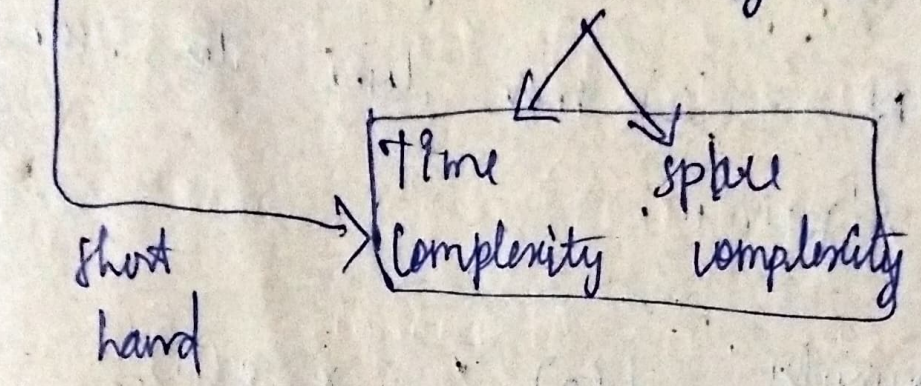
unit - 1 :

Asymptotic Notations

Algorithm → best ah irukanum na. efficiency check pannum.



Definition:

> It is a mathematical notation used to describe the running time of an algorithm.

> Various notations. Θ, O, Ω, θ.

1) Big oh Notation:

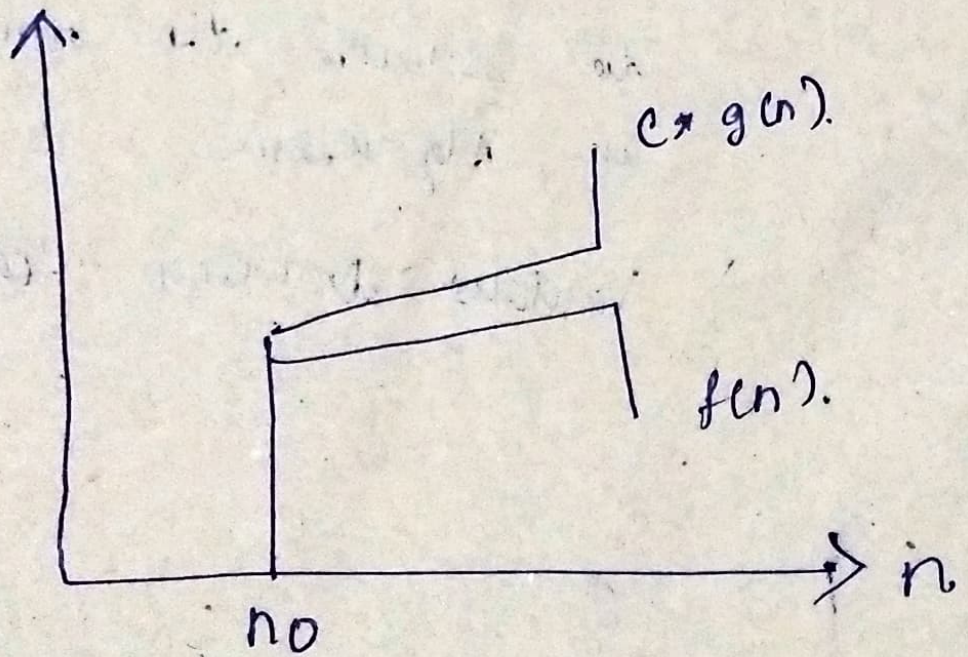
> It is denoted by 'O'

> It represents the upper bound of Algorithm running time.

> It Takes more time to run an Algorithm.

Formula: $f(n) \leq c * g(n)$.

Diagram:



2). Omega Notation :

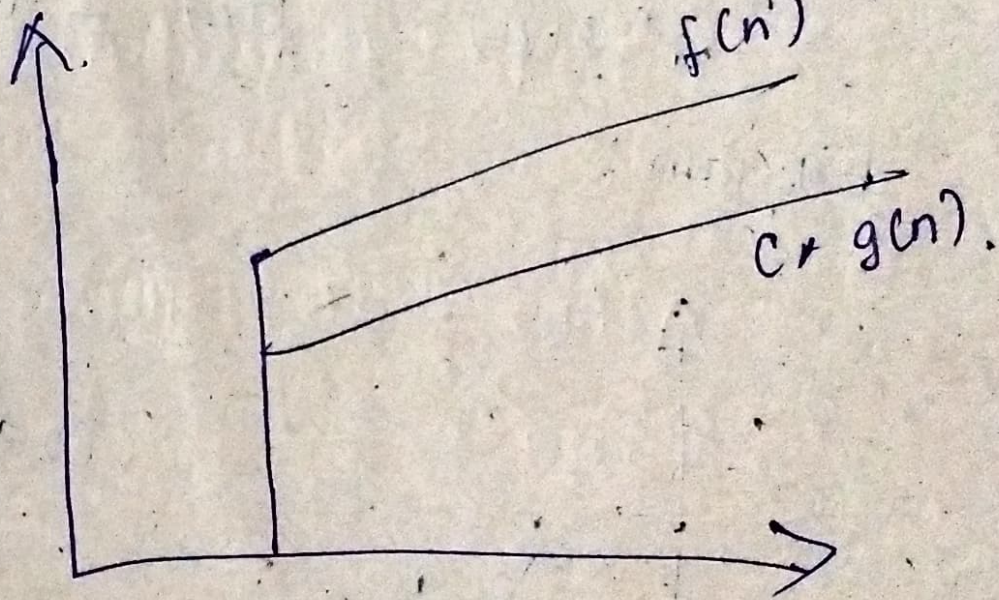
> It is denoted by 'Ω'

> It represents the Lower bound of Algorithm running time.

> It takes less time, the run an Algorithm.

Formula : $f(n) \geq c * g(n)$.

Diagram :



5) Big Theta Notation :

> It is denoted by 'Θ'.

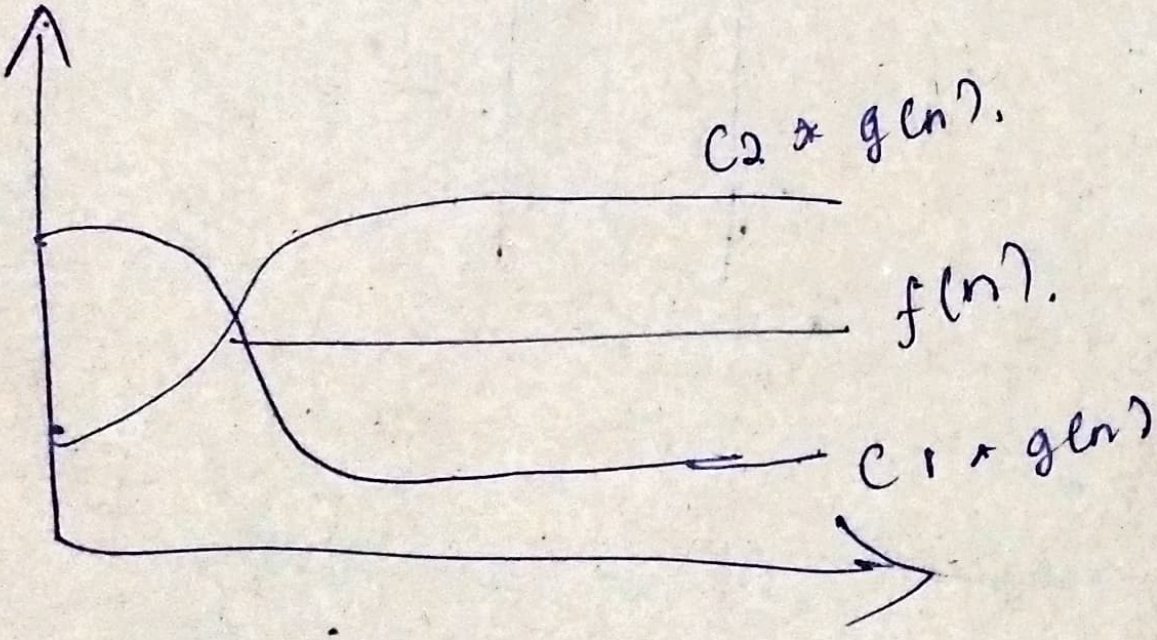
> It is the method the running time is between the upper and lower bound.

> It Takes Average time to run an Algorithm.

Formula :

$$c_1 * g(n) \leq f(n) \leq c_2 * g(n).$$

Diagram :



properties of order of growth :

1. $f_1(n)$ in order of $g_1(n)$ & $f_2(n)$ in " " $g_2(n)$, then.

$f_1(n) + f_2(n) \in O(\max(g_1(n), g_2(n))$.

2. Polynomials of degree m $\in \Theta(n^m)$.

3. $O(1) < O(\log n) < O(n) < O(n^2) < O(2^n)$

4. Exponential functions an have different orders of growth for different values of a.

Properties of Asymptotic Notations:

1. General properties:

i) $f(n) = O(g(n))$ then $a * f(n) = O(g(n))$

ii) $f(n) = \Omega(g(n))$ then $a * f(n) = \Omega(g(n))$

iii) $f(n) = \Theta(g(n))$ then $a * f(n) = \Theta(g(n))$

2. Reflexive:

$f(n) = O(f(n))$.

$f(n) = n^2$ then $f(n) = O(n^2)$.

similarly:

$f(n) = \Omega(f(n))$.

$f(n) = \Theta(f(n))$.

3. Symmetry:

$f(n) = \Theta(g(n))$ if and only if $g(n) = \Theta(f(n))$.

Eg:

$f(n) = n^3$ and $g(n) = n^3$ then.

$f(n) = \Theta(n^3)$ and $g(n) = \Theta(n^3)$.

4. Transitivity:

$f(n) = O(g(n))$ & $g(n) = O(h(n))$

then $f(n) = O(h(n))$.

5. Transpose symmetry:

$f(n) = O(g(n))$ if and only if

$g(n) = \Omega(f(n))$.

b). $f(n) = O(g(n))$ and

$f(n) = \Omega(g(n))$ then

$f(n) = \Theta(g(n))$

d) $\Theta(f(n) + g(n)) = \max(f(n), g(n))$.