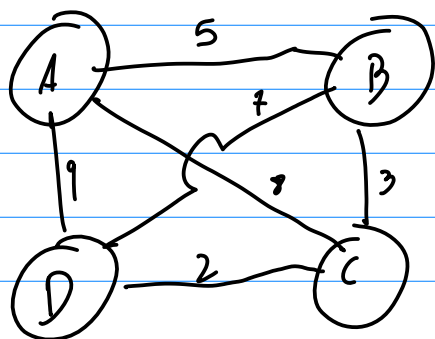


P vs NP

P: tratable
NP: intratable

P $\begin{cases} \rightarrow \text{con solución computacional} \\ \rightarrow \text{sin solución computacional} \end{cases}$ $\begin{cases} \text{Tratables} \\ \text{intratables: el tamaño de la entrada hace exponencialmente los pasos.} \end{cases}$



$$O(2^n) \subset O(n!)$$

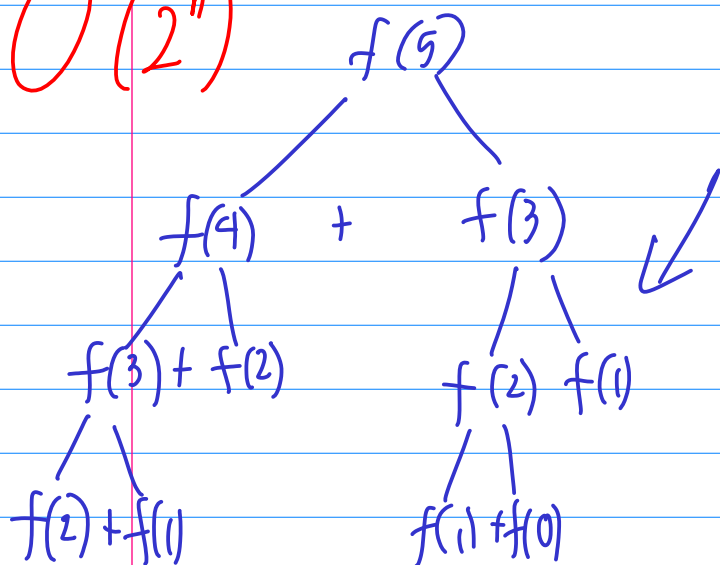
$$\lim_{n \rightarrow \infty} \frac{n!}{2^n} = \frac{\sum_{i=1}^n \log(i)}{n \cdot \log(2)} = \infty$$

$$f(n) = \begin{cases} 0 & \text{si } n=0 \\ 1 & \text{si } n=1 \\ f(n-1) + f(n-2) & \end{cases}$$

$$f(n) = f'(n, 0, 1)$$

$$f'(n, p, u) = \begin{cases} p & \text{si } n=0 \\ f'(n-1, u, u+p) & \end{cases}$$

$O(2^n)$



$$\begin{aligned} f(5) &= f'(5, 0, 1) \\ &= f'(4, 1, 1) \\ &= f'(3, 1, 2) \\ &= f'(2, 2, 3) \\ &= f'(1, 3, 5) \\ &= f'(0, 5, 8) \\ &= 5 \end{aligned} \quad O(n)$$

matriz característica



$$\begin{pmatrix} 0 & 1 \\ 1 & 1 \end{pmatrix} \times \begin{pmatrix} 0 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$

$$\begin{pmatrix} 0 & 1 \\ 1 & 1 \end{pmatrix} \times \begin{pmatrix} f_n \\ f_{n+1} \end{pmatrix} = \begin{pmatrix} f_{n+1} \\ f_{n+2} \end{pmatrix}$$

$$\begin{pmatrix} 0 & 1 \\ 1 & 1 \end{pmatrix} \times \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$$

$$M \times (M \times (M \times (M \times \begin{pmatrix} 0 \\ 1 \end{pmatrix}))) = \begin{pmatrix} f_4 \\ f_5 \end{pmatrix}$$

$$= M^4 \times \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

$$\begin{pmatrix} 0 & 1 \\ 1 & 1 \end{pmatrix} \times \begin{pmatrix} 1 \\ 2 \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$$

$$\Rightarrow M^n \times \begin{pmatrix} 0 \\ 1 \end{pmatrix} = \begin{pmatrix} f_n \\ f_{n+1} \end{pmatrix}$$

$$\hookrightarrow O(\log(n))$$

$$\begin{pmatrix} 0 & 1 \\ 1 & 1 \end{pmatrix} \times \begin{pmatrix} 2 \\ 3 \end{pmatrix} = \begin{pmatrix} 3 \\ 5 \end{pmatrix}$$

$$a^n = \left(a^{n/2} \right)^2$$

$$pot(a, n) = \begin{cases} 1 & \text{si } n=0 \\ (pot(a, n/2))^2 & \text{si } n \neq 0 \end{cases}$$

$$\begin{pmatrix} 0 & 1 \\ 1 & 1 \end{pmatrix} \times \begin{pmatrix} 3 \\ 5 \end{pmatrix} = \begin{pmatrix} 5 \\ 8 \end{pmatrix}$$

$$\begin{pmatrix} 0 & 1 \\ 1 & 1 \end{pmatrix} \times \begin{pmatrix} 5 \\ 8 \end{pmatrix} = \begin{pmatrix} 8 \\ 13 \end{pmatrix}$$

$$f(n) = \begin{cases} 7 & \text{si } n=0 \\ 6 & \text{si } n=1 \\ 3 & \text{si } n=2 \\ \frac{f(n-1)}{2} + 2f(n-2) - f(n-3) \end{cases}$$

$$O(k^3 \cdot \log(n))$$

$$\begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & 2 & 1/2 \end{pmatrix}^n \begin{pmatrix} 7 \\ 6 \\ 3 \end{pmatrix} = \begin{pmatrix} f(n) \\ f(n+1) \\ f(n+2) \end{pmatrix}$$

$$\begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & 2 & 1/2 \end{pmatrix} \begin{pmatrix} 7 \\ 6 \\ 3 \end{pmatrix} = \begin{pmatrix} 6 \\ 3 \\ f_3 \end{pmatrix}$$