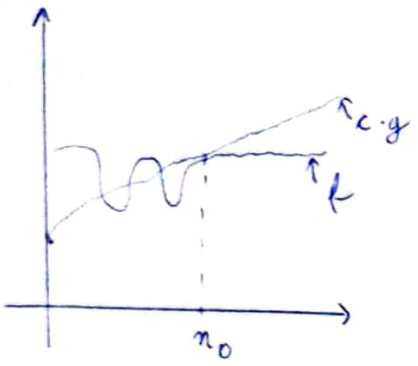
[Structuri de date]

! Curs I - Notațiile $O, o, \Omega, \omega, \Theta$

O



O - crește mai mult

[Def] Spunem că $f \in O(g)$ dacă $\exists c, n_0 > 0$ a.î. $\forall n \geq n_0$ avem $f(n) \leq c \cdot g(n)$

Exemple: $200n \in O(n)$? DA, $c = 200$

$10^{100} \cdot n \in O(n \log n)$? DA

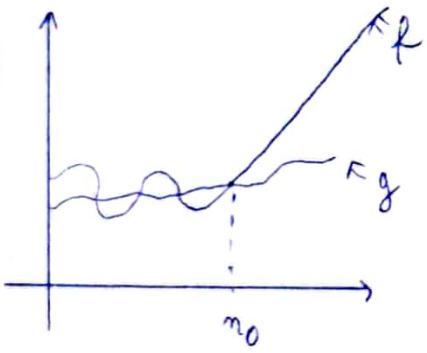
Fie $c = 10^{100}$, $n_0 = 1$ $\Rightarrow \forall n \geq 1 \quad n \cdot 10^{100} \leq 10^{100} n \log n$

$n \in O(n^2)$? DA

$2^{n+1} \in O(2^n)$ $c = 2$, $n_0 = 1$ DA

$2^{2n} \notin O(2^n)$ prin RA.

Ω



Ω - scade mai mult

[Def] $f \in \Omega(g)$ dacă $\exists c, n_0 > 0$ a.î. $\forall n \geq n_0$ avem $f(n) \geq c \cdot g(n)$

Exemple $n^2 \in \Omega(n)$

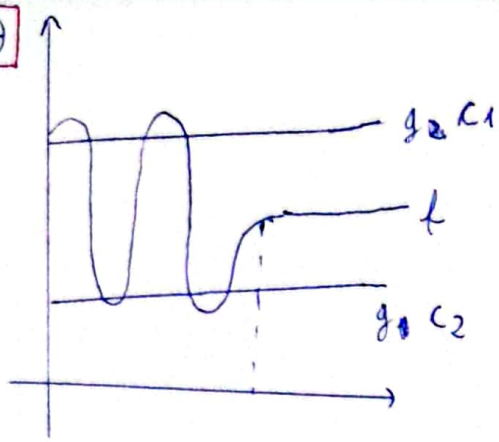
$n^2 \in \Omega(n \log n)$

$n^2 \notin \Omega(n^3)$

$n^2 \in \Omega\left(\frac{n^2}{100}\right)$

$n^2 \in \Omega(10^{100} n^2)$

Θ



[Def:] $f \in \Theta(g)$ dacă $\exists c_1, c_2, n_0 > 0$ a.î. $\forall n \geq n_0$ avem

$$c_1 g(n) \geq f(n) \geq c_2 g(n)$$

* Teoremă: $f(n) \in \Theta(g(n)) \iff \begin{cases} f(n) \in O(g(n)) \\ \text{și} \\ f(n) \in \Omega(g(n)) \end{cases}$

Exemple: $200n \in \Theta(n)$

$n \notin \Theta(n^2)$

o

Def: $f \in o(g)$ dacă $\boxed{\forall} c > 0 \quad \exists n_0 > 0$ a.î. $\forall n \geq n_0 \quad f(n) < c\,g(n)$ (∀∀)

Exemple: $n \in o(n^2)$

$n \notin o(10^{100} n)$

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

↑ crește mai încet

$\log \log n \in o(\log n)$

ω

[Def] $f \in \omega(g)$ dacă $\forall c > 0, \exists n_0 > 0$ a.î. $\forall n \geq n_0$ avem $f(n) > c \cdot g(n)$.

- Teoremă (exercițiu) $f \in O(g) \iff g \in \omega(f)$

Exemple - $\log \log \log n \in \omega(\log^* n)$ ✓

↓

crește mai repede? DA