Urejanje tabel

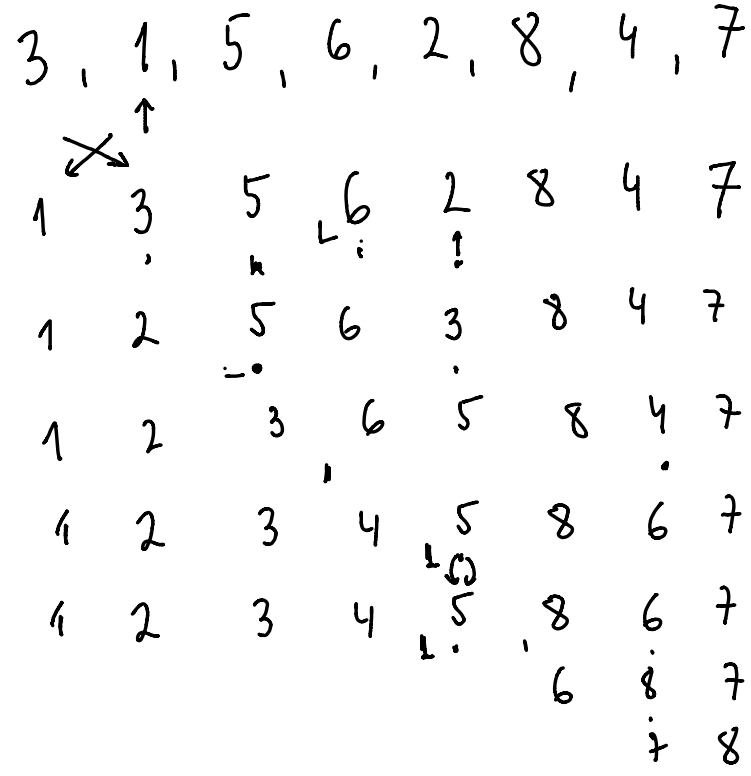
Naloga:

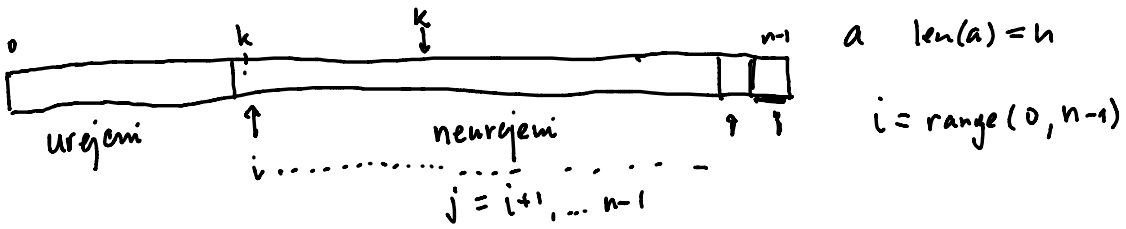
VHOD: tabela a

IZHOD: urejena tabela a

1. Urejanje na mestu:
   Spremenimo tabelo a, da postane urejena
   (elemente v a premeščamo)
2. Naredimo novo, urejeno tabelo. Tabela a se ne spremeni.

① Urejanje na mestu: urejanje z izbiranjem

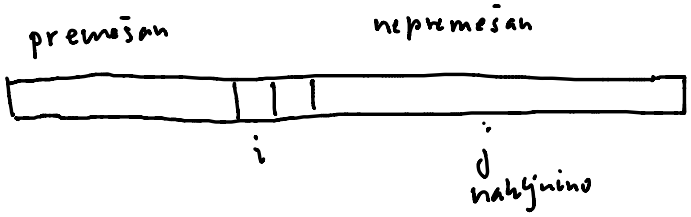




Premešamo:

1 2 3 4 5 6 7 8 n

4 2 3 1 5 6 7 8



1 2 3 4 5 6 7 8

4

Časovna zahtevnost urejanja z izbiranjem:

```
for i in range(0, len(a)-1):
    k = i # kandidat za indeks najmanšega v a[i:]
    for j in range(i+1, len(a)):
        if a[j] < a[k]:
            k = j
    a[i], a[k] = a[k], a[i]
```

$i=0$: $j=1 \dots n-1$ ..... $n-1$

$i=1$ $j=2 \dots n-1$ ..... $n-2$

$i=2$ $j=3 \dots n-1$ ..... $n-3$

$\vdots$

$i=n-2$ $j=n-1 \dots n-1$ 1

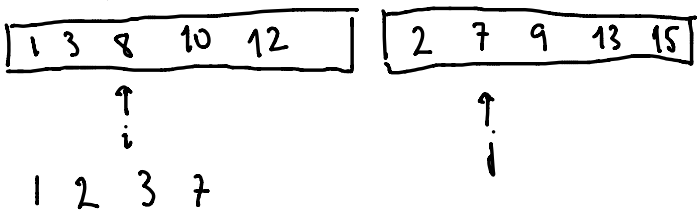
$$1+2+3+\dots+(n-1) = \frac{n}{2}(n-1)$$

je $O(n^2)$

v vsakem primeru

(2) Urejanje v novo tabelo

Zlivanje dveh urejenih tabel:

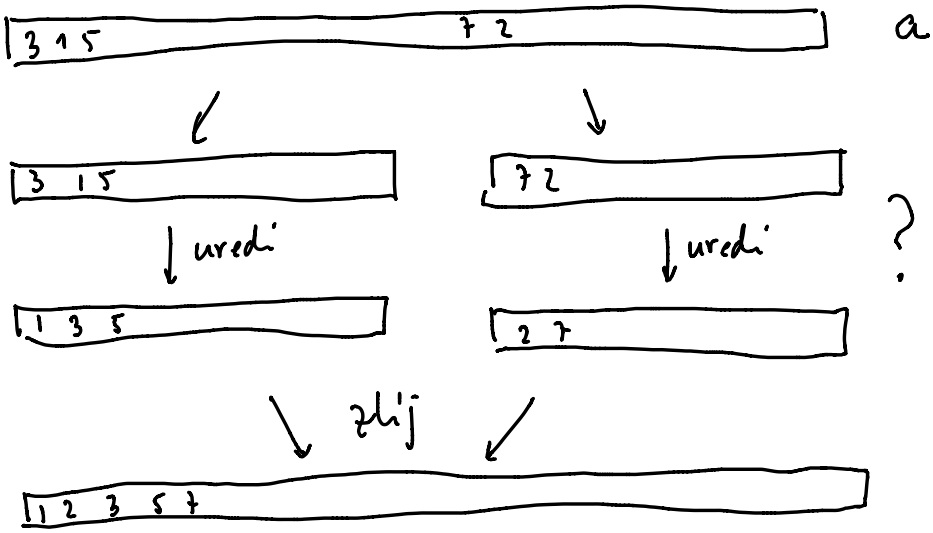


VHOD: že urejeni tabeli a in b $n = len(a) + len(b)$

IZHOD: urejena tabela, ki združuje a in b

Zahtevnost $O(n)$

Urejanje z zlivanjem:




```
def uredi(a):
    """Uredi tabelo a z zlivanjem."""
    if len(a) <= 1:
        return a
    else:
        i = len(a) // 2 # sredina (približno)
        return zlij(uredi(a[:i]), uredi(a[i:]))
```

$n/2$ (□ * △)

$T(n)$ = število korakov za urejanje tabele dolžine n (v najslabšem primeru)

$T(0) = 1$

$T(1) = 1$

$T(n) = 1 + \underbrace{\frac{n}{2} + T\left(\frac{n}{2}\right)}_{*} + \underbrace{\frac{n}{2} + T\left(\frac{n}{2}\right)}_{\triangle} + \underbrace{n}_{\square}$

$T(n) = c_1 + c_2 \cdot \frac{n}{2} + T\left(\frac{n}{2}\right) + c_3 \cdot \frac{n}{2} + T\left(\frac{n}{2}\right) + c_4 \cdot n$

$\leq c\left(1 + \frac{n}{2} + \frac{n}{2} + n\right) + 2 \cdot T\left(\frac{n}{2}\right)$ $\quad c = \max(c_1, \ldots, c_4)$

$$= 1 + 2n + 2T\left(\frac{n}{2}\right)$$

$$\Rightarrow \quad T(n) = n + 2 \cdot T\left(\frac{n}{2}\right)$$

$$T(n) = n + 2 \cdot \left(\frac{n}{2} + 2 \cdot T\left(\frac{n}{4}\right)\right) =$$

$$= 2n + 4 \cdot T\left(\frac{n}{4}\right) =$$

$$= 2n + 4\left(\frac{n}{4} + 2T\left(\frac{n}{8}\right)\right) =$$

$$= 3n + 8T\left(\frac{n}{8}\right) =$$

$$\vdots$$

$$= kn + 2^k \cdot T\left(\frac{n}{2^k}\right) = \qquad \text{končíme, když } n = 2^k$$

$$k = \log_2 n$$

$$= (\log_2 n) \cdot n + 2^{\log_2 n} \cdot T(1)$$

$$= n \cdot \log_2 n + n \cdot 1$$

$$\in \mathcal{O}(n \cdot \log n) \qquad \text{v našem případě}$$