Motivação

n	1000	10^9
da ordem de $O(n)$	10^3	10^9
	$\ll 1$ seg	≈ 1 seg
$O(n^2)$	$(10^3)^2 = 10^6$	$(10^9)^2 = 10^{18}$
	$\ll 1$ seg	$\approx 10^9$ seg

1 GHz = 10^9 operações por seg.

$3600 \frac{seg}{h}$ $24 \frac{h}{dia}$ $365 \frac{dias}{ano}$

Recursão

resolve um prob. a partir de sol. de instâncias menores do mesmo problema

Seq de Fibonacci

$F_0\ F_1\ F_2\ F_3\ \ldots$

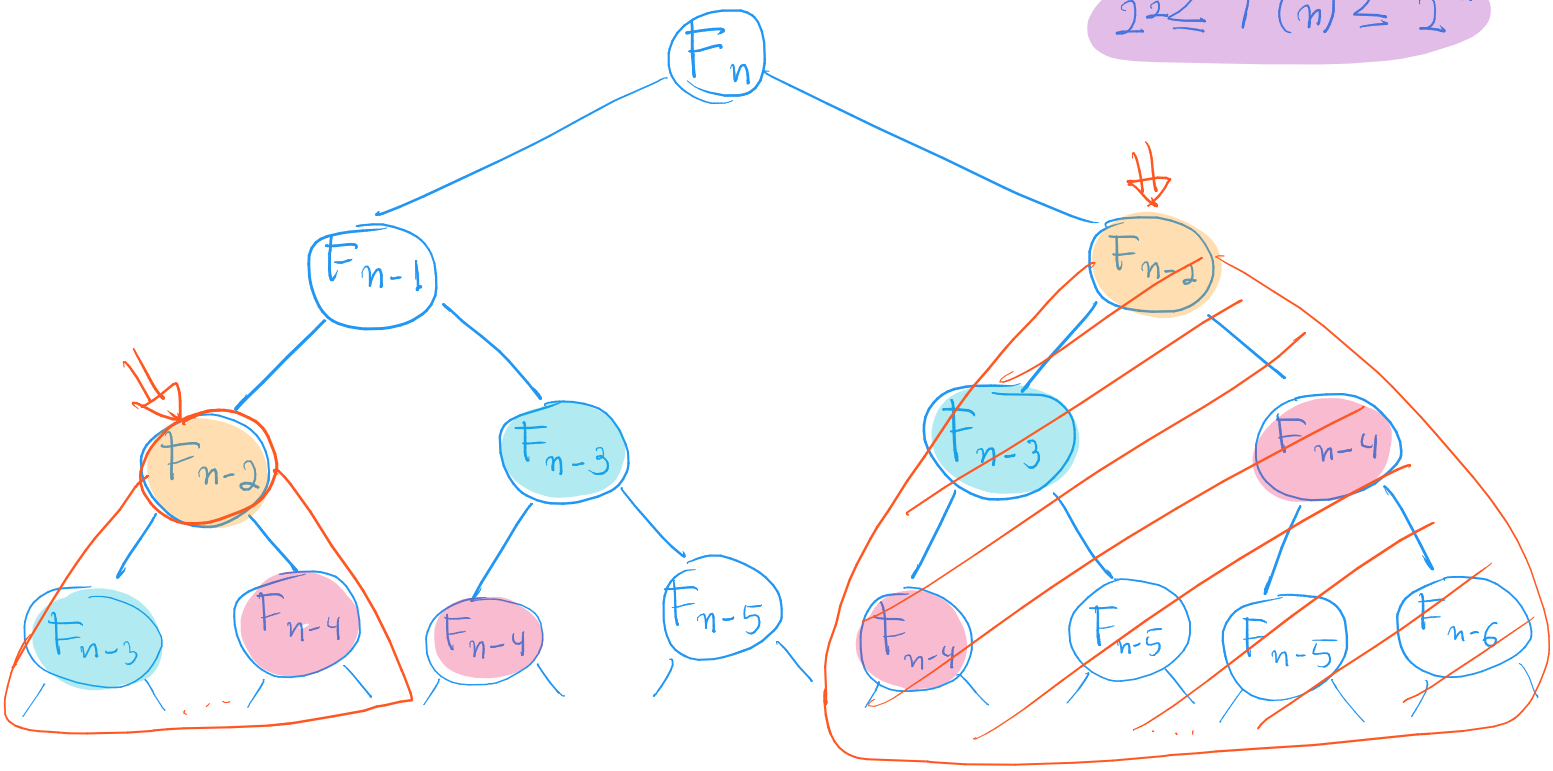
0 1 1 2 3 5 8 13 21 34 55 ...

dado $n \in \mathbb{Z}_{\geq 0}$ devolva F_n

$$F_n = \begin{cases} 0, & \text{se } n = 0 \\ 1, & \text{se } n = 1 \\ F_{n-1} + F_{n-2}, & \text{se } n \geq 2 \end{cases}$$

```
FibRec(n):
    se n = 0: return 0
    se n = 1: return 1
    return FibRec(n-1)
         + FibRec(n-2)
```

$2^{\frac{n}{2}} \leq T(n) \leq 2^n$




```
FibRecMem(n):
    se n = 0: return 0
    se n = 1: return 1
    se Mem[n] > 0: return Mem[n]
    Mem[n] = FibRec(n-1) + FibRec(n-2)
    return Mem[n]
```

$= F(n) \quad n = 3$

$F(3): \Rightarrow 2$

$F(2): \Rightarrow 1$

$F(1) \Rightarrow 1$

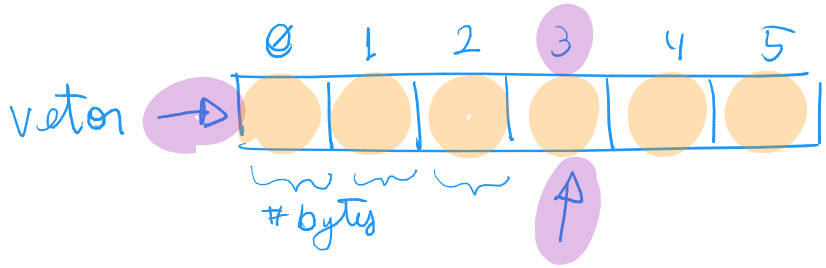
$F(0) \Rightarrow 0$

$F(1): \Rightarrow 1$

Mem

0	1	2	3	4	
	1	2			...

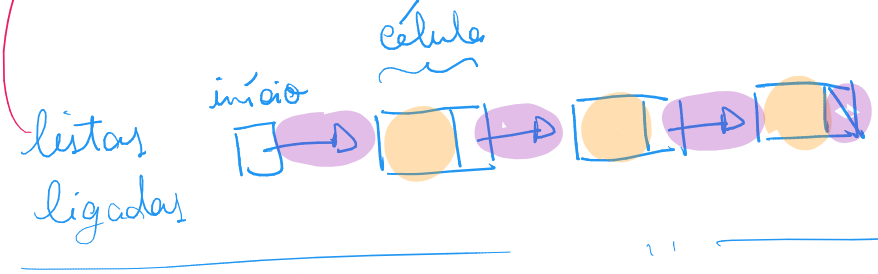
Vetores e Listas Ligadas



↑ acesso arbitrário

↑↑ acesso sequencial

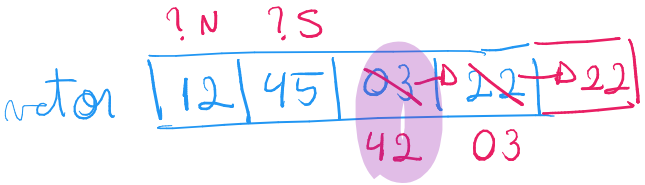
array dinâmico



↓ acesso arbitrário

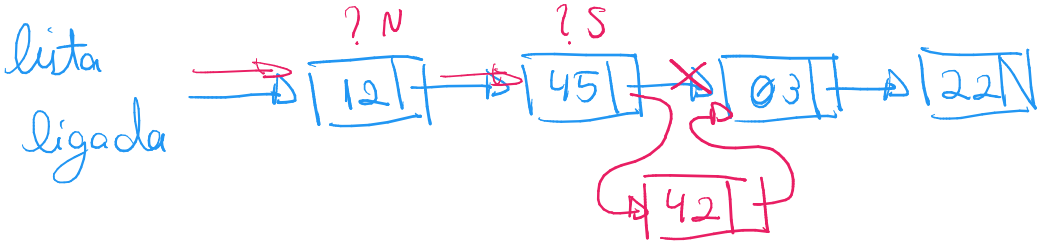
↑ acesso sequencial

operações de inserção e remoção



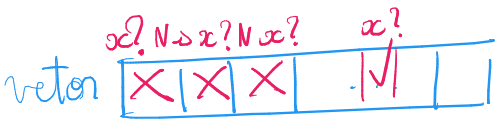
↓ inserção e remoção

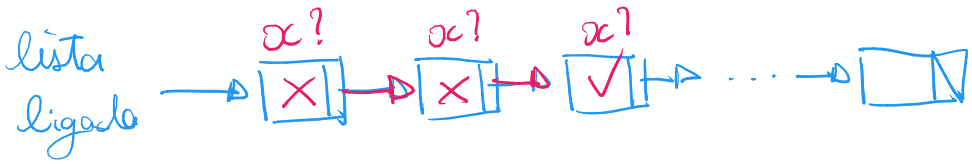
inserir 42 depois do 45



↑ inserção e remoção

Busca linear e binária

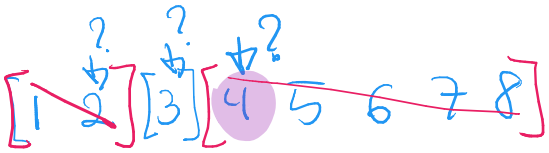




busca linear pelo x

busca binária

- dados em ordem
- acesso arbitrário

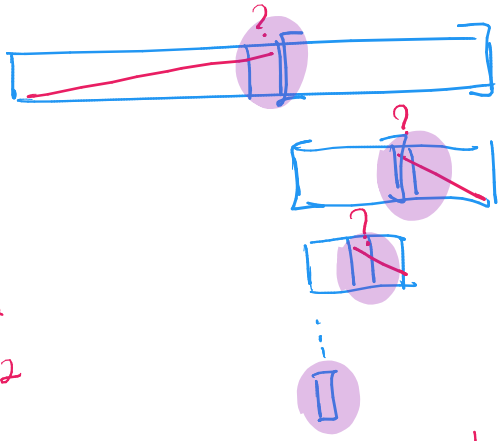


$x = 3$

elementos

$n \xrightarrow{\div 2} n/2 \xrightarrow{\div 2} n/4 \xrightarrow{\div 2} \cdots \xrightarrow{\div 2} 1$

$\lg n$



$n = 10^9$

busca linear 10^9

busca binária $\lg 10^9 \approx 30$