1. Indicar funciones que sean

2 funciones para cada

$O(n^2) \rightarrow 5n^2, \ 5n-3$

$\Omega(n) \rightarrow 2n, \ 5n^2$

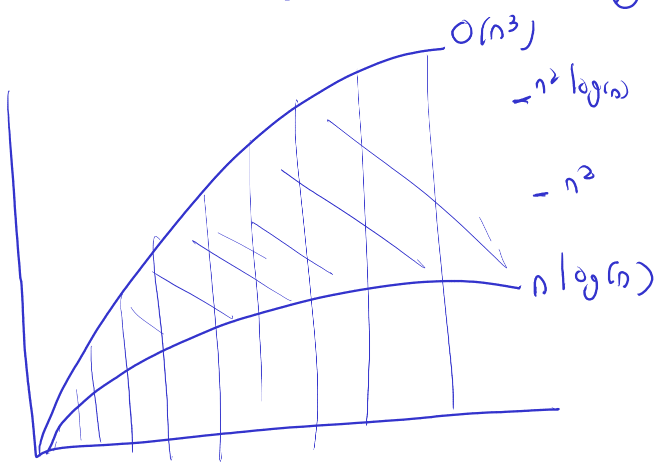
$\Theta(n^3) \rightarrow n^3+n^2, \ 5n^3-3n$

$O(n\log(n)) \rightarrow n+3, \ \log(n)$

$\Omega(n^4) \rightarrow n^7, \ 5n^6$

$\Theta(1) \rightarrow 5, \ 3,$

Indique dos funciones que sea $O(n^3)$ y $\Omega(n\log(n))$



1) n^2

2) $n^2\log(n)$

$3n^3 + n + 1$

Resolver la RR

$$\boxed{T(n) = 5T(n/2) + 3n^2}$$

$T(1) = 10$

Recurrencias

Dado $T(n) = aT(n/b) + f(n)$, donde $a\geq 1$, $b>1$, se puede acotar asintóticamente como sigue:

1. $T(n)=\Theta(n^{\log_b a})$
   Si $f(n)=O(n^{\log_b a-\varepsilon})$ para algún $\varepsilon>0$
2. $T(n)=\Theta(n^{\log_b a}\lg n)$
   Si $f(n)=\Theta(n^{\log_b a})$ para algún $\varepsilon>0$
3. $T(n)=\Theta(f(n))$
   Si $f(n)=\Omega(n^{\log_b a+\varepsilon})$ para algún $\varepsilon>0$ si $a*f(n/b) \leq c*f(n)$ para algun $c<1$

1) Expansion

2) Arbole

3) Teorema Maestro

$\log_b a = \log_2 5 > 2 \quad < 3$

1) $3n^2$ es $O(n^{\log_2 5 - \epsilon})$

$O(n^2)$ ✓

$\Theta(n^{\log_2 5}) \approx \Theta(n^{2.32})$

$$T(n) = 5T\left(\frac{n}{2}\right) + 3n^2 \qquad 1)\ 3n^2 + 5T\left(\frac{n}{2}\right)$$

$$3n^2 + 5\left(3\left(\frac{n}{2}\right)^2 + 5T\left(\frac{n}{2^2}\right)\right)$$

$$3n^2 + 5 \times 3\frac{n^2}{2^2} + 5^2 T\left(\frac{n}{2^2}\right)$$

$$3n^2 + 5 \times 3\frac{n^2}{2^2} + 5^2\left(3\left(\frac{n}{2^2}\right)^2 + 5T\left(\frac{n}{2^3}\right)\right)$$

$$3n^2 + 5 \times 3\frac{n^2}{2^2} + 5^2\frac{3 \times n^2}{(2^2)^2} + 5^3 T\left(\frac{n}{2^3}\right)$$

$$3n^2 + \frac{5 \times 3n^2}{2^2} + \frac{5^2 \times 3n^2}{(2^2)^2} + 5^3\left(3\left(\frac{n}{2^3}\right)^2 + 5T\left(\frac{n}{2^4}\right)\right)$$

$$3n^2 + \frac{5 \times 3n^2}{(2)^2} + \frac{5^2 \times 3n^2}{(2^2)^2} + 5^3 \times 3\left(\frac{n}{2^3}\right)^2 + 5^4 T\left(\frac{n}{2^4}\right)$$

$$3n^2\left(1 + \frac{5}{2^2} + \frac{5^2}{(2^2)^2} + \frac{5^3}{(2^3)^2}\right) + 5^4 T\left(\frac{n}{2^4}\right) \qquad (2^2)^3 = (2^3)^2$$

$$3n^2\left(1 + \frac{5}{4} + \frac{5^2}{4^2} + \frac{5^3}{4^3}\right) + 5^4 T\left(\frac{n}{2^4}\right) \qquad (2^2)^1 + (2^2)^2 + (2^3)^2$$

$$4 + 4^2 + 4^3$$

$$3n^2\left(1 + \frac{5}{4} + \left(\frac{5}{4}\right)^2 + \left(\frac{5}{4}\right)^3 + \dots + \left(\frac{5}{4}\right)^{k-1}\right) + 5^k T\left(\frac{n}{2^k}\right) \qquad \frac{n}{2^k} = 1 \quad k = \log_2(n)$$

$$3n^2\left(\sum_{i=0}^{\log_2(n)-1}\left(\frac{5}{4}\right)^i\right) + 5^{\log_2(n)} T(1)$$

$$3n^2\left(\frac{\left(\frac{5}{4}\right)^{\log_2(n)} - 1}{\frac{5}{4} - 1}\right) + n^{\log_2(5)} \times 10 = 3n^2\left(\frac{n^{\log_2\left(\frac{5}{4}\right)} - 1}{\frac{1}{4}}\right) + n^{\log_2(5)} \times 10$$

$$12n^2\left(n^{\log_2(5) - \log_2(4)} - 1\right) + 10n^{\log_2(5)} = 12n^2\left(n^{\log_2(5) - 2} - 1\right) + 10 \times n^{\log_2(5)}$$

$$\boxed{= 22n^{\log_2(5)} - 12n^2} \qquad \Theta\left(n^{\log_2(5)}\right)$$

$T(n) = 3n^2 + 5T(n/2)$ $\quad T(1) = 10$

$3n^2 \qquad \left(\frac{5}{4}\right)^0 3n^2$

$T(n/2) \quad T(n/2) \quad T(n/2) \quad T(n/2) \quad T(n/2)$

$\frac{3n^2}{4} \qquad \frac{5}{4} \times 3n^2$

$T(n/2^2) \quad T(n/2^2)$

$\frac{3n^2}{(4)^2} \longrightarrow \frac{5^2}{4^2} \times 3n^2$

$T(n/2^3) \quad T(n/2^3)$

$\frac{5^{k-1}}{4^{k-1}} \times 3n^2$

$\vdots$

$5^{\log_2(n)}$

$T(1) \quad \ldots \quad k = \log_2(n)$

$$\boxed{T(n) = \left(\sum_{i=0}^{\log_2(n)-1} 3n^2 \left(\frac{5}{4}\right)^i\right) + 5^{\log_2(n)} \times T(1)}$$