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Disciplina: Projeto e Análise de Algoritmos Profº: Philippe Leal

13 ♥ 02 ♥ 23

1 → Expansão

$$T(m) = T(m-1) + \frac{1}{m}$$
$$T(m-1) = T(m-2) + \frac{1}{m-1} + \frac{1}{m}$$
$$T(m-2) = T(m-3) + \frac{1}{m-2} + \frac{1}{m-1} + \frac{1}{m}$$
$$T(m-3) = T(m-4) + \frac{1}{m-3} + \frac{1}{m-2} + \frac{1}{m-1} + \frac{1}{m} +$$
$$\hookrightarrow T(k) = T(m-k) + \sum_{i=0}^{k-1} \frac{1}{m-i} \quad \text{Lei da função}$$

critério de parada: $m-k=1 \rightarrow k=m-1$

Conjectura: $T(m) = T(m-(m-1)) + \sum_{i=0}^{(m-1)-1} \frac{1}{m-i}$

$$\hookrightarrow T(1) + \sum_{i=0}^{m-2} \frac{1}{m-i} \rightarrow \frac{1}{m-(m-1)} + \sum_{i=0}^{m-2} \frac{1}{m-i}$$
$$\hookrightarrow \sum_{i=0}^m \frac{1}{m-i} = \sum_{i=0}^m \frac{1}{i}$$

Passo base: $T(m_0) = T(1) + \frac{1}{1} = 1 + 1 = 1 \checkmark$

Passo indutivo:

$$T(k+1) = \sum_{i=0}^{k+1} \frac{1}{i} \rightarrow \sum_{i=0}^k \frac{1}{i} + \frac{1}{k+1} \rightarrow \sum_{i=0}^{k+1} \frac{1}{i}$$

Logo, $T(m) = \sum_{i=0}^m \frac{1}{i}$, $m \geq 1$ é verdadeiro

tilibra

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```
int function(n) {
```

```
    if (n == 1)
```

```
        return n;
```

```
    else
```

```
        return function(n-1) + n
```

```
}
```

$$\begin{cases} T(1) = 1 \\ T(n) = T(n-1) + n \end{cases}$$

Expansão:

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

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

$$T(n-2) = T(n-3) + (n-2) + (n-1) + n$$

$$T(n-3) = T(n-4) + (n-3) + (n-2) + (n-1) + n$$

Lei da função $\Rightarrow T(n) = T(n-k) + \sum_{i=0}^{k-1} (n-i)$

critério de parada $\Rightarrow n-k = 1 \Rightarrow k = n-1$

Conjectura:

$$T(n - (n-1)) = \sum_{i=0}^{n-1} (n-i)$$

$$= T(1) + \sum_{i=0}^{n-1} (n-i)$$

$$= \frac{n \cdot (n+1)}{2}$$

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Passo base: $\frac{1(1+1)}{2} = 1 \rightarrow 1 = 1 \checkmark$

Passo indutivo:

$$T(k) = \frac{k(k+1)}{2}, k \geq 1$$

$$T(k+1) = \frac{(k+1) \cdot (k+1+1)}{2} = \frac{(k+1) \cdot (k+2)}{2}$$

$$\hookrightarrow \frac{k^2 + 2k + 2}{2} = \frac{k^2 + k}{2} + k + 1 = \frac{k \cdot (k+1)}{2} + k + 1$$

$$\hookrightarrow = T(k) + (k+1) \checkmark$$