

Problem 1:

Problem 2:

Using PSO algorithm, we can find the minimizer:

$$\begin{aligned}x_0 &= 0.000279321964182 \\x_1 &= 0.000193196456243 \\f(x_0, x_1) &= 2.28836604776e - 07\end{aligned}$$

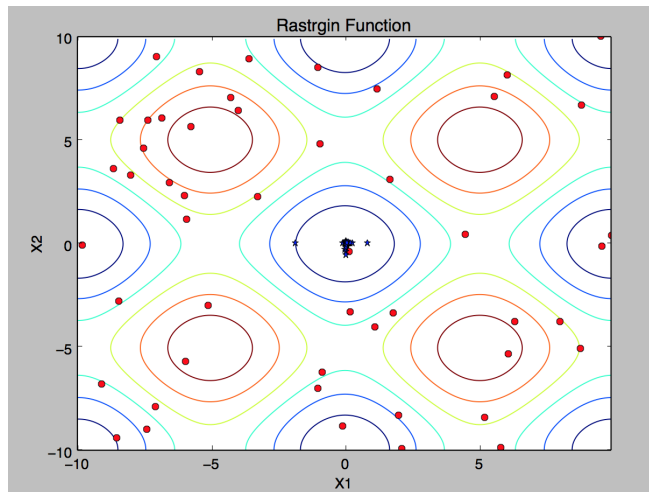


Figure 1: PSO Algorithm (problem 2): circle points are randomly generated 50 initial points. Stars indicate the positions after 50 iterations.

Problem 3:

Using PSO algorithm, we can find the maximizer:

$$\begin{aligned}x_0 &= -5.02482780601 \\x_1 &= 5.02524813509 \\f(x_0, x_1) &= -40.5025451078\end{aligned}$$

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

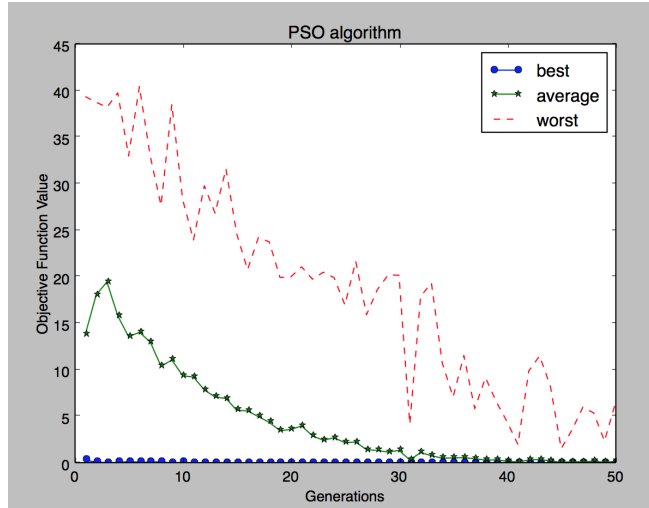


Figure 2: PSO Algorithm (problem 2): plots of the best, average, and the worst objective function values in the population for 50 generations

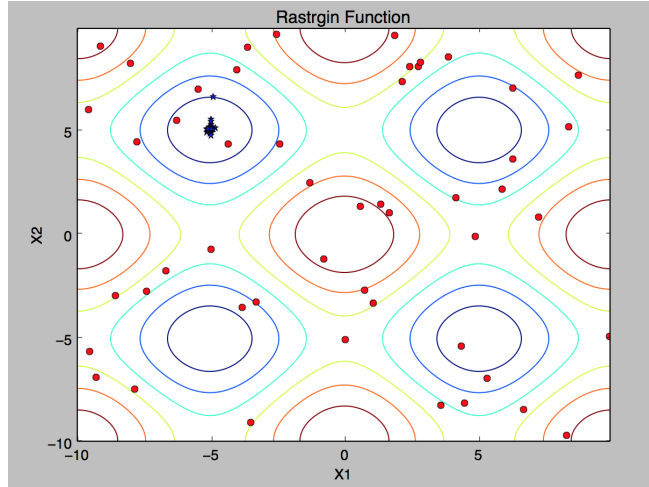


Figure 3: PSO Algorithm (problem 3): circle points are randomly generated 50 initial points. Stars indicate the positions after 50 iterations.

For canonical number genetic algorithm, the minimizer is:

$$\begin{aligned}x_1 &= 0.0408935546875 \\x_2 &= 0.0390625 \\f(x_1, x_2) &= 0.00634456702034\end{aligned}$$

For real number genetic algorithm, the minimizer is :

$$\begin{aligned}x_1 &= 0.018313265874 \\x_2 &= 0.0286761643909 \\f(x_1, x_2) &= 0.00229673023909\end{aligned}$$

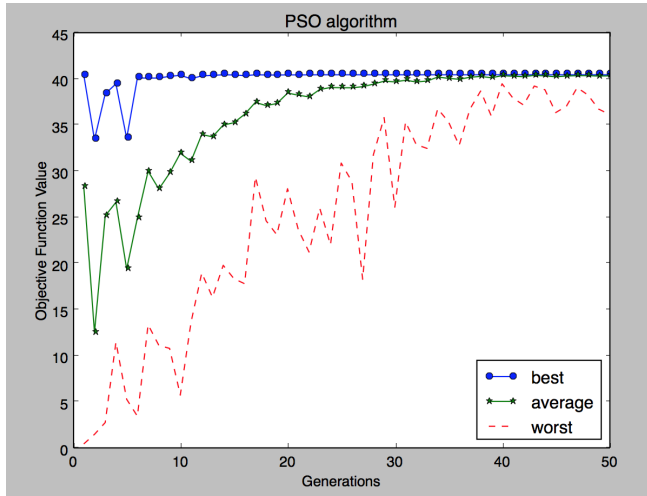


Figure 4: PSO Algorithm (problem 3): plots of the best, average, and the worst objective function values in the population for 50 generations

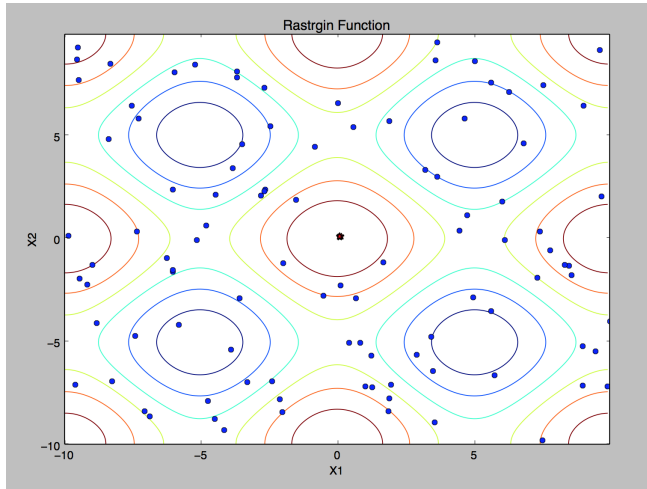


Figure 5: Canonical Genetic Algorithm (problem 4): circle points are randomly generated 50 initial points. Stars indicate the positions after 50 iterations.

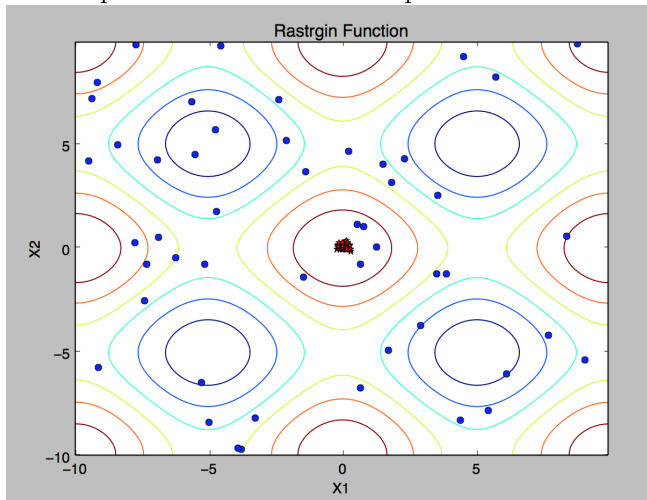


Figure 6: Real Number Genetic Algorithm: circle points are randomly generated 50 initial points. Stars indicate the positions after 50 iterations.

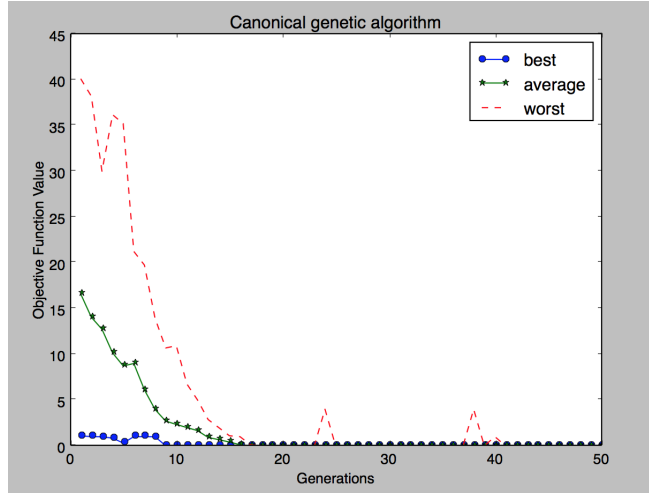


Figure 7: Canonical Genetic Algorithm (problem 4): plots of the best, average, and the worst objective function values in the population for 50 generations

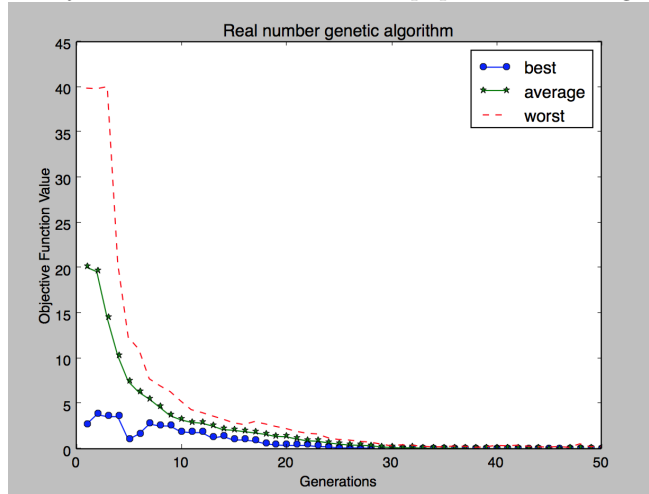


Figure 8: Real Number Genetic Algorithm: plots of the best, average, and the worst objective function values in the population for 50 generations