

# Multimi

- Reflexivă

$$a R a$$
$$\nexists a \in S$$

- Simetrică

$$a R b \Rightarrow b R a$$

- Antisim.

- Transitivă

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ceil  $\nearrow$  floor  $\searrow$   
[ ] approx. [ ]

---

Sume și Recurrente

Gauss ;  $\sum_{i=1}^n i^2 = \frac{2n^3 + 3n^2 + n}{6}$

$$\text{factorial : } \left\{ \begin{array}{l} n! = (n-1)! \cdot n, n \geq 1 \\ 1! = 0! = 1 \end{array} \right.$$

$$\text{Fibonacci : } \left\{ \begin{array}{l} f(n) = f(n-1) + f(n-2) \\ f(1) = f(0) = 1 \end{array} \right.$$


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```

unsigned long factorial( uint n ) {
    if ( n == 0 )
        return 1;
    else
        return n * fact( n - 1 );
}

```

$$T(0) = C \quad (\text{const. timp})$$

$$T(1) = C + T(0) = 2C$$

$$T(2) = C + \underline{T(1)} = 3C$$


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$$T(n) = (n+1)C$$

## Tehnici demonstrare

- Dem. directe (deducție)
- Contradicție
- Inducție

$p, p, a \models \exists \text{ lui } \text{Max}$

dacă  $\text{Max} \in \mathbb{N} \rightarrow \text{Max} + 1 \notin \mathbb{N}$

$\text{Max} + 1 > \text{Max} \Rightarrow \nexists \text{ lui}$

# Inductia

- Cas initial  $P(k_0)$  adeu.
- Pasul de inductie  $P(k) \Rightarrow P(k+1)$

Caz de baza  $\rightarrow$  stop. la rec.

if ( $n = 0$ )  
return 0

Rez de ind.  $\rightarrow$  rez.  $n \neq f(n-1)$

## Interval (Rec)

void f ( int start, int end ) {

if ( start == end ) cas  
baza

else

f( start, end - 1 ) pas  
ind.

$P_{\text{NPF1}}$   $\rightarrow$  G  
 $\rightarrow$   
 $\rightarrow$

# Ana liza Algoritmos

for  $c \cdot n \cdot m$   
for  $T(n) = c n^2$

3 caiuri

- }) Cel mai favorabil
- } Cel mai nefavorabil
- { Average case

Notatii asimptotice

fct.  $g(n) \rightarrow \Theta(g(n))$  (theta)

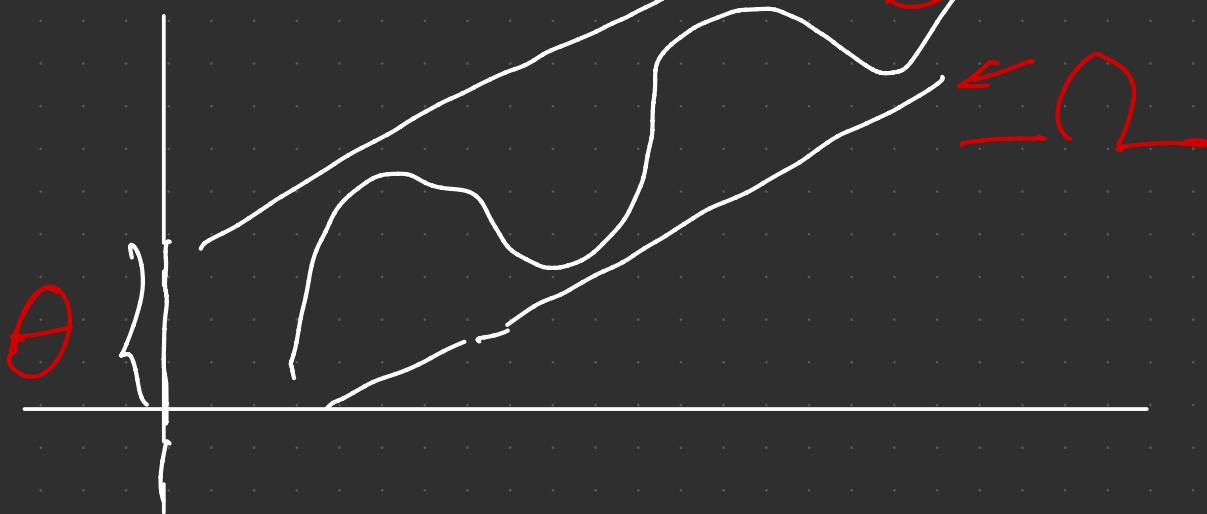
$\Theta(g(n)) = \{ f(n); \exists \text{ const} > 0$   
 $c_1, c_2 \text{ si } n_0 \text{ a.} \}$

$$0 \leq c_1 \cdot g(n) \leq f(n) \leq c_2 \cdot g(n)$$

$\forall n \geq n_0$

$$\frac{1}{2} n^2 - 3n = \Theta(n^2)$$

$$C_1 \cdot n^2 \leq \frac{1}{2} n^2 - 3n \leq C_2 n^2$$



Apreciera + execu $\underline{\text{c}}\text{i}$ e

p.f. + constant  $\Theta(1) \Rightarrow d_1$   
 $(O(n^0))$

Nu  $\exists$  alte constante in  $d(\dots)$

for (---) { mc  
 a[ ] ... }

for(  $i = 0; i < 100; i++$ )

$$a[i] = i + 1$$

$$C \cdot 100 = C \rightarrow O(1)$$

for(  $i = 0; i < n; i++$ )

  for(  $j = 0, j < i, j++$ )  $\{ O(n^2)$

$$a[ij] = j + 1$$

$$C + C + \dots + C = nc$$

$n$

for(  $k = 1; k < n; k \times 2$ )

~~log n ori~~

Căutarea binară

$T(n) \approx 1$

$$T(n) = T(n/2) + 1$$

$$T(n) = \log n \Rightarrow \Theta(n)$$

Profiling Algoritmos

→ VS Profiling (CPU, Mem)