Asymptotic Notations

1. Big O (O)
2. Big Omega (Ω)
3. Theta (Θ)
4. Small (o)
5. Small Omega(ω)

Small 'o' Notation

Small o means **loose upper-bound** of f(n). It is a rough estimate of the maximum order of growth whereas Big-O may be the actual order of growth.

In mathematical relation,

f(n) = o(g(n)) means

$\lim_{n \to \infty} f(n)/g(n) = 0$, f(n)=n2-4=>o(n3),

g(n)=**n3,(n2-4)/n3=(1-4/n2)/n=1/infinity=0**

Small o Notation Examples

Examples:

Is $7n + 8 \in o(n^2)$? /n3/n4/

then check limits,

$$\lim_{n\to\infty} f(n)/g(n) = \lim_{n\to\infty} (7n + 8)/(n^2) = \lim_{n\to\infty} 7/n+8/n2 =0$$

Small Omega (ω)

Small Omega means **loose lower-bound** of f(n). It is a rough estimate of the minimum order of growth whereas Big-Omega may be the actual order of growth. In mathematical relation,

if $f(n) \in \omega(g(n))$ then,

$$\lim_{n \to \infty} f(n)/g(n) = \infty$$

Small Omega (ω) Notation Examples

Example:

1. $4n + 6 \in \omega(1)$;Nx where x is less than the given power

here,we have functions f(n)=4n+6 and g(n)=1

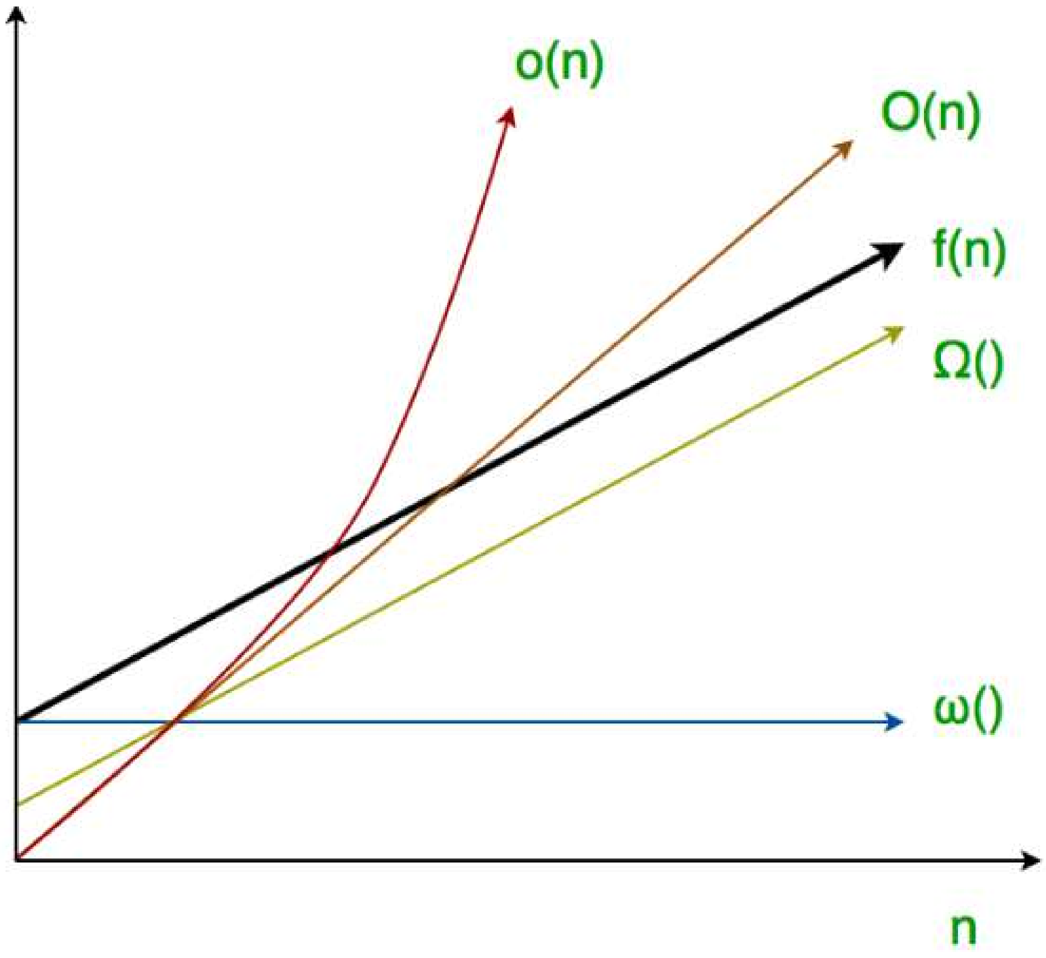
$$\lim_{n \to \infty} (4n+6)/(1) = 4 * \infty + 6 = \infty$$

2. **$5n^2+6n+4 \in \omega(1)$ or $\omega(n)$;**

here,we have functions f(n)= $5n^2+6n+4$ and g(n)=1

$$\lim_{n \to \infty} 5n^2+6n+4 /(1) = \infty$$

$$\lim_{n \to \infty} (5n^2+6n+4) /(n) = \lim_{n \to \infty} 5n+6 = \infty$$



o(n)
O(n)
f(n)
Ω()
ω()
n

Linear Search

Best Case

$\Theta(1)$/ $\Theta(c)$

Average Case

$(n/2-s)<=c<=(n/2+s)$

O(n)

Worst Case

$(n-1)<=c<=(n+1)$

$\Theta(n)$–when ur element is in the arrray

/ Ω (n) –not present

Binary Search

Best Case

$\Theta(1)$

Average Case

$lg_2(n)/2-1 <= c <= lg_2 (n)/2+1$

$O(lg_2 n)$

Worst Case

$(lg_2 n-1) <= c <= (lg_2 n+1)$

$\Theta(lg_2 n) / \Omega (lg_2 n)$

//that last element is the desired element