

Advanced Algorithm

Assignment 4

Center Selection Problem

12032189

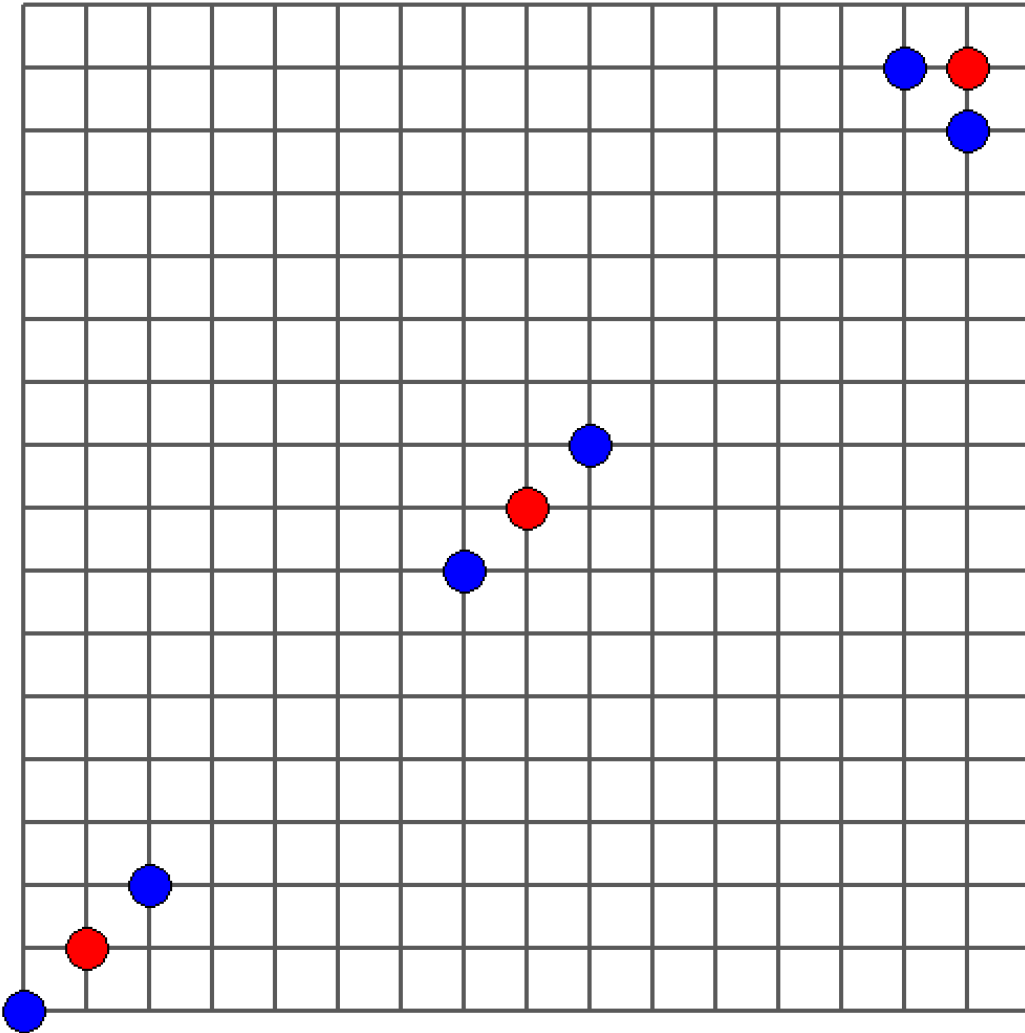
Yuxi Liu

context

- Exercise 3-1
- Exercise 3-2

Exercise 3-1

Optimal condition:

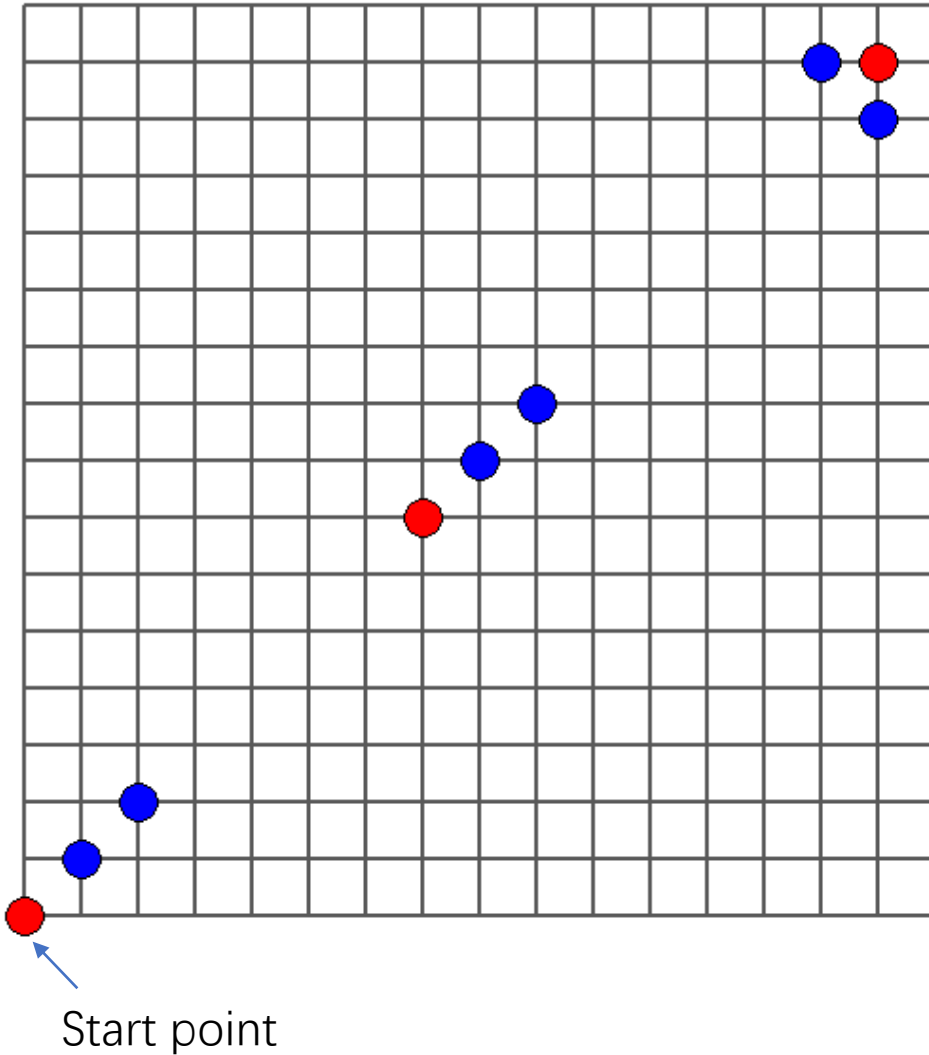


Create an example where the obtained value $r(C)$ by the algorithm is close to $2r(C^*)$. Create another example where the obtained value $r(C)$ by the algorithm is close $r(C^*)$.

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

Exercise 3-1

Center Selection Algorithm:

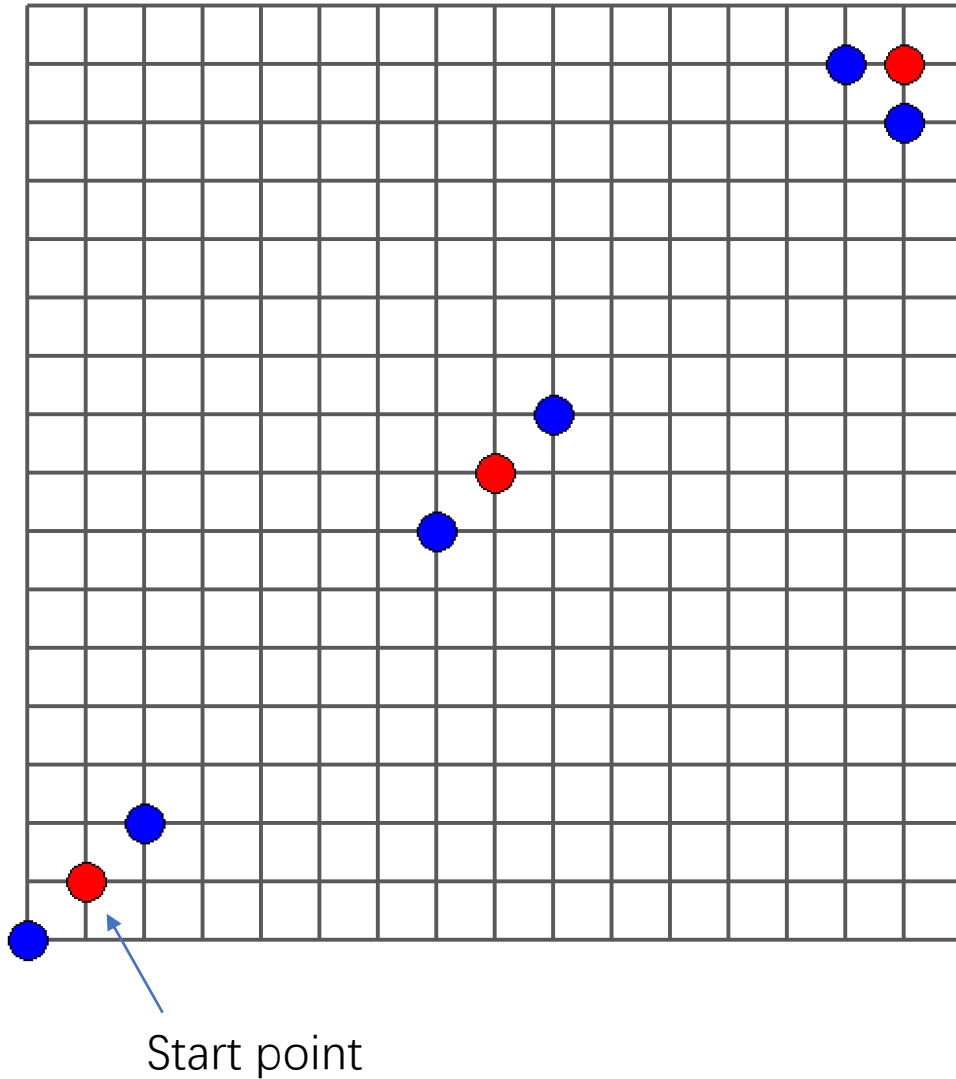


$$r(C) = 2\sqrt{2}$$

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

Exercise 3-1

Optimal condition:



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

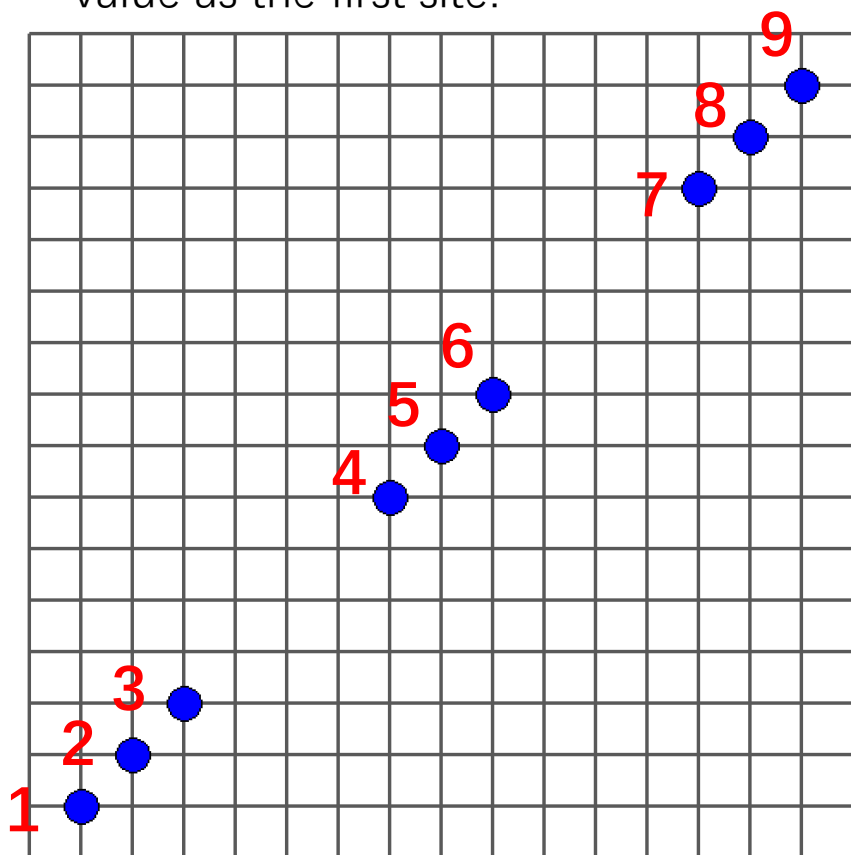
$$r(\mathcal{C}) = r(\mathcal{C}^*)$$

Exercise 3-2

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

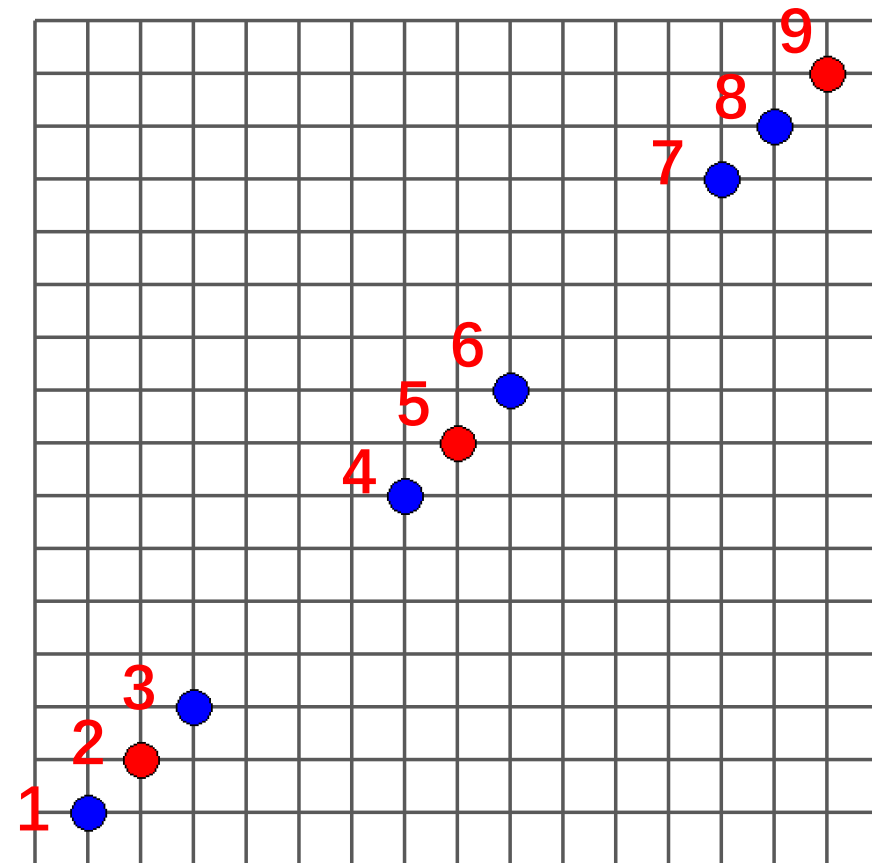
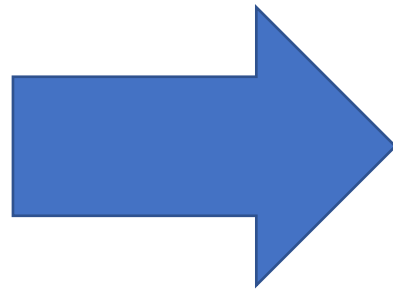
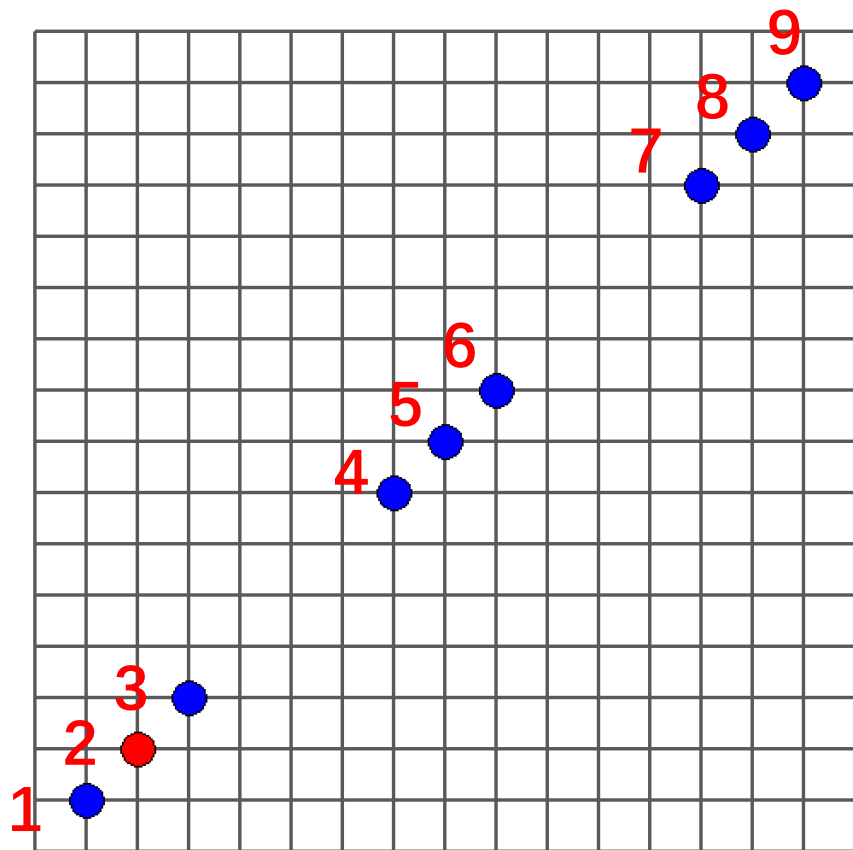
First, we calculate the distance between any two points, and then we calculate the sum of the distances from the nearest $\left\lceil \frac{N}{K} \right\rceil - 1$ points of each point. Finally, we choose the one with the smallest value as the first site.

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



| 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 |

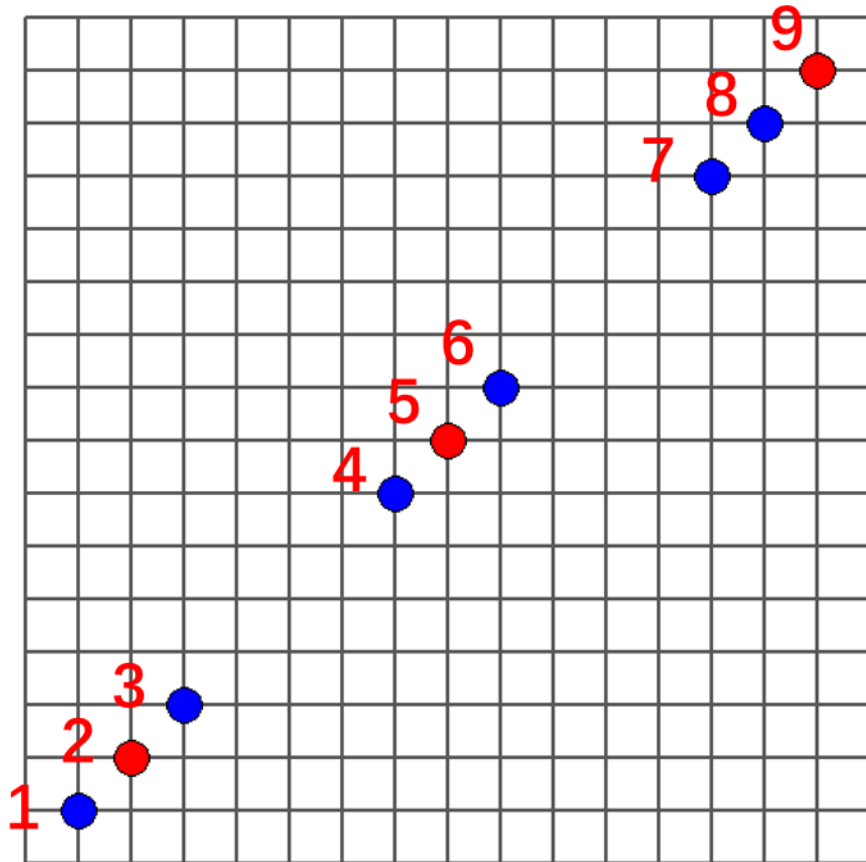
Exercise 3-2



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

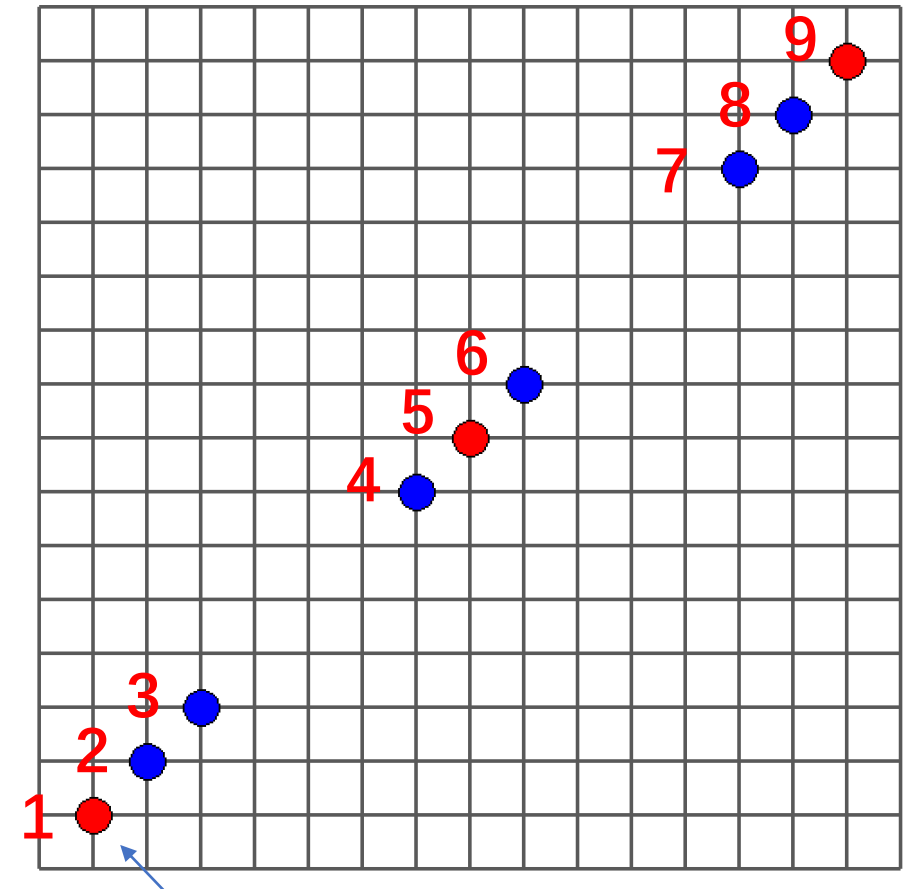
Exercise 3-2

Nearest Center Selection Algorithm:



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

Random Center Selection Algorithm:



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

Thank you