NOT BLOSSOMSORT (v, n)

```
for i ← 1 to n-1
    for j ← n to i+1
        if v[j] > v[j-1]
            k ← v[j]
            v[j] ← v[j-1]
            v[j-1] ← k
```

C1 - 2024 - 1

4) $n^6 = \theta\left(\binom{n}{6}\right)$

$\binom{n}{k} = \frac{n!}{k!(n-k)!}$, $n \geq k \geq 0$, else $\binom{n}{k} = 0$

$\exists\, c_1, c_2, n_0 > 0$ tq $\forall n \geq n_0 \longrightarrow c_1\binom{n}{6} \leq n^6 \leq c_2\binom{n}{6}$

1er approach: expandir todo y operar

↓ análisis ↑ operación

$P(n) = \frac{n(n-1)(n-2)(n-3)(n-4)(n-5)}{6!}$

$c_1 P(n) \leq n^6 \leq c_2 P(n)$

2do approach: Parafrasear

$c_1\binom{n}{6} \leq n^6 \leq c_2\binom{n}{6}$

$\binom{n}{6} \leq \frac{1}{c_1} n^6$

$\longleftrightarrow$

$\frac{1}{c_2} n^6 \leq \binom{n}{6}$

$b_1 n^6 \leq \binom{n}{6} \leq b_2 n^6$

Probaremos que tomando $n_0 \geq 10$, $c_1 =$ $c_2 =$

Como $n \geq 10 \longrightarrow n - \frac{n}{2} = 5 \longrightarrow \frac{n}{2} \leq n-5 \leq n-4 \leq n-3 \leq n-2 \leq n-1 \leq n$

$\longrightarrow \frac{n}{2} \leq n-i \leq n \quad \forall\ 0 \leq i \leq 5$

$\longrightarrow \left(\frac{n}{2}\right)^6 = \prod_{i=1}^{6}\left(\frac{n}{2}\right) \leq \prod_{i=1}^{6}(n-i) \leq n^6 \Rightarrow \left(\frac{n}{6}\right)^2 \leq n(n-1)(n-2)(n-3)(n-4)(n-5)$

$\longrightarrow \frac{1}{720} \cdot \frac{n^6}{64} \leq \binom{n}{6} \leq \frac{1}{720} \cdot n^6$

$\Rightarrow 720\binom{n}{6} \leq n^6 \leq 64720\binom{n}{6}$

c) $2n^3 - 2023n^2 - 2023^2 n \lg(n) + 10^{10} \lg^2 n + 1 = O(0{,}5^{2023} n^3)$

$\exists\, c, n_0 > 0$ tq $2n^3 - 2023n^2 - 2023^2 n \lg(n) + 10^{10} \lg^2 n + 1 \leq c\, 0{,}5^{2023} n^3$

Probaremos que tomando $n_0 \geq 1$, $c =$ ______

$$\underline{2n^3} \underbrace{-2023n^2}_{\leq 0} \underbrace{-2023^2 n \lg(n)}_{\leq 0} + \underline{10^{10} \lg^2 n + 1} \leq c\, 0{,}5^{2023} n^3$$

$\mp$ $\lg^2 n \leq n^3$

$n = 2^k$

$\boxed{k^2 \leq 2^{3k}}$ $\forall k \geq 1$

$$2n^3 \leq \frac{4}{0{,}5^{2023}}\, \underline{0{,}5^{2023} n^3} \quad \forall n \geq n_0 = 1$$

$-2023n^2 \leq 1/0$ —— $n_0 = 1$

$-2023^2 n \lg n \leq 1/0$ —— $n_0 = 1$

$+10^{10} \lg^2 n \leq 10^{10}/6$ —— $n_0 = 1$

$1 \leq 1/0$ —— $n_0 = 1$

$$\leq \underbrace{\boxed{\frac{10^{11}+7}{0{,}5^{2023}}}}_{c}\, 0{,}5^{2023} n^3 \quad \forall n_0 \geq 1$$

i j K

```
1: For i ← 1 to n-1
2:     for j ← i+1 to n
3:         for k ← i to n
4:             A[j,k] ← ◯
```

$\sum_{i=1}^{n} P_i$

1 iteración más

$\sum_{i=1}^{n-1} \sum_{j=i+1}^{n+1} S_{ij}$

$\sum_{i=1}^{n-1} \sum_{j=i+1}^{n} \sum_{k=i}^{n+1} T_{ijk}$

$\sum_{i=1}^{n-1} \sum_{j=i+1}^{n} \sum_{k=i}^{n} C_{ijk}$

P_i : # ejecuciones de la línea 1 $\begin{cases} 1 & 1 \le i \le n-1+1 \\ 0 & \text{else} \end{cases}$

S_{ij} : " línea 2 $\begin{cases} 1 & 1 \le i \le n \wedge i+1 \le j \le n+1 \\ 0 & \text{else} \end{cases}$

T_{ijk} : " línea 3 $\begin{cases} 1 & 1 \le i \le n \wedge i+1 \le j \le n \wedge i \le k \le n+1 \\ 0 & \text{else} \end{cases}$

C_{ijk} : " línea 4

for 2 en 2

a_b

- $\sum_{i=1}^{n} 1 = n$

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

- $\sum_{i=1}^{n-1} \sum_{j=i+1}^{n} \sum_{k=i}^{n+1} 1 = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} (n-i+1) = \sum_{i=1}^{n-1} (n-i)(n-i+1) \overset{j=n-i}{=} \sum_{j=1}^{n-1} j(j+1)$

$= \frac{(n-1)(n)(n+1)}{3}$

$\sum_{i=1}^{n-1} 1 \quad +1$

$\sum_{i=1}^{n-1} \left(\sum_{j=i-1}^{n} 1 \quad +1 \right)$

$\sum_{i=1}^{n-1} \sum_{j=i-1}^{n} \left(\sum_{k=i} +1 \right)$

ALGORITMO (v, w, n)

1: t ← 0 (contador)

2: i ← 1 ← iterador 1

3: while i ≤ n

4:     t ← t + 1 X

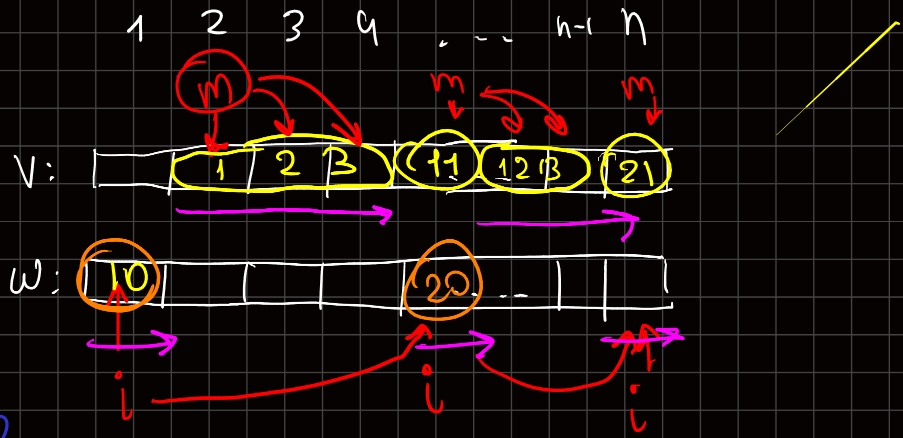
5:     m ← i + 1 ← iterador 2

6:     while m ≤ n and v[m] < w[i]

7:         m ← m + 1

8:     i ← m ←

9: return t



ALGORITMO (v, w, n)

1: t ← 0   1

2: i ← 1   1

3: while i ≤ n T_i → # de veces que se ejecuta la línea 3

4:     t ← t + 1

5:     m ← i + 1

6:     while m ≤ n and v[m] < w[i] S_m → #

7:         m ← m + 1

8:     i ← m

9: return t

For $i \leftarrow 1$ to n

$v \leftarrow 1$

$i \leftarrow 2i$

$$\sum_{i=1}^{\lg n+1} 1 \quad \lg n + 1 \neq \cancel{k+1} \quad \rightarrow \lg n + 1$$

#	1	2	3	4	5	...	i	
i	1	2	4	8	16	...	2^{i-1}	n

$2^{k-1} = n$

$k-1 = \lg n$

$k = \lg n + 1$