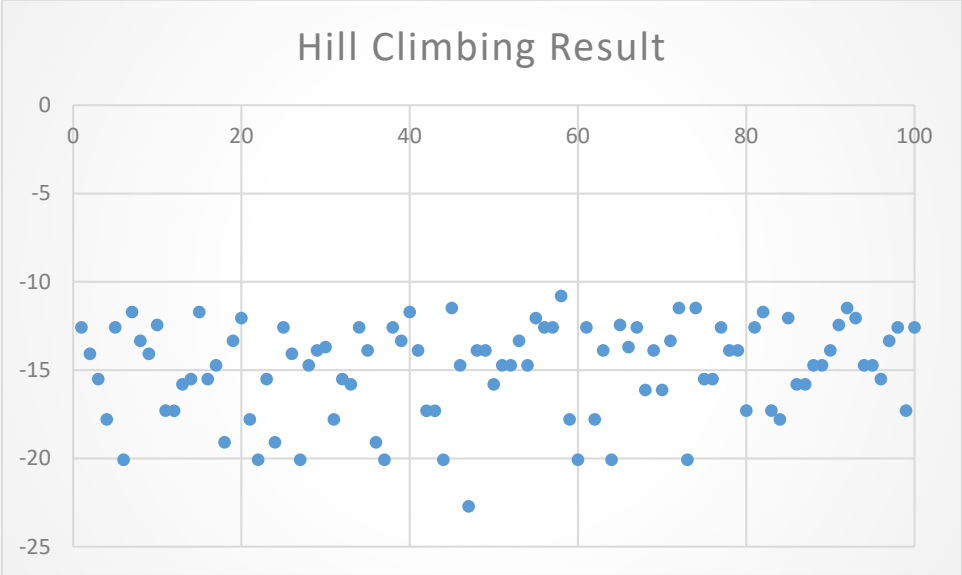
1. Optimization of a function with real parameters

1.1 Execution

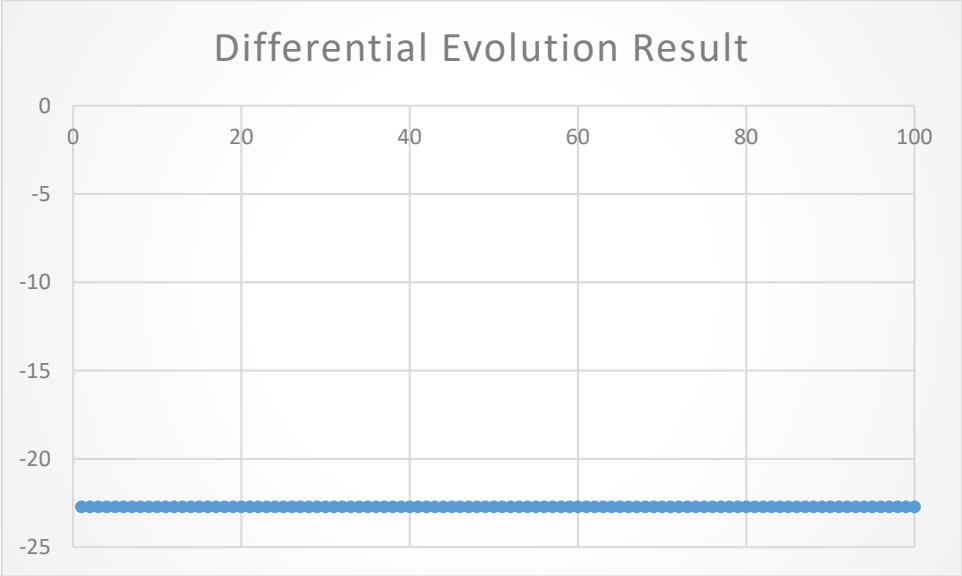
a. The folder named as ‘assg02-1’ is for this question.

b. When you run the program, the solution will be generated in the file ‘output.txt’.

1.2 Analysis



As this figure shows, under the Hill Climbing algorithm, it only found the global minimum 1 time in total 100 runs.



As this figure shows, under the Differential Evolution algorithm, it nearly found the global minimum every time in the total 100 runs. Although in 7 times, it only found the local minimum (not x=0 and y=0), but the value of the Ackley’s function is nearly the same as the global minimum (exactly the same in 4 decimal places).

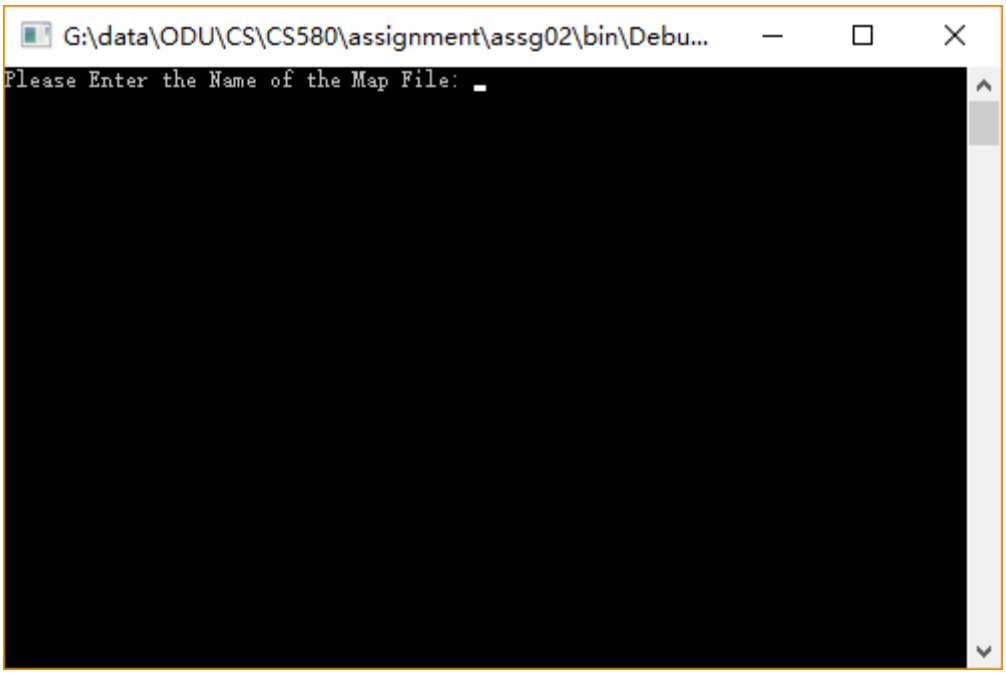
2. Traveling Salesman Problem (TSP)

2.1 Execution

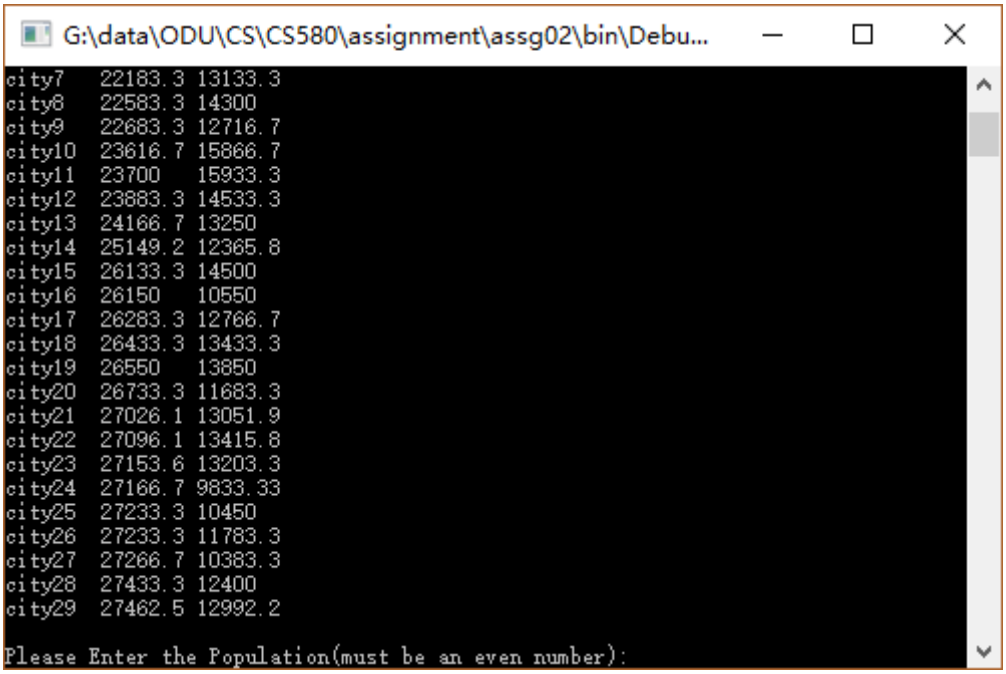
a. The folder named as ‘assg02’ is for this question.

b. When you run the program, first you will be asked to input the name of map file.

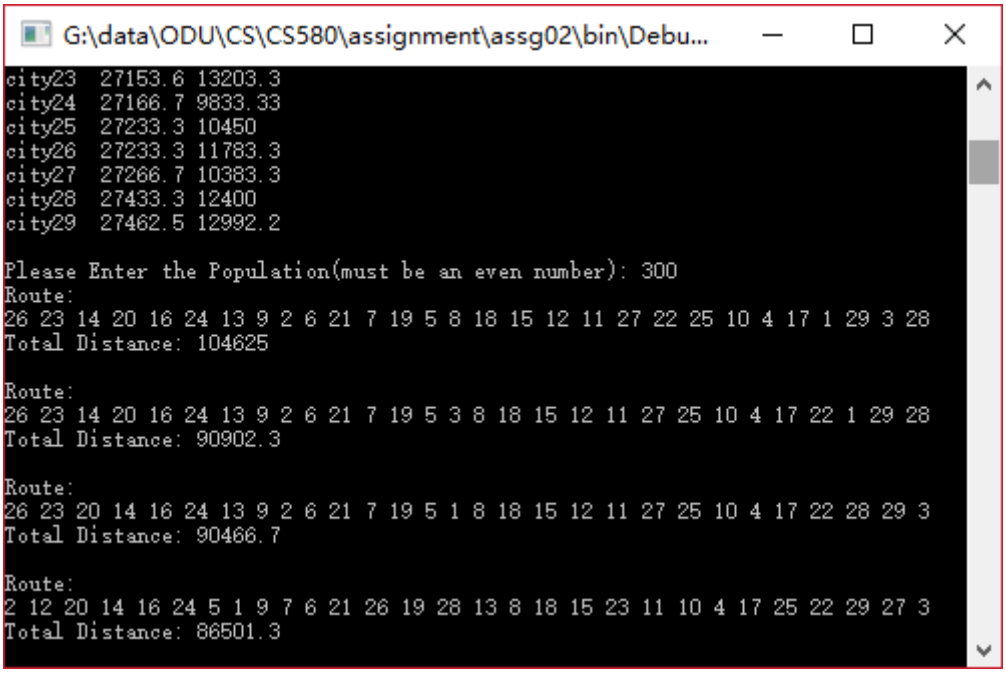
Please enter the full name of the map file (e.g. map.txt).



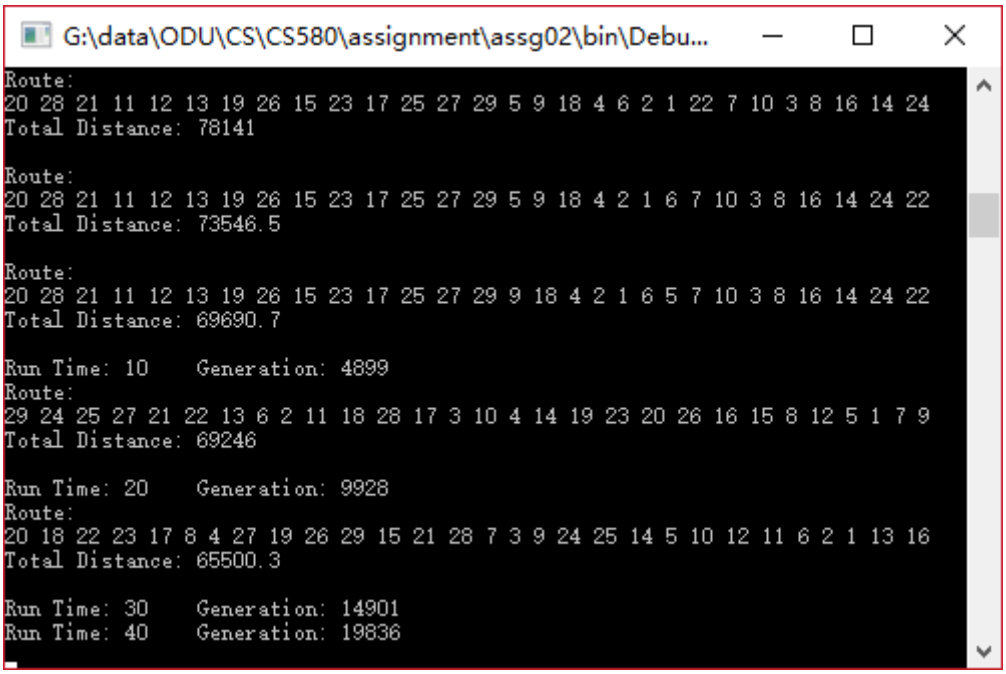
c. Once you enter the name of the map file, it will display the coordinates of the cities. Then you will be asked to enter the population. (It is recommended that the population is 10 times of the cities.)



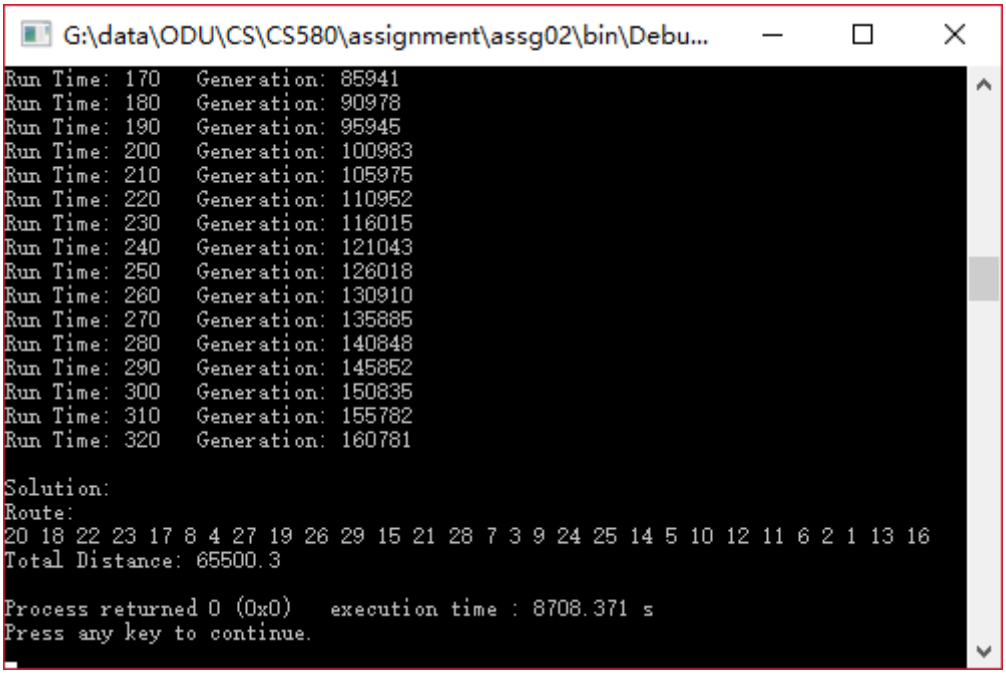
d. After you enter the population, it will start to find the solution. When a better solution is found, it will be displayed on the screen including the route and the total distance.



e. Every 10 seconds, it will show how many generations have been generated.



f. If there has not been any better solution found in last 300 seconds, the program will stop and display the final solution including the route and the total distance.



2.2 Approaches

In this program, 2 crossover algorithms and 2 mutation algorithms are implemented with the crossover probability of 60% and mutation probability of 10%. The 2 crossover algorithms and 2 mutation algorithms have the same chance to be chosen.

The first crossover algorithm is PMX and the second one is Revised PMX in which I modified the mapping strategy of PMX. In PMX, it starts from the first crossover point looking for elements in that segment of P2 that have not been copied. But in Revised PMX, it starts from the left side looking for elements not in that segment of P2 that have not been copied (it's just like the last step in PMX). Then it fills the rest of the offspring with those elements that have not been dealt with from the crossover segment in P2 in the same order.

Step1:

1	2	3	4	5	6	7	8	9

9	3	7	8	2	6	5	1	4

→

			4	5	6	7		

Step2:

1	2	3	4	5	6	7	8	9

9	3	7	8	2	6	5	1	4

→

9	3		4	5	6	7	1	

Step3:

1	2	3	4	5	6	7	8	9

9	3	7	8	2	6	5	1	4

→

9	3	8	4	5	6	7	1	2

The first mutation algorithm is Swap Mutation and the second one is Insert Mutation.

2.3 Analysis

Nearly every time, this program will get a solution with total distance less than 70000. The best solution I have got is 57482.5, and the route is 26, 17, 7, 4, 8, 10, 5, 1, 2, 6, 3, 9, 14, 28, 24, 16, 27, 29, 21, 18, 19, 11, 22, 20, 15, 13, 12, 23, 25.