

Ejercicio 7

Para cada uno de los siguientes fragmentos de código, calcule, intuitivamente, el orden del tiempo de ejecución.

a_

```
for(int i = 0; i < n; i++)  
    sum++;
```

O(n)

b_

```
for(int i = 0; i < n; i+=2)  
    sum++;
```

(1) i = 0

(2) i = 2

(3) i = 4

(4) i = 6

...

(k) i = 2(k-1)

$2(k-1) = n-1$

$2k - 2 = n-1$

$2k - 2 + 1 = n$

$2k - 1 = n$

$2k = n + 1$

$k = (n + 1) / 2$

$\sum_{i=1}^{(n+1)/2}$

$$c = c * (n + 1)/2 = c/2 * n + c/2$$

Por lo tanto es de O(n)

c_

```
for(int i = 0; i < n; i++)  
    for(int j = 0; j < n; j++)  
        sum++;
```

sumatoria externa:

(1) i = 0
(2) i = 1
(3) i = 2
...
(k) i = k - 1

n - 1 = k - 1
k = n

sumatoria interna:

(4) j = 0
(5) j = 1
(6) j = 2
...
(k) j = k - 1

n - 1 = k - 1
k = n

$$\sum_{i=1}^n \sum_{j=1}^n c = \sum_{i=1}^n n * c = n * n * c = n^2 * c$$

Por lo tanto es de $O(n^2)$

d_

```
for(int i = 0; i < n + 100; ++i) {
    for(int j = 0; j < i * n ; ++j){
        sum = sum + j;
    }
    for(int k = 0; k < n + n + n; ++k) {
        c[k] = c[k] + sum;
    }
}
```

$$\sum_{i=1}^{n+100} \left(\sum_{j=1}^{i*n} \text{cte1} + \sum_{k=1}^{3n} \text{cte2} \right) \rightarrow \sum_{i=1}^{n+100} (i*n * \text{cte1} + 3n * \text{cte2})$$

$$n * \sum_{i=1}^{n+100} ((i * \text{cte1}) + (3 * \text{cte2})) = n * \text{cte} * \sum_{i=1}^{n+100} i + \sum_{i=1}^{n+100} 3 =$$

$$n * \text{cte} * \left(\frac{(n+100)*(n+101)}{2} \right) + 3n + 300 =$$

$$\text{cte} * n * \left(\frac{n^2 + 201n + 10100}{2} \right) + 3n + 300 =$$

$$\frac{n^3 * \text{cte}}{2} + \frac{201n^2 * \text{cte}}{2} + 5050n * \text{cte} + 3n^2 * \text{cte} + 300n * \text{cte} \rightarrow o(n^3)$$

e_

```
for(int i = 0; i < n; i++)
    for(int j = 0; j < n; j++)
        sum++;

for(int i = 0; i < n; i++)
    sum++;
```

$$\sum_{i=0}^n \left(\sum_{j=0}^n \text{cte1} \right) + \sum_{i=0}^n \text{cte2} \rightarrow n(n + \text{cte1}) + n * \text{cte2}$$

$$\rightarrow n^2 + n * \text{cte1} + n * \text{cte2} \rightarrow o(n^2)$$

f)

```
int i,j;
int x = 1;
for (i = 0; i <= n2; i=i+2)
    for (j = n; j >= 1; j-= n/4)
        x++;
```

Iteracion externa

r	i	
1	0	$2(k-1) = n^2$
2	2	$k-1 = n^2/2$
3	4	$k = (n^2/2) + 1$
k	$2(k-1)$	

Iteracion interna

r	i
1	n
2	$3/4n$
3	$2/4n$
4	$1/4n$

$$\sum_{i=1}^{(n^2/2)+1} (4 * \text{cte}) = \sum_{i=1}^{(n^2/2)+1} 4 * \text{cte} = (n^2/2 + 1) * 4\text{cte} \rightarrow o(n^2)$$