

NOT BLOSSOM SORT ( $v, n$ )

1: for  $i \leftarrow 1$  to  $n-1$

2:     for  $j \leftarrow n$  to  $i+1$

3:         if  $v[j] > v[j-1]$

4:              $k \leftarrow v[j]$

5:              $v[j] \leftarrow v[j-1]$

6:              $v[j-1] \leftarrow k$

C1 - 2024 - 4

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

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

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

1<sup>er</sup> approach: expandir todo y operar

↓ análisis

↑ operación

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

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

2<sup>do</sup> approach: Parafrasear

$$c_1 \binom{n}{6} \leq n^6 \leq c_2 \binom{n}{6} \quad \begin{array}{c} \binom{n}{6} \leq \frac{1}{c_1} n^6 \\ \frac{1}{c_2} n^6 \leq \binom{n}{6} \end{array} \quad b_1 n^6 \leq \binom{n}{6} \leq b_2 n^6$$

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

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

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

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

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

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

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

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

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

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

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

$$n = 2^k$$

$$\boxed{k^2 \leq 2^{3k}}$$

$$\forall k \geq 1$$

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

$$-2023n^2 \leq \frac{1}{0} \quad n_0 = 1$$

$$-2023^2 n \leq \frac{1}{0} \quad n_0 = 1$$

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

$$1 \leq \frac{1}{0} \quad n_0 = 1$$

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

1: For  $i \leftarrow 1$  to  $n-1$

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

2: For  $j \leftarrow i+1$  to  $n$

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

3: For  $k \leftarrow i$  to  $n$

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

4:  $A[j,k] \leftarrow$  

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

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

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

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

$C_{ijk}$ : " línea 4 for 2 en 2

a\_b

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

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

$$\bullet \sum_{i=1}^{n-1} \sum_{j=i+1}^{n-1} \sum_{k=i}^{n+1} 1 = \sum_{i=1}^{n-1} \sum_{j=i+1}^n (n-i+1) \stackrel{j=n-i}{=} \sum_{i=1}^{n-1} (n-i)(n-i+1) = \sum_{j=1}^{n-1} j(j+1) = \frac{(n-1)(n)(n+1)}{3}$$

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

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

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

ALGORITMO ( $v, w, n$ )

1:  $t \leftarrow 0$  (contador)

2:  $i \leftarrow 1$  ← iterador 1

3: while  $i \leq n$

4:  $t \leftarrow t + 1$  X

5:  $m \leftarrow i + 1$  ← iterador 2

6: while  $m \leq n$  and  $v[m] < w[i]$

7:  $m \leftarrow m + 1$

8:  $i \leftarrow m$  ←

9: return  $t$



ALGORITMO ( $v, w, n$ )

1:  $t \leftarrow 0$

2:  $i \leftarrow 1$

3: while  $i \leq n$

4:  $t \leftarrow t + 1$

5:  $m \leftarrow i + 1$

6: while  $m \leq n$  and  $v[m] < w[i]$

7:  $m \leftarrow m + 1$

8:  $i \leftarrow m$

9: return  $t$

1

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$T_i \rightarrow \#$  do veces que se ejecuta la línea 3

$S_m \rightarrow \#$

For  $i \leftarrow 1$  to  $n$

$v \leftarrow 1$

$i \leftarrow 2i$

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

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

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

$$k-1 = \lg n$$

$$k = \lg n + 1$$