Automaton)

> $M = (A, S, Y, s_0, F)$

where

> $A = \{a, b\}$ is the set of input symbols
> $S = \{s_0, s_1, s_2\}$ is the set of internal states
> $Y = \{s_0, s_1\}$ is the set of yes states
> s_0 is the initial state
> $F : S \times A \to S$ is the next state function

F	a	b
s_0	s_0	s_1
s_1	s_0	s_2
s_2	s_2	s_2

> ababba
> $P_1 = s_0 \overset{a}{\longrightarrow} \ s_0 \overset{b}{\longrightarrow} \ s_1 \overset{a}{\longrightarrow} \ s_0 \overset{b}{\longrightarrow} \ s_1 \overset{b}{\longrightarrow} \ s_2 \overset{a}{\longrightarrow} \ s_2$

Since $s_2 \notin Y$, the word $ababba$ will not matched by the automaton, M.