$O(g(n)) = \{ f(n) / \exists c \in \mathbb{R}, c>0 \text{ și } n_0 \in \mathbb{N} \text{ a.î. } 0 \le f(n) \le c\,g(n) \}$

$\lim_{n\to\infty} \frac{f(n)}{g(n)} \in \mathbb{R}^* = [0, \infty)$

$4n^2 \in O(n^2)$

$\Omega(g(n)) = \{ f(n) \mid \exists c \in \mathbb{R}, c>0 \text{ și } n_0 \in \mathbb{N} \text{ și } 0 \le c\,g(n) \le f(n) \}$

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

$\lim_{n\to\infty} \frac{f(n)}{g(n)} \in (0, +\infty]$

$\Theta(g(n)) = \{ f(n) \mid \exists c \in \mathbb{R}, n_0 \in \mathbb{N} \text{ a.i. } c_1 g(n) \le f(n) \le c_2 g(n) \}$

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

1) $f(n) \in \Theta(g(n)) \Leftrightarrow f(n) \in O(g(n))$ și $f(n) \in \Omega(g(n))$

$\Rightarrow f(n) \in O(g(n))$

"⇒" $f(n) \in \Theta(g(n)) \Rightarrow \exists c_1, c_2 \in \mathbb{R}, c_1, c_2 > 0, n_0 \in \mathbb{N}$ a.î. $\boxed{c_1 g(n) \le \boxed{f(n)}} \le c_2 g(n)$

$f(n) \in \Omega(g(n))$

"⇐"

$f(n) \in O(g(n)) \Rightarrow \exists c_1 \in \mathbb{R}, c_1 > 0$ și $n_1 \in \mathbb{N}$ a.î. $0 \le f(n) \le c_1 g(n) \quad \forall n \ge n_1$

$f(n) \in \Omega(g(n)) \Rightarrow \exists c_2 \in \mathbb{R}, c_2 > 0 \quad n_2 \in \mathbb{N}_2$ a.î. $0 \le c_2 g(n) \le f(n) \quad \forall n \ge n_2$

$c_2 g(n) \le f(n) \le c_1 g(n), \forall n \ge \max(n_1, n_2)$

2) $\max(f(n), g(n)) \in \Theta(f(n) + g(n))$

$x(n) \in \Theta(f(n), g(n)) \Leftrightarrow \{ x(n) \mid \exists c \in \mathbb{R}, c>0 \text{ și } n_0 \in \mathbb{N} \text{ a.î. } c_1(f(n)+g(n)) \le x(n) \le c_2(f(n)+g(n)) \}$

$\max(f(n), g(n))$ și $\Theta(f(n)+g(n)) \Leftrightarrow c_1(f(n)+g(n)) \le \max(f(n)+g(n)) \le c_2(f(n)+g(n))$

$$\left.\begin{array}{l} \max(f(n), g(n)) \le c_2(f(n)+g(n)) \ \forall \ c_2 > 1 \\ \max(f(n)\ g(n)) \ge c_1(f(n)+g(n)) \ \forall c_1 \in \end{array}\right\} \Rightarrow \max(f(n), g(n)) \in \Theta(f(n)+g(n))$$

$\max(f(n), g(n)) \in \Omega(f(n), g(n))$

$\max(f(n), g(n)) \ge f(n), \ \forall n \ge n_0$

$\underline{\max(f(n), g(n)) \ge g(n)}, \ \forall n \ge n_0$

$\oplus$

I $f(n) \ge g(n)$

$f(n) \ge g(n)$

$f(n) \le f(n) + g(n)$

II $g(n) \ge f(n)$

$g(n) \le g(n) + f(n)$

$2 \max(f(n), g(n)) \ge f(n) + g(n)$

$\max(f, g) \ge \frac{1}{2}(f(n) + g(n))$

$2^{n+1} \in O(2^n)$

$2^{2n} \in O(2^n)$

$2^{2n} \le c \cdot 2^n \ \forall n_0$

$2^n \le c \ \forall n \ (x)$

$T(n)$ este cel puțin $O(n^2)$

$$O(g(n)) = \left\{ f(n) \;\middle|\; \begin{array}{l}\forall c > 0 \\ \exists n_0 \in \mathbb{N}^*\end{array} \text{ a.î. } 0 \le f(n) \le c \cdot g(n) \ \forall n \ge n_0 \right\}$$

$$\omega(g(n)) = \left\{ f(n) \;\middle|\; \begin{array}{l}\forall c > 0 \\ \exists n_0 \in \mathbb{N}\end{array} \text{ a.î. } 0 \le c \cdot g(n) < f(n) \ \forall n > n_0 \right\}$$

$$\underbrace{\omega(g(n)) \cap \Theta(g(n))}_{A} \overset{?}{=} \emptyset$$

$f(n) \in \omega(g(n)) \Rightarrow \forall c_1 > 0 \ \exists n_1 \in \mathbb{N}^*$ a.î. $0 \le c_1 g(n) < f(n) \ \forall n > n_1$

Fie $f(n) \in A$

$f(n) \in \omega(g(n)) \Rightarrow \forall c_1 > 0 \ \exists n_1 \in \mathbb{N}^*$ a.î. $0 \le c_1 g(n) < f(n) \ \forall n > n_1$

$f(n) \in \Theta(g(n)) \Rightarrow \forall c_2 > 0 \ \exists n \in \mathbb{N}^*$ a.î. $0 < f(n) < c_2 g(n) \ \forall n \ge n_2$

$c \cdot g(n) < f(n), \ \forall n \ge \max(n_1, n_2)$

$f(n) < c\, g(n) \ \forall n \ge \max(n_1, n_2)$ $\cancel{\infty}$

$(n+a)^b \in \Theta(n^b) \quad \forall a \in \mathbb{R}_+$
$\forall b \in \mathbb{N}^*$

$\Theta(g(n)) = \{ f(n) \mid \exists c \in \mathbb{R} \; n_0 \in \mathbb{N} \; ai \; c_1 g(n) \le f(n) \le c_2 g(n) \}$

$(n+a)^b \in \Theta(n^b) \iff \exists c \in \mathbb{R}_+ \; n \in \mathbb{N}^* \; a.i. \quad c_1 n^b \le (n+a)^b \le c_2 n^b$

$C_b^0 n^b \le (n+a)^b = C_b^b n^b a^0 + C_b^1 n^{b-1} a + \dots + C_b^b a^0 + a^n \le n^b (C_b^a a^0 + C_b^1 a^1 + \dots + C_b^n a^n)$

$\Omega(n^b)$

$f(n) + g(n) \in \Theta(\min(f(n) + g(n)))$

$n^2 + n \in O(n)$

$f(n) \in O(g(n)) \Rightarrow 2^{f(n)} \in O(2^{g(n)})$

$2n \in O(n) \Rightarrow 2^{2n} \notin O(2^n)$

1 1 2 3 1 2 3
7 1 2 4 3 5 6

$(2,4) \to Da$
$(1,5) \to Nu$

$C_j - C_i = j - i$

$a \oplus a = 0$

$a \oplus b \oplus c \oplus a$

$a \oplus a \oplus b \oplus c$

2SUM