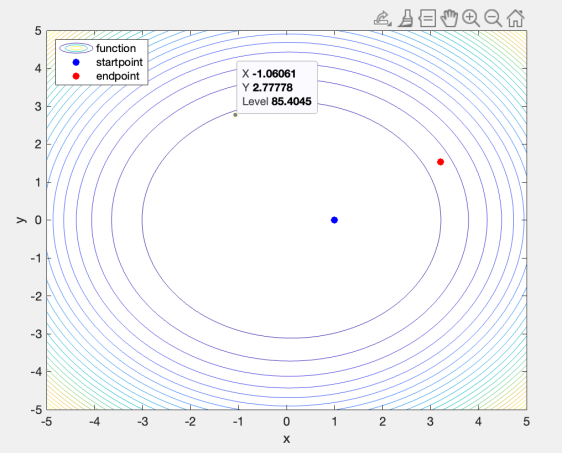
Problem 1.

Here we have the the main function is coord_search.m, and **test_P1** is the test function. The result should be like figure 1a. The plotting should be like figure 1b. In the test, I feel around 100 points near the minimum and feel that it is the true mimimum.



(a) Problem 1 plotting

```
Start point is [0.251902, 4.614790]
Converged after 3 iterations.  pstar = [0.999967, 0.000000].
The test success 100 times, fail 0 times
```

(b) Problem 1 result

Figure 1: Problem 1

Problem 2.

The test function here is **test_P2.m**. The result should be like figure 2. Compare the result in the website, we can find that S1 can't get the true minimum, while S2 and S3 do a great job. I think the reason is that the direction other two have rich directions but S1 only have 4 directions.

Problem 3.

In this problem I alter a few things in the code run_simulated_annealing to make it accept N as parameter. Then I write run_ brute.m to verify if it is the true. The test function is **test_P3.m**. The result should be like figure 3. According to my computer's result, with $N = 10$ it uses about 10 seconds, with $N = 11$ it uses 90 seconds, and with $N = 12$ it use 1080 seconds. If $N = 20$, the brute method may use 4050 years.

```
>> test_P2
D_S1,
xend =

    0.3647    0.5530    0.8530

D_S2, Lowest point found after 6 iteration, [x,y,z] = [0.114589, 0.555649, 0.852547]
D_S3, Lowest point found after 8 iteration, [x,y,z] = [0.114591, 0.555649, 0.852547]
```

Figure 2: Problem2

```
N = 12
Initial visiting order  列 1 至 11

    {'a'}    {'b'}    {'c'}    {'d'}    {'e'}    {'f'}    {'g'}    {'h'}    {'i'}    {'j'}    {'k'}

  列 12 至 13

    {'l'}    {'a'}

Total initial travel distance = 1050.974625
Observed minimum visiting order  列 1 至 11

    {'a'}    {'d'}    {'e'}    {'f'}    {'c'}    {'i'}    {'g'}    {'l'}    {'b'}    {'j'}    {'h'}

  列 12 至 13

    {'k'}    {'a'}

At end, smallest observed travel distance = 609.795898
At end of annealing, optimized travel distance = 609.795898
Progress: [##################################################] 100%
True travel distance = 609.795898
True minimum travel order  列 1 至 11

    {'a'}    {'d'}    {'e'}    {'f'}    {'c'}    {'i'}    {'g'}    {'l'}    {'b'}    {'j'}    {'h'}

  列 12 至 13

    {'k'}    {'a'}

N = 12 annealing use 3.6055 second
N = 12 brute method use 1080.72 second
The annealing answer is the truth
```

Figure 3: Problem3