

Advanced Algorithm

Assignment 4

Center Selection Problem

12032189

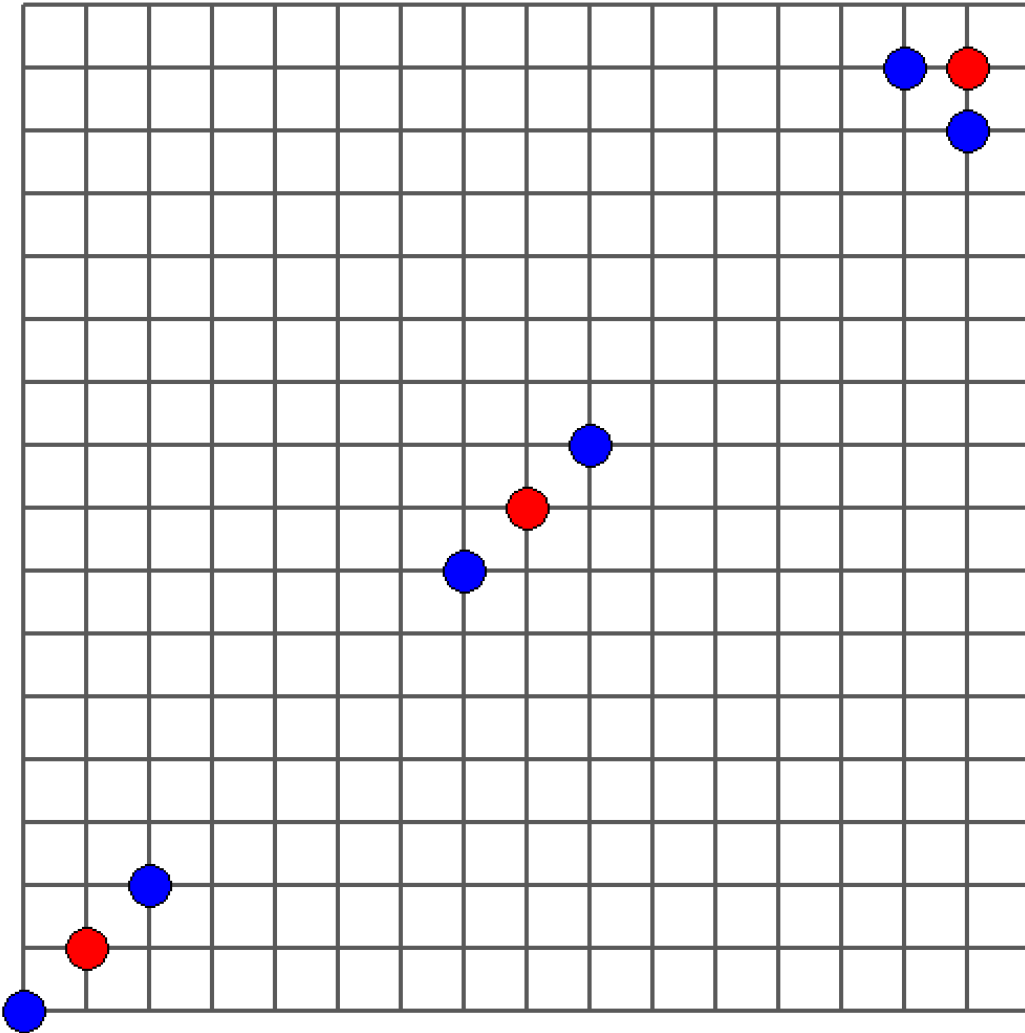
Yuxi Liu

context

- Exercise 3-1
- Exercise 3-2

Exercise 3-1

Optimal condition:

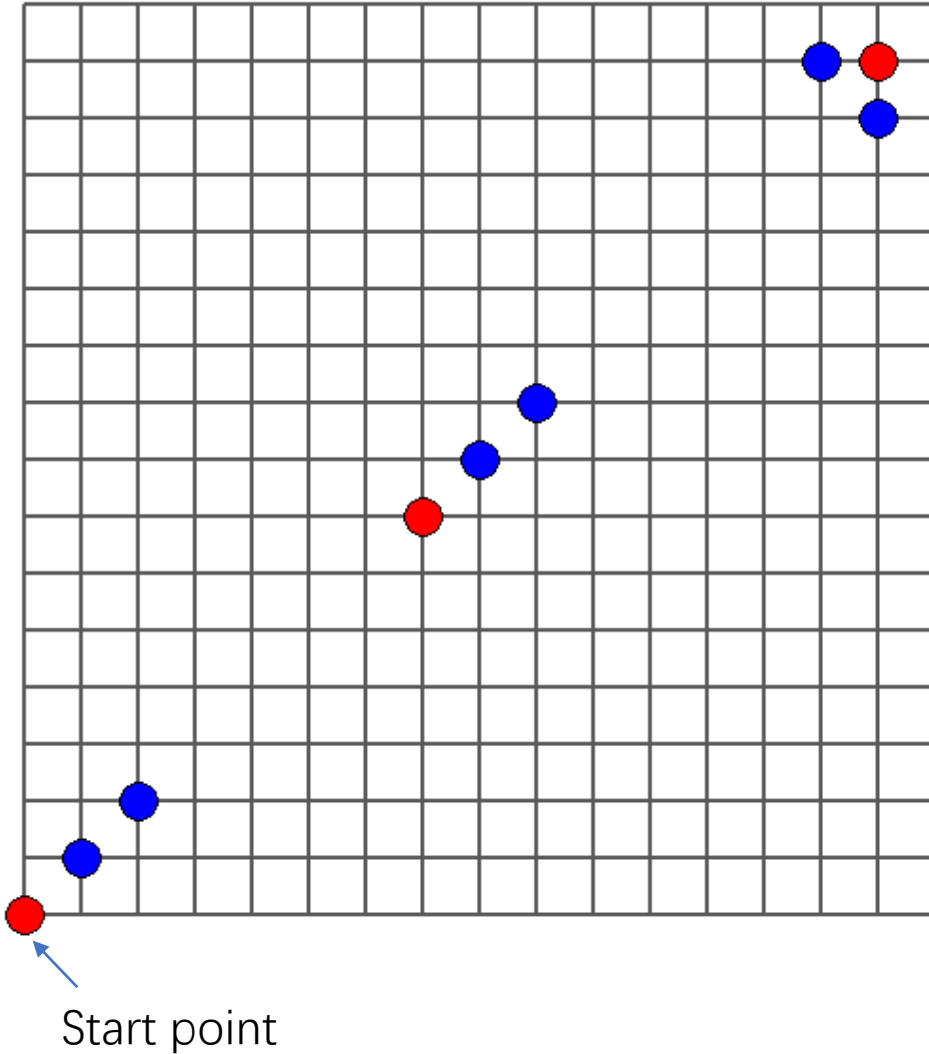


Create an example where the obtained value $r(C)$ by the algorithm is close to $2r(C^*)$. Create another example where the obtained value $r(C)$ by the algorithm is close $r(C^*)$.

$$r(C^*) = \sqrt{2}$$

Exercise 3-1

Center Selection Algorithm:

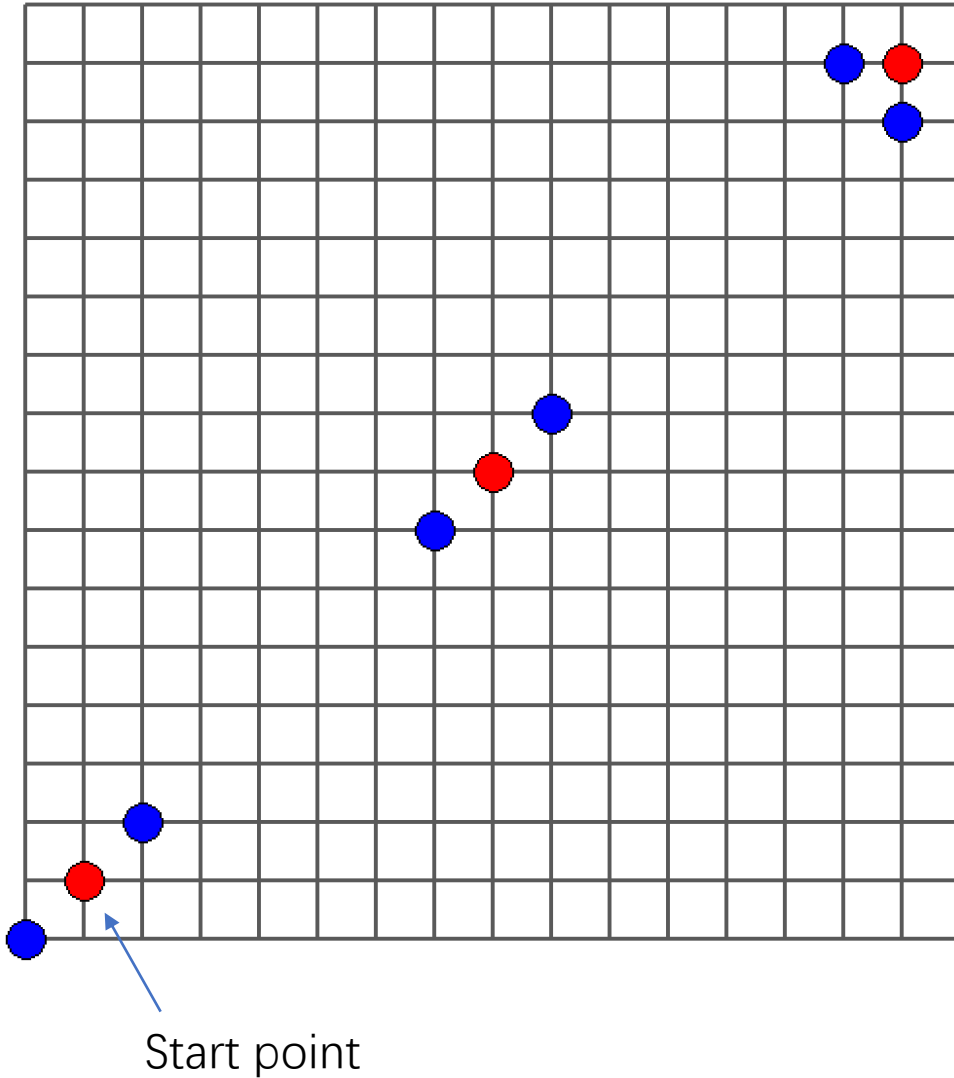


$$r(C) = 2\sqrt{2}$$

$$r(C) = 2r(C^*)$$

Exercise 3-1

Center Selection Algorithm:



$$r(\mathcal{C}) = \sqrt{2}$$

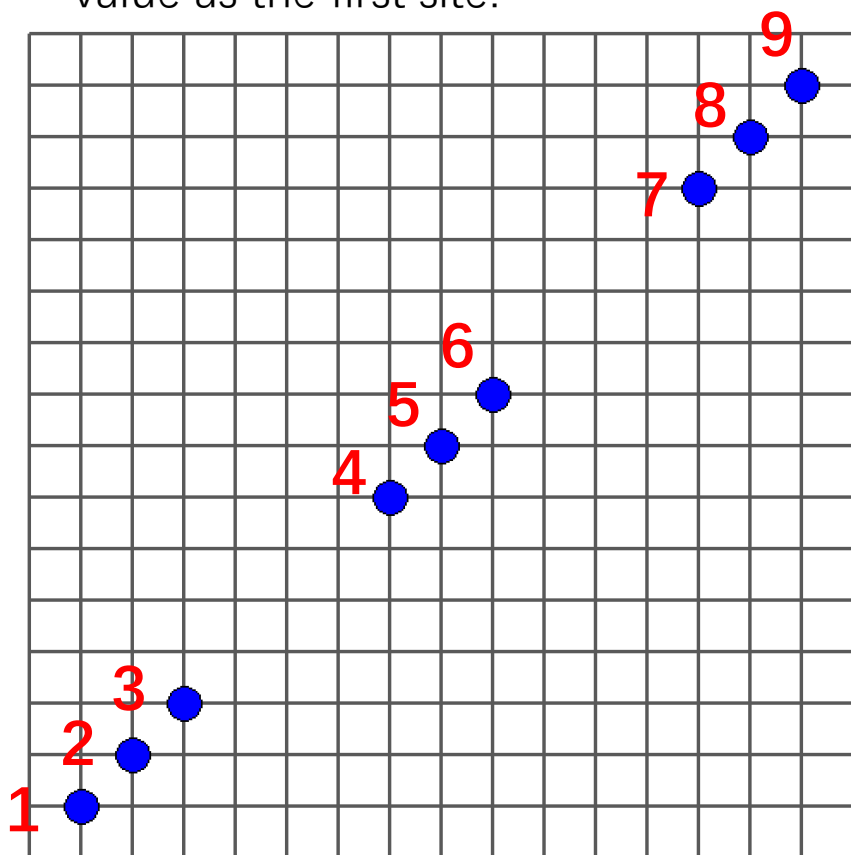
$$r(\mathcal{C}) = r(\mathcal{C}^*)$$

Exercise 3-2

We assume that we have N points and we need to select K centers.

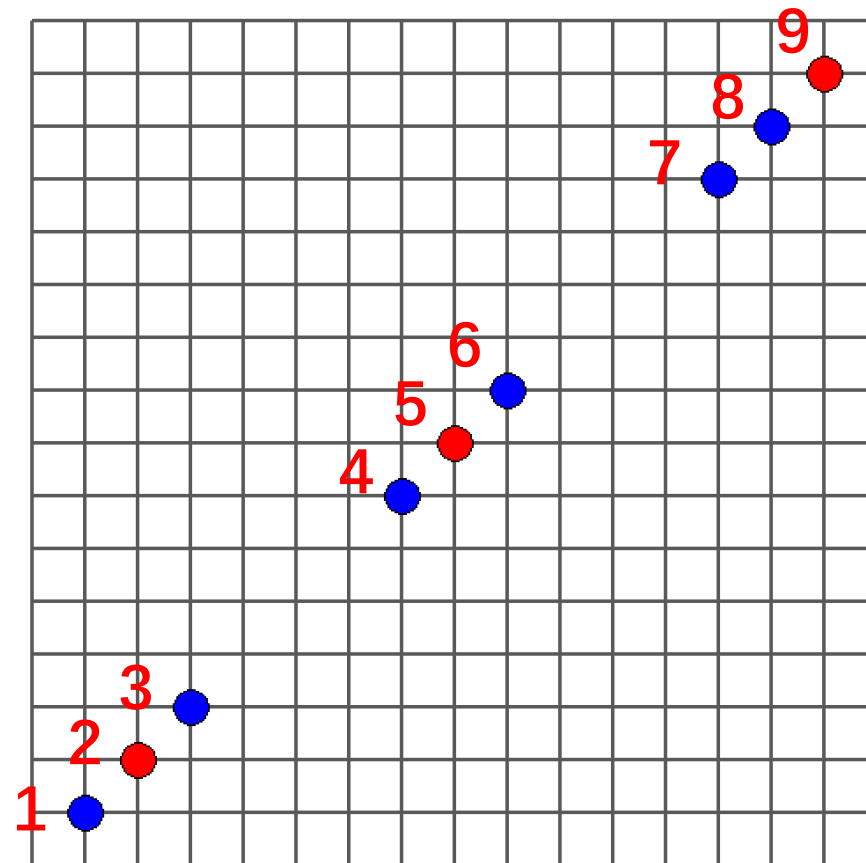
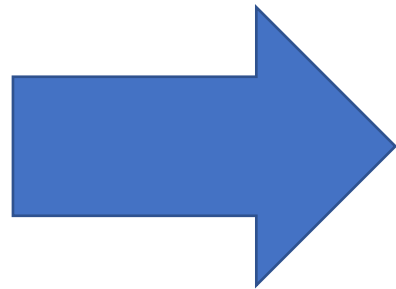
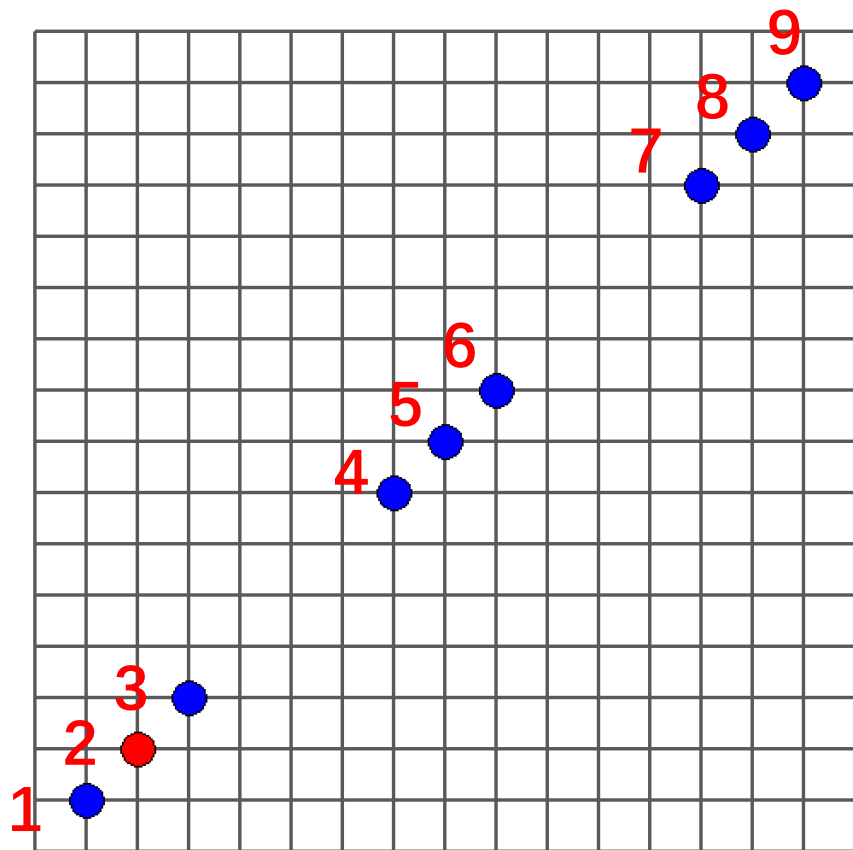
First, we calculate the distance between any two points, and then we calculate the sum of the distances from the nearest $\left\lceil \frac{N}{K} \right\rceil - 1$ points of each point. Finally, we choose the one with the smallest value as the first site.

$$\left\lceil \frac{N}{K} \right\rceil - 1 = 2$$



Site	Sum_distances	The nearest sites
1	$3\sqrt{2}$	2、3
2	$2\sqrt{2}$	1、3
3	$3\sqrt{2}$	2、1
4	$3\sqrt{2}$	5、6
5	$2\sqrt{2}$	4、6
6	$3\sqrt{2}$	4、5
7	$3\sqrt{2}$	8、9
8	$2\sqrt{2}$	7、9
9	$3\sqrt{2}$	7、8

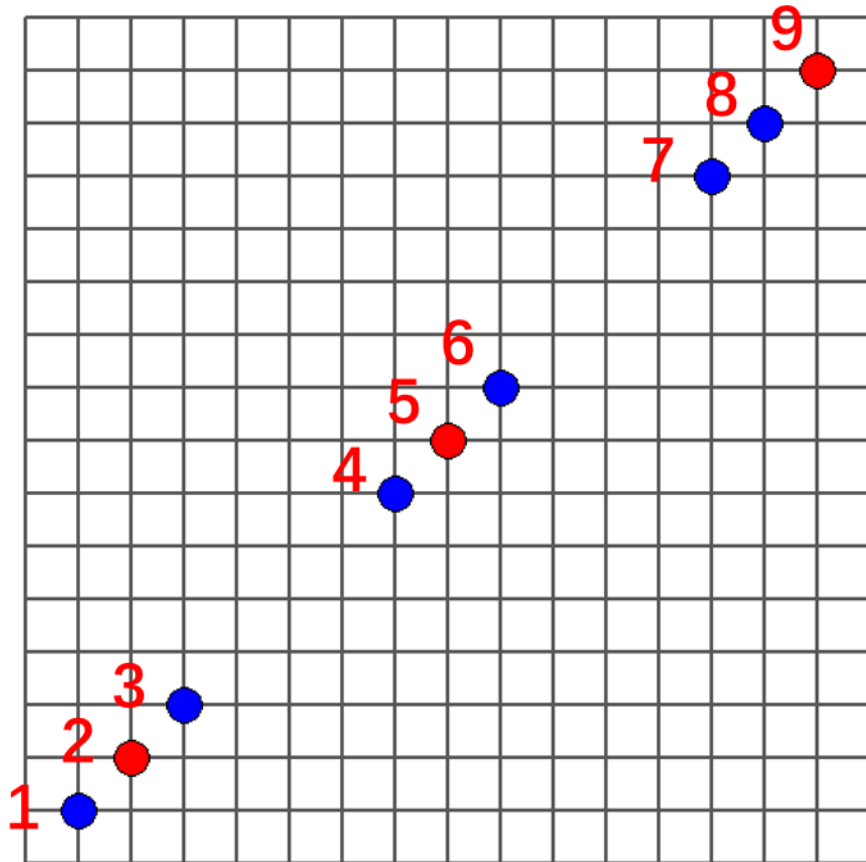
Exercise 3-2



$$r(C) = 2\sqrt{2}$$

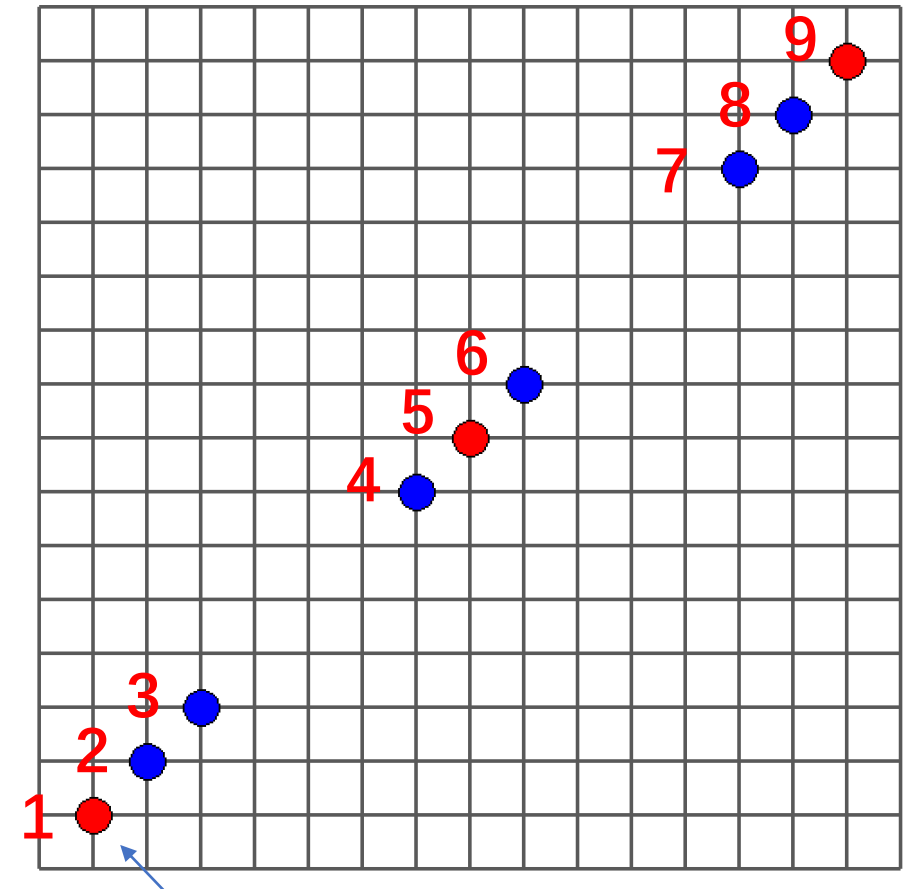
Exercise 3-2

Nearest Center Selection Algorithm:



$$\text{Totdistance} = 7\sqrt{2}$$

Random Center Selection Algorithm:



$$\text{Totdistance} = 8\sqrt{2}$$

Thank you