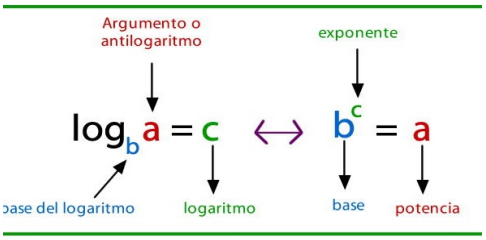
Ejercicio 8

Para cada uno de los algoritmos presentados calcule el T(n).
a. Expresar en función del tiempo de ejecución.
b. Establecer el orden de dicha función usando notación Big-Oh

```
1.  int c = 1;
    while ( c < n ) {
        algo_de_O(1);
        c = 2 * c;
    }
```

R	c
1	2
2	4
3	8
4	16
k	2^k

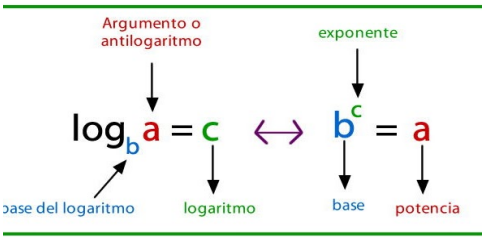


$2^k < n$
$k < \log_2(n)$

$$ct1 + \sum_{c=1}^{log2(n)} ct2 = ct1 + log2(n)\, ct2 = O(log2(n))$$

```
2. int c = n;
   while ( c > 1 ) {
     algo_de_O(1);
     c = c / 2;
   }
```

R	c
1	n
2	n/2
3	n/4
4	n/8
k	$n/2^{(k-1)}$



$\frac{n}{2^{(k-1)}} > 1$

$n > 2^{(k-1)}$

$\log_2(n) = k-1$

$\log_2(n) + 1 = k$

$$ct1 + \sum_{c=1}^{log2(n)+1} ct2 = ct1 + (log2(n) + 1)\, ct2 = O(log2(n))$$

```
3. public static void calcular(int n) {
        int i, j, r = 0;
        for ( i = 1; i < n; i= i+2)
            for (j = 1; j <= i; j++ )
                r = r + 1;
        return r;
    }

}
```

for externo

R	i
1	1
2	3
3	5
4	7
k	2k-1

n < 2k-1

$\frac{n+1}{2}$ < k

ct1+ $\sum_{i=1}^{\frac{n+1}{2}} (\sum_{j=1}^{i} ct3) =$

$ct1 + \sum_{i=1}^{\frac{n+1}{2}} i\, ct3 =$

$ct1 + ct3 \sum_{i=1}^{\frac{n+1}{2}} i =$

ct1 + ct3 ($\frac{(\frac{n+1}{2})*((\frac{n+1}{2})+1)}{2}$) =

ct1 + ct3 ($\frac{(\frac{n+1}{2})^2+(\frac{n+1}{2})}{2}$) =

ct1 + ct3 ($\frac{(\frac{n}{2}+\frac{1}{2})^2+(\frac{n+1}{2})}{2}$) =

ct1 + ct3 $\left(\frac{\left(\left(\frac{n}{2}\right)^2+2\left(\frac{n}{2}\right)\left(\frac{1}{2}\right)+\left(\frac{1}{2}\right)^2+\left(\frac{n+1}{2}\right)\right.}{2}\right)$ =

ct1 + ct3 $\left(\frac{\left(\left(\frac{n^2}{4}\right)+\left(\frac{n}{2}\right)+\left(\frac{2}{4}\right)+\left(\frac{n+1}{2}\right)\right.}{2}\right)$ =

ct1 + ct3 $\left(\left(\frac{n^2}{4}\right)/2 + \left(\frac{n}{2}\right)/2 + \left(\frac{2}{4}\right)/2 + \left(\frac{n+1}{2}\right)/2\right)$

ct1 + ct2 $\left(\left(\frac{n^2}{8}\right) + \left(\frac{n}{4}\right) + \left(\frac{2}{8}\right) + \left(\frac{n+1}{4}\right)\right)$

ct1 + ct2 $\left(\left(\frac{n^2}{8}\right) + \left(\frac{n}{4}\right) + \left(\frac{1}{4}\right) + \left(\frac{n+1}{4}\right)\right)$

ct1 + ct2$\frac{n^2}{8} + ct2\frac{n}{4} + ct2\frac{1}{4} + ct2\frac{n+1}{4} \rightarrow O(n^2)$