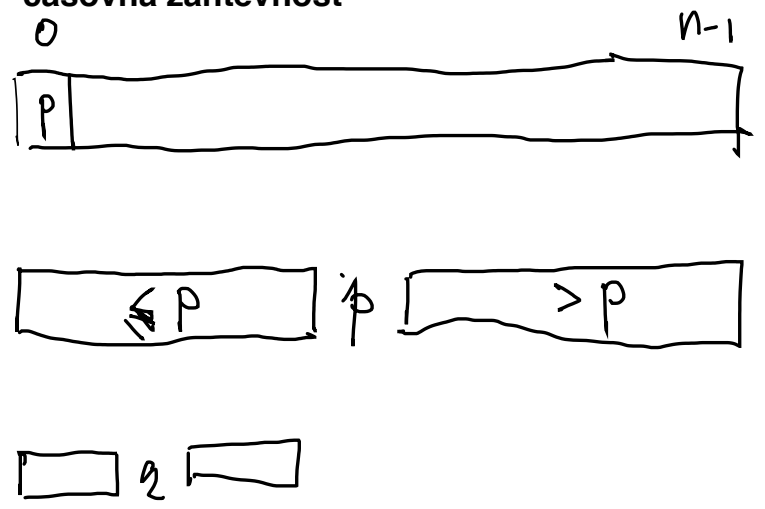


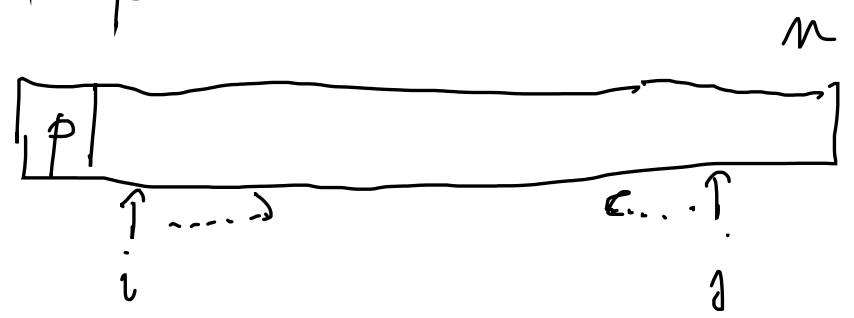
Quicksort - časovna zahtevnost



Primer: p na sredini
 $T(n)$ = število korakov algoritma
 $T(n) = ?$

$T(n)$ = št. korakov za pivotiranje + $2 \cdot T(\frac{n}{2})$
 $T(1) = 1$

Pivotiranje



n korakov :
 ker vsako polje pogledamo enkrat

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

$$T(n)$$

$$T(1) = 1$$

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

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

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

⋮ (po k ponovitvah)

$$= \underbrace{n + \dots + n}_k + 2^k \cdot T\left(\frac{n}{2^k}\right)$$

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

Kdaj bomo imeli $T(1)$? ko $\frac{n}{2^k} = 1 \Rightarrow n = 2^k \Rightarrow k = \log_2 n$

Vstavimo:

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

$$= n \cdot \log_2 n + n \cdot 1 = n \cdot \log_2 n + n \in \mathcal{O}(n \cdot \log n)$$

$n \log n$ vs. n^2

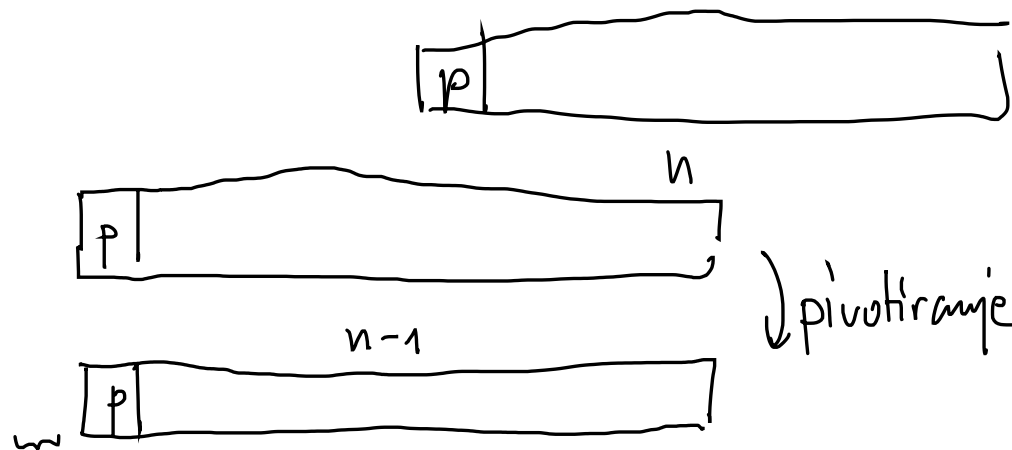
$$10^9 \cdot n \cdot \log_2 n$$

vs.

$$n^2$$

Sklep: hitro urejanje v najboljšem primeru
(pivot na sredini) je $O(n \cdot \log n)$

Slab primer: pivot vedno na začetku (ali na koncu)



urejena tabela

$$T(n) = n + T(0) + T(n-1)$$

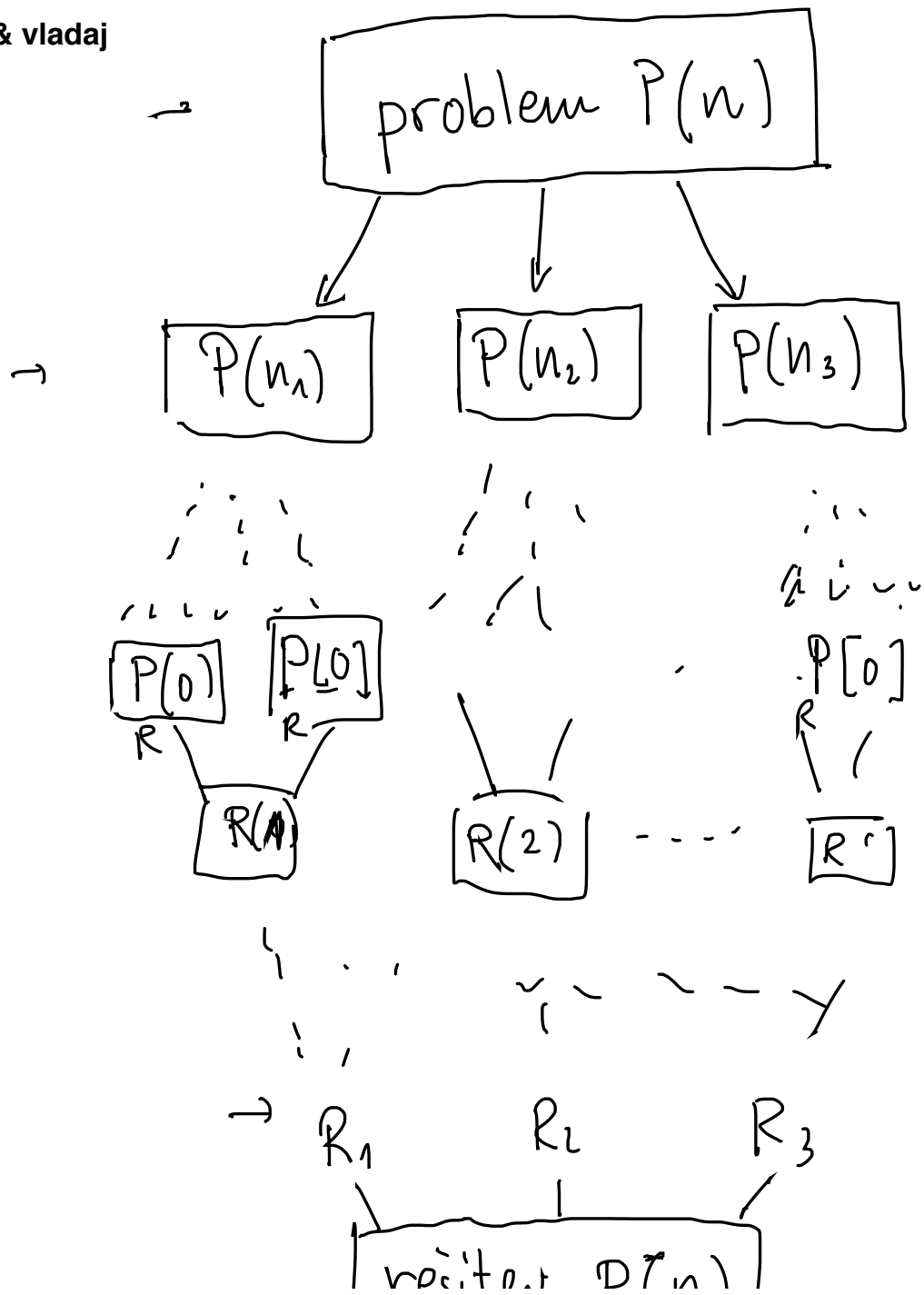
$$= n + \cancel{T(0)} + T(n-1)$$

$$T(0) = T(1) = 1$$

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

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

Deli & vladaj



deli

deli

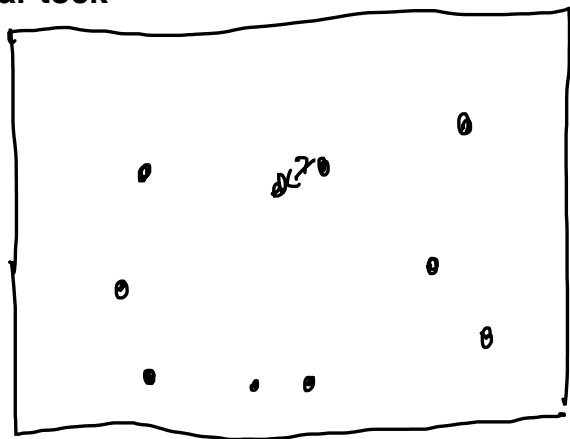
deli

osnovni problemi

vladaj

vladaj

Najbližji par točk



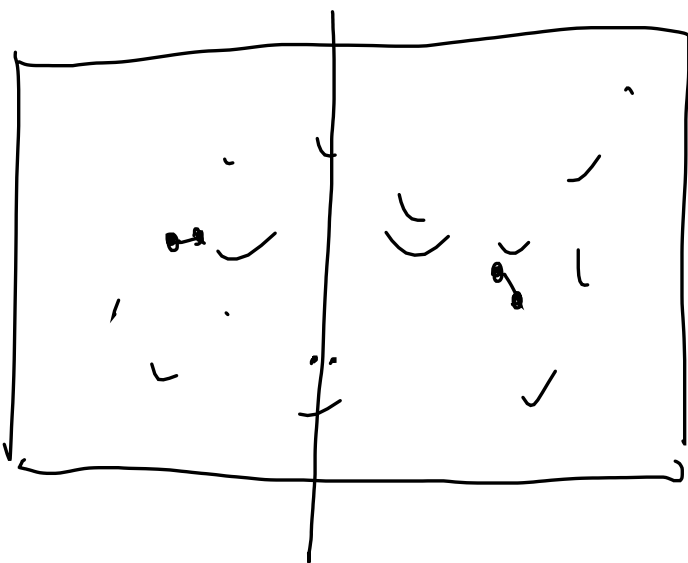
Točke T_1, \dots, T_n

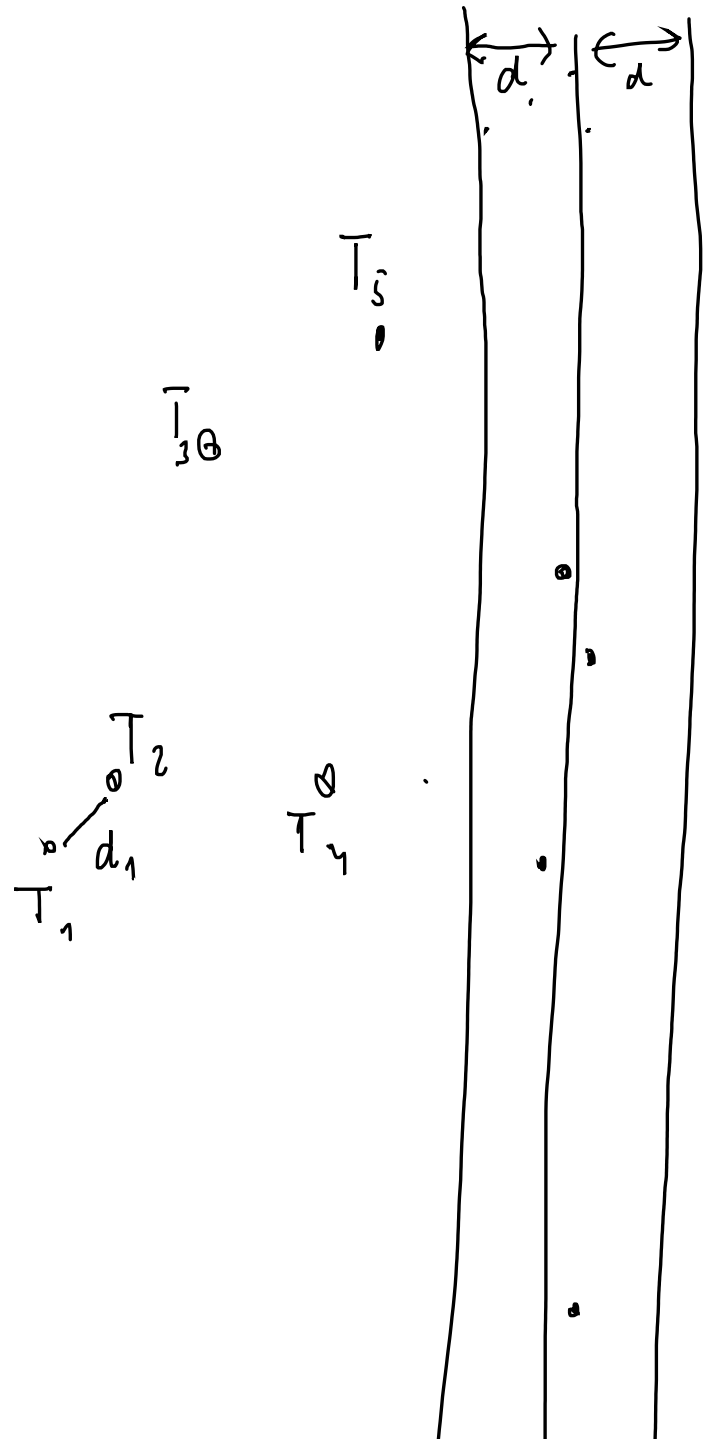
$$T_i = (x_i, y_i)$$

Naloga: poišči i in j , da je $d(T_i, T_j)$ minimalna.

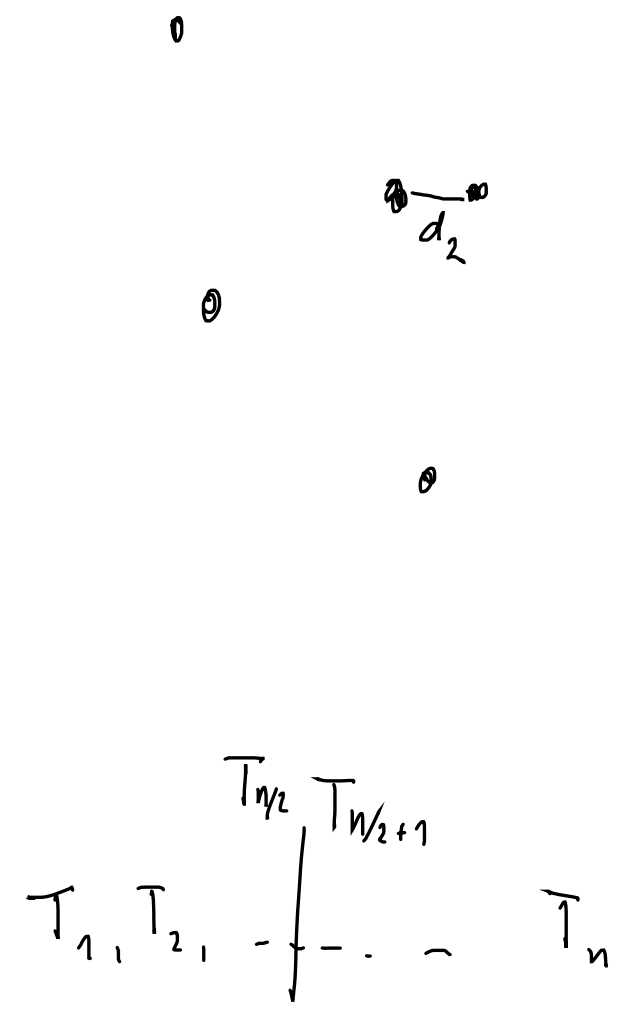
Najboljša metoda: pregledamo vse pare (T_i, T_j) , $i < j$.

Časovna zahtevnost $O(n^2)$

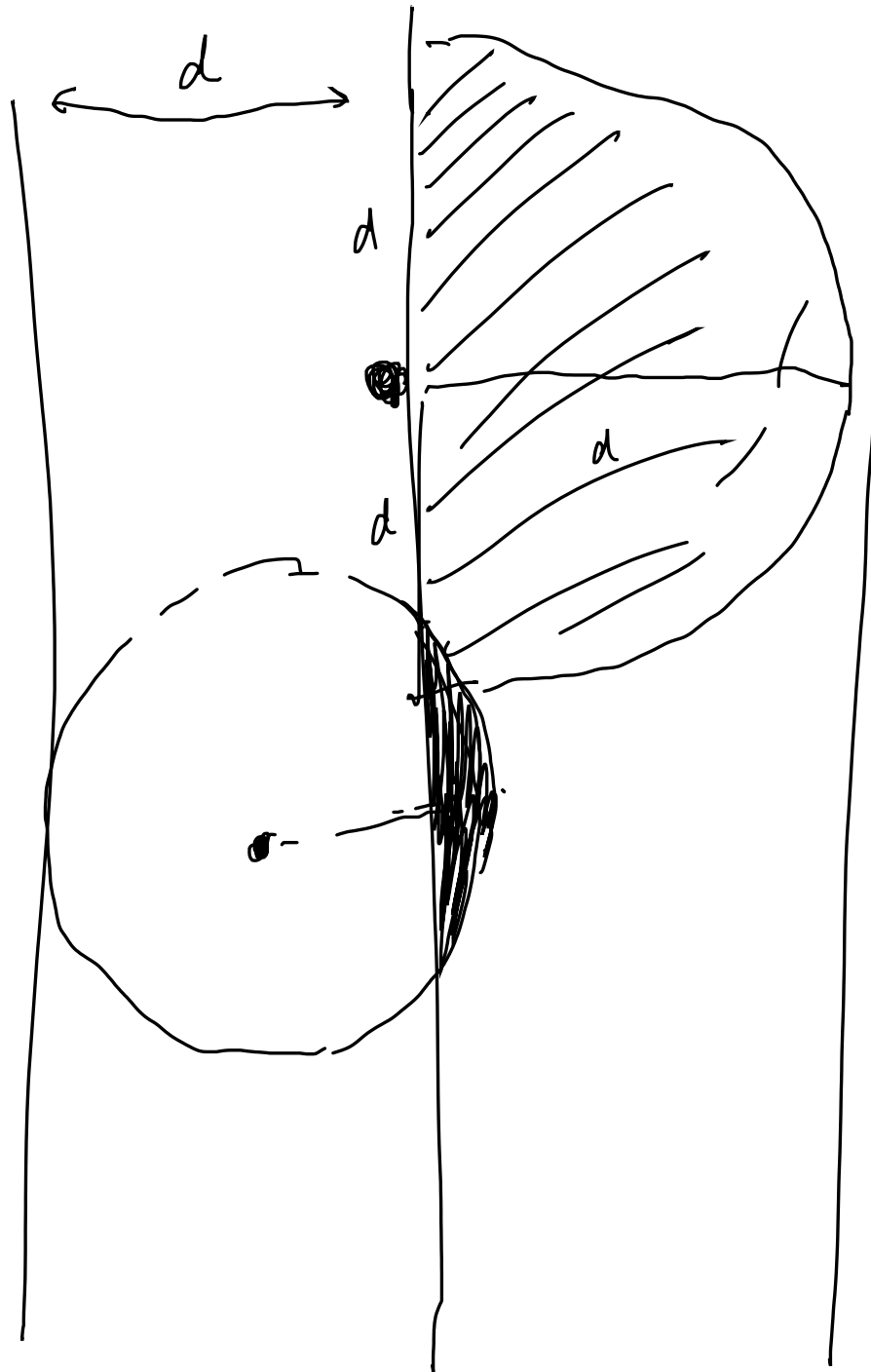




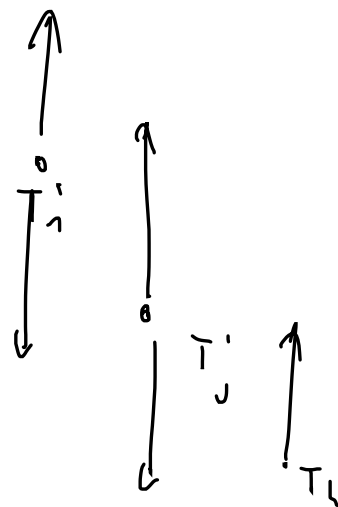
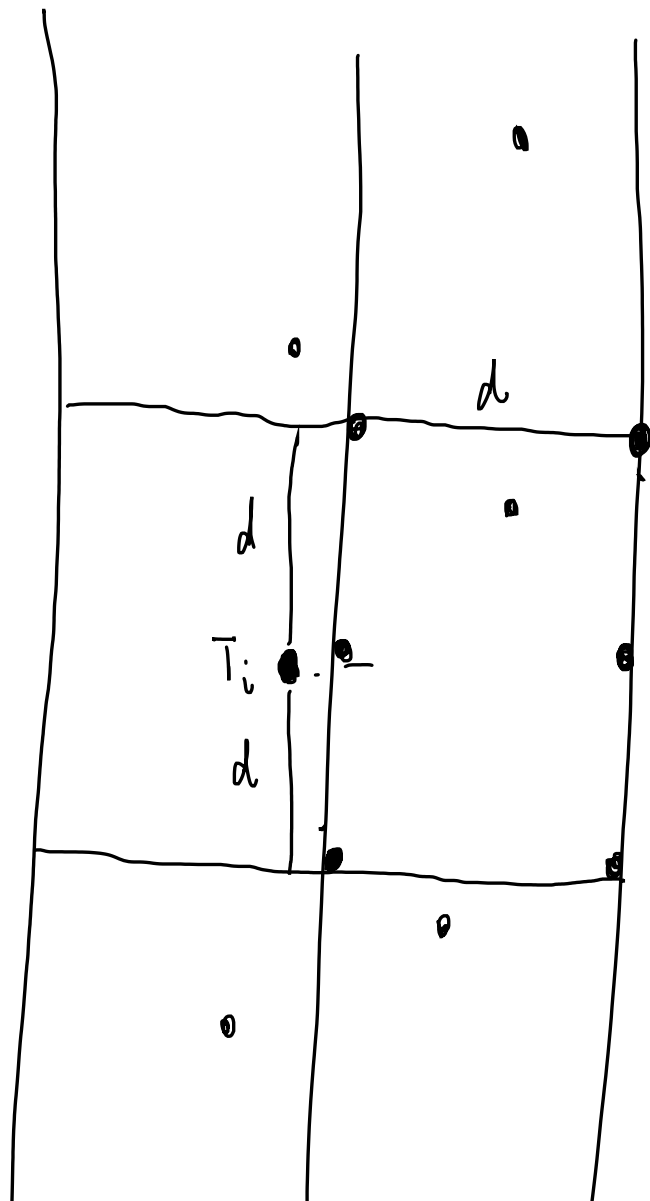
$$d = \min(d_1, d_2)$$



pas



pas



Algoritem Vhod: tabela točk $T = [T_0, \dots, T_{n-1}]$ $T_i = (x_i, y_i)$

1) Sortiraj po x ; tabelo T in shrani v T^x

~~2) sortiraj po y ; tabelo T in shrani v T^y~~

3) deli in vladaaj:

- razdeli T^x na dva enaka dela po x

$$T^x[0 \dots n/2]$$

$$T^x[\frac{n}{2}+1 \dots n-1]$$

rekurzivni klic

$$d_1 = \min(T_a, T_b)$$

$$d_2 = \min(T_c, T_d)$$

- vladaaj: $d = \min(d_1, d_2)$

• poiščemo pas & bisekcijo

→ podtabelo $T^x[l \dots h]$
 → uredimo po $y \rightarrow T'$
 → iščemo par v T' , ki je bližje od d