Alphabet : A finite nonempty set of symbols eg

U = {1} or {0} Unary

B = {0,1} Binary (will be our default alphabet}

D = {0, 1, 2, … , 9} Decimal etc

Strings over an alphabet $\sum$: finite sequence x = (x1, x2, … , xn) of symbols of $\sum$ ie xi $\in \sum$. | x | = n – length of the string x. |x| may be zero for the empty string ε = ( ) – a string over any alphabet.

Concatenation : If x = (x1, x2, … , xm) and y = (y1, y2, … , yn) then the concatenation of x and y is x o y or xy = (x1, x2, … , xm, y1, y2, … , yn). Clearly concatenation is associative (not commutative), |xy| = |x| + |y|, and x ε = ε x = x.

Powers of a string : $x^0 = \varepsilon$, $x^1 = x$, $x^2 = xx$, $x^3 = x^2 x = x x^2$ etc.

Reversal : For x = (x1, x2, … , xn), the reversal is the string x^R = (xn, … , x2, x1). X is a palindrome if x = x^R. x x^R is an even palindrome or a palindrome of even length.

Set of all strings over ∑ is denoted by ∑*.

Language : A language L over ∑ is a subset of ∑* ie a set of strings over ∑.

Special Languages : φ, ∑*, {ε} often denoted by ε. For a Є ∑, a can denote the symbol, or can denote the string of length 1 consisting of the single symbol a, or even the language {a} (the meaning depends on the context).

Concatenation of Languages : For languages L1, L2 the concatenation L1 L2 is defined by L1 L2 = {w1 w2 | w1 Є L1, w2 Є L2}. Concatenation is associative and so we can define the powers : L^0 is ε, L^1 is L, L^2 is L L, L^3 is L^2 L or L L^2 etc.

We define the Kleene star operation $L^* = L^0 \cup L^1 \cup L^2 \cup L^3 \cup \ldots\ldots$ and $L^+ = L \cup L^2 \cup L^3 \ldots.$. Hence $L^* = L^+ \cup \{\varepsilon\}$ and $L^* = L^+$ iff $\varepsilon \in L$.

Since languages are sets we have the operations L^c, $L1 \cup L2$, $L1 \cap L2$, $L1 - L2$ $(= L1 \cap L2^c)$. L^R will denote $\{w^R \mid w \in L\}$.

Note that if $\sum 1$ is a subset of $\sum 2$, any string over $\sum 1$ is a string over $\sum 2$. Hence if L1 is a language over $\sum 1$ and L2 is a language over $\sum 2$, for the binary operations $L1 \cup L2$, $L1 \cap L2$ etc both L1, L2 are taken to be languages over $\sum 1 \cup \sum 2$.

Some examples of languages are $\sum^*$, φ, ε, a for $a \in \sum$, $\sum$, $\sum^2$, $\sum^3$,…, $\{0^n1^n \mid n \geq 0\}$ $\{w \in \{0,1\}^* \mid$ no of 0's = no of 1's ie $n0(w) = n1(w)\}$, $\{0^n \mid n$ is a prime number$\}$, $\{0^n \mid n$ is a perfect square$\}$, the set of binary strings which represent numbers which are 1 mod 4 ie {1, 101, 1001, 1101, 10001…}