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

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

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

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

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

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

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

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

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

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

$\Rightarrow 720 \binom{n}{6} \leq n^6 \leq 64\,720 \binom{n}{6}$

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 $n_0 \geq \underline{1}$, $c = \_\_\_\_$

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

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

$n = 2^k$

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

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

$$-2023n^2 \leq 1/0 \quad\text{——}\quad n_0 = 1$$

$$-2023^2 n\lg n \leq 1/0 \quad\text{——}\quad n_0 = 1$$

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

$$1 \leq 1/0 \quad\text{——}\quad n_0 = 1$$

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

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

i 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

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

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

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

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

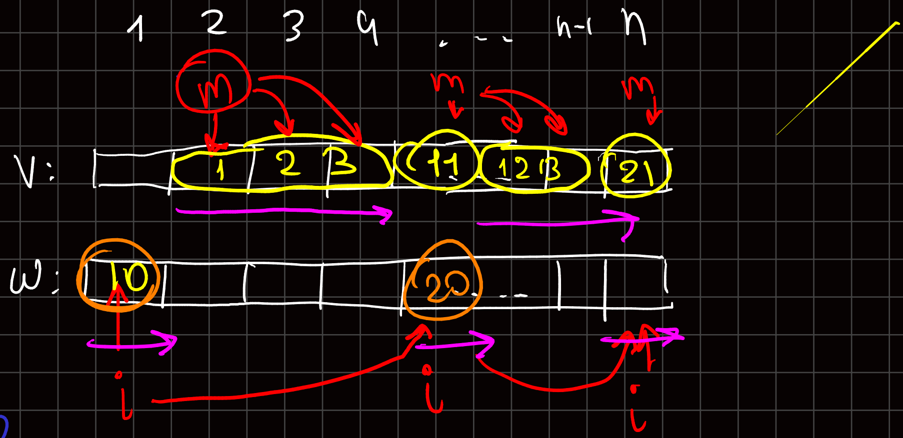
$\sum_{i=1}^{n-1} 1 \quad +1$

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

$\sum_{i=1}^{n-1} \sum_{j=i-1}^{n} \left(\sum_{k=i}^{2} + 1 \right)$

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                 Ti → # 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]       Sm → #
7:          m ← m + 1
8:      i ← m
9:  return t
```

For $i \leftarrow 1$ to n

$v \leftarrow 1$

$i \leftarrow 2i$

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

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

$$2^{k-1} = n$$

$$k-1 = \lg n$$

$$k = \lg n+1$$