Problem 1:

Problem 2:

Using PSO algorithm, we can find the minimizer:

$$x_0 = 0.000279321964182$$
$$x_1 = 0.000193196456243$$
$$f(x_0, x_1) = 2.28836604776e - 07$$

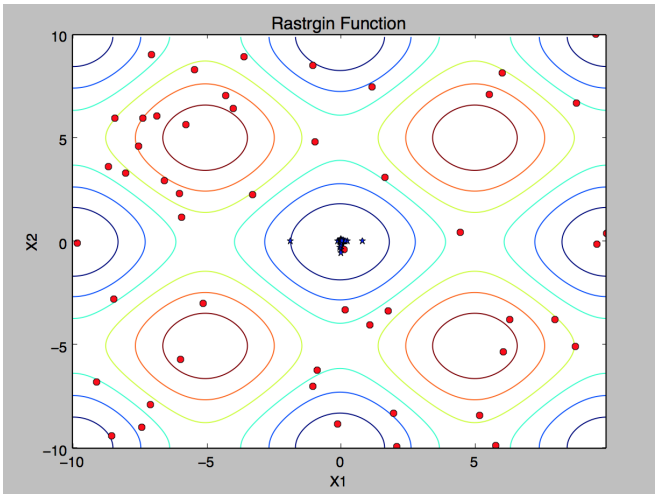

Figure 1: PSO Algorithm (problem 2): circle points are randomly generated 50 initial points. Stars indicate the positions after 50 iterations.

Problem 3:

Using PSO algorithm, we can find the maximizer:

$$x_0 = -5.02482780601$$
$$x_1 = 5.02524813509$$
$$f(x_0, x_1) = -40.5025451078$$

In fact, there are several other global maximizers. PSO method will converge to different global maximizer depending on the initial points which are randomly chosen.

Problem 4:

Population size: 50
Number of iterations: 50

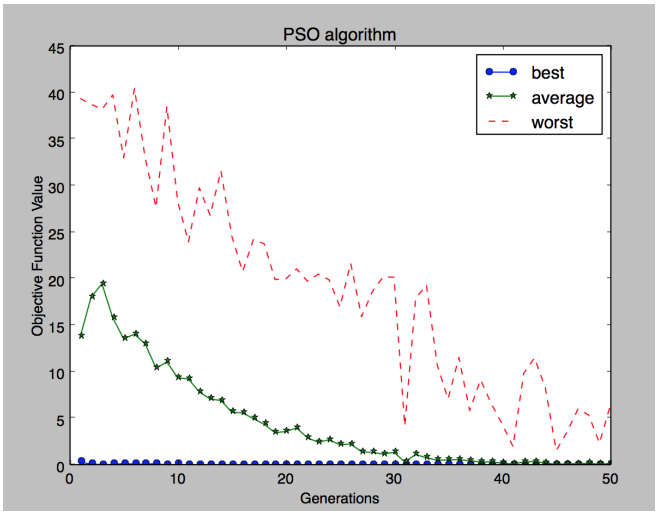

Figure 2: PSO Algorithm (problem 2): plots of the best, average, and the worst objective function values in the population for 50 generations

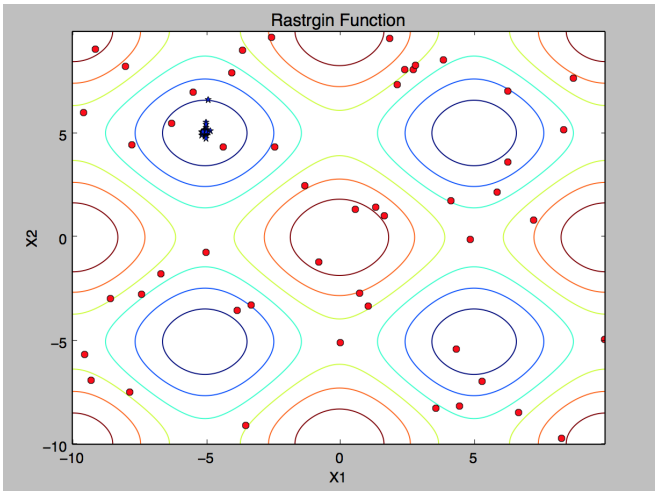

Figure 3: PSO Algorithm (problem 3): circle points are randomly generated 50 initial points. Stars indicate the positions after 50 iterations.

For canonical number genetic algorithm, the minimizer is:

$$x_1 = 0.0408935546875$$
$$x_2 = 0.0390625$$
$$f(x_1, x_2) = 0.00634456702034$$

For real number genetic algorithm, the minimizer is :

$$x_1 = 0.018313265874$$
$$x_2 = 0.0286761643909$$
$$f(x_1, x_2) = 0.00229673023909$$

Problem 5:

The shortest path is shown in Figure 9, and the shortest distance is : 37.7222579198

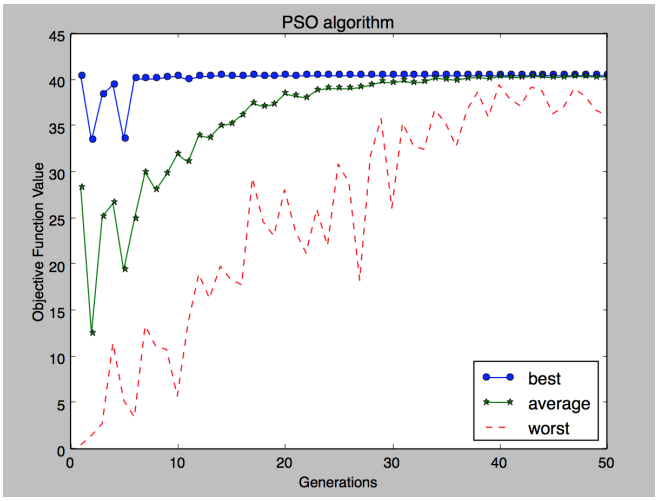

Figure 4: PSO Algorithm (problem 3): plots of the best, average, and the worst objective function values in the population for 50 generations

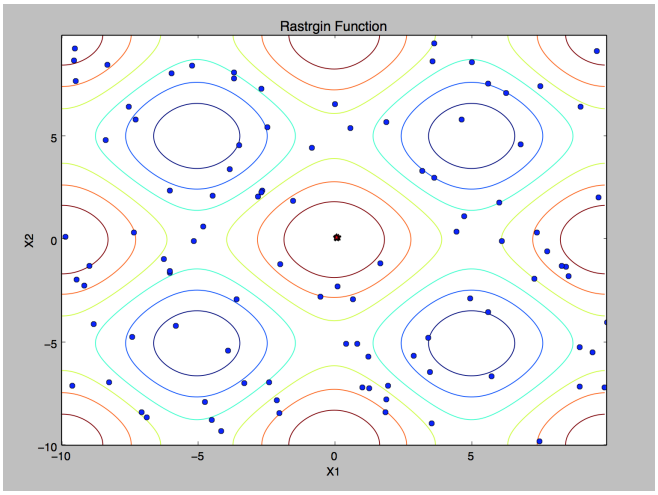

Figure 5: Canonical Genetic Algorithm (problem 4): circle points are randomly generated 50 initial points. Stars indicate the positions after 50 iterations.

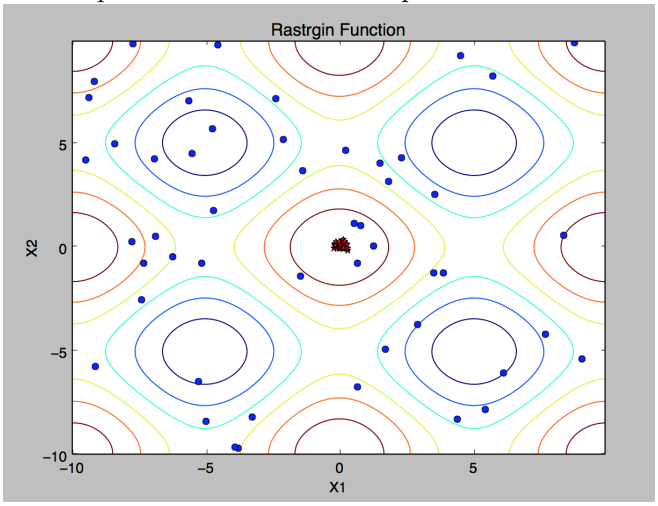

Figure 6: Real Number Genetic Algorithm (problem 4): circle points are randomly generated 50 initial points. Stars indicate the positions after 50 iterations.

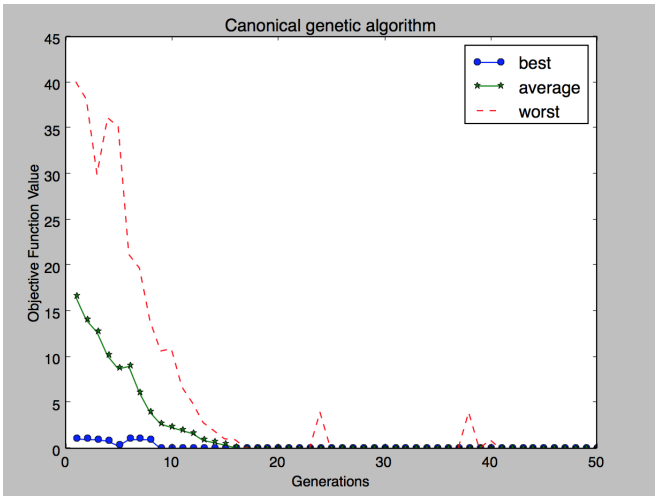

Figure 7: Canonical Genetic Algorithm (problem 4): plots of the best, average, and the worst objective function values in the population for 50 generations

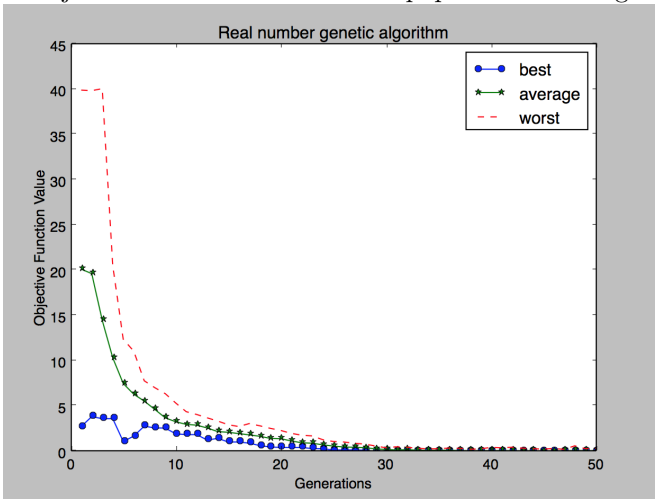

Figure 8: Real Number Genetic Algorithm (problem 4): plots of the best, average, and the worst objective function values in the population for 50 generations

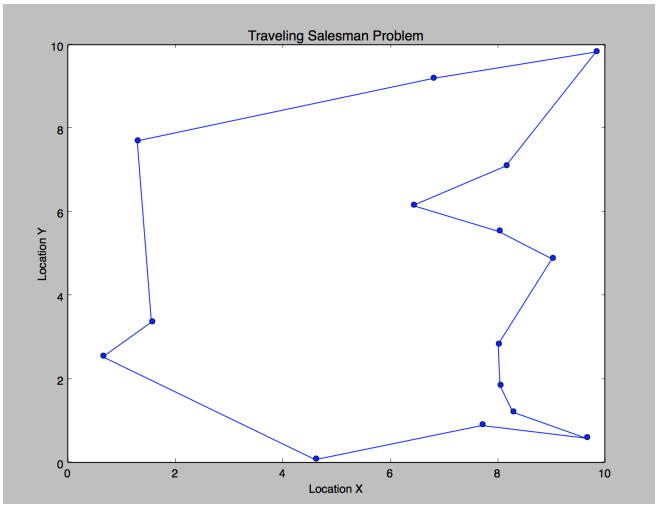

Figure 9: Traveling salesman problem (problem 5): plots of the shortest distance path

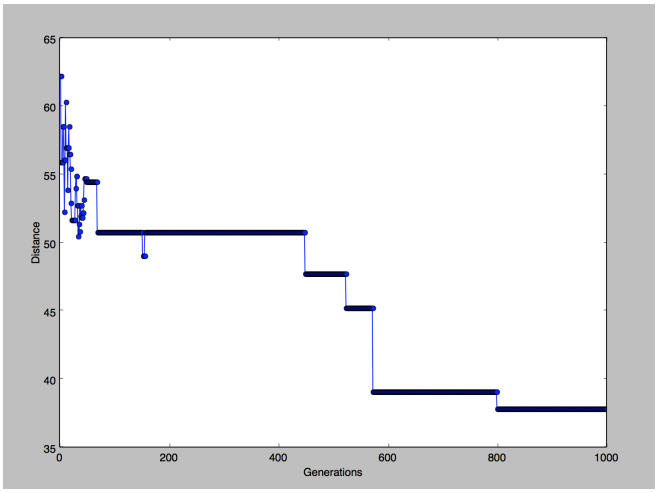

Figure 10: Traveling salesman problem (problem 5): plots of the shortest distance for different combinations of the population for 1000 generations