**Exercise 1**

In each of the following situations indicate whether f=O(g), or f=Ω(g), or both (in which case f=Θ(g)).

Θ – The basis of the function is the same and grow the same

O – The basis of the function is different but grows the same

Ω – different

|  |  |  |
| --- | --- | --- |
|  | f(n) | g(n) |
| 1 | n-100 | n-200 |
| f = Θ(g). | | |
| 2 | n1/2 | n2/3 |
| f = O(g). | | |
| 3 | 100n+logn | n+(logn)2 |
| f = Θ(g). | | |
| 4 | Nlogn | 10nlog10n |
| f = Θ(g). | | |
| 5 | Log(2n) | log3n |
| f = Θ(g). | | |
| 6 | 10logn | log(n2) |
| f = Θ(g). | | |
| 7 | n1.01 | nlog2n |
| f = Ω(g) | | |
| 8 | n2/logn | n(logn)2 |
| f = Ω(g) | | |
| 9 | n0.1 | (logn)10 |
| f = Ω(g). | | |
| 10 | (logn)logn | n/logn |
| f = Ω(g). | | |
| 11 | n2n | 3n |
| f = O(g). | | |
| 12 | 2n | 2n+1 |
| f = Θ(g). | | |
| 13 | n! | 2n |
| f = Ω(g). | | |

**Exercise 2**

Show that, if ***c*** is a positive real number, then g(n)=1+c+c2+…+cn is:

a) Θ(1) if c < 1.

b) Θ(n) if c = 1.

c) Θ(cn) if c > 1.

Lim f(x) / g(x) < infinity = big O

Lim f(x)/ g(x) > 0 = Omega

Lim f(x)/ g(x) = c, 0 < c < infitiy = Teta

Geom progr:

g(n) = 1 + c + c^2 + … + c^n = (c^(n+1) – 1) / (c – 1)

if(c < 1 ) {

lim (->inf) g(n) = (0 – 1) / (c-1) = 1 / (1 – c) (lim (->inf) c ^ (n+1) = inf)

Teta

}

If(c == 1 ) {

g(n) = n + 1;

Teta

}

If(c > 1) {

Lim (inf) g(n)/c^n= lim (inf) c / (c-1)

g(n) = O(c^n). \n g(n) = Omega(e^n) for c > 1. We have g(n) = Teta(c^n)

Teta

}

**Exercise 3**

Implement procedures of Linear-Search, Better-Linear-Search, Sentinel-Linear-Search and Recursive-Linear-Search using any programming language and find how long each procedure is performed.







