Assignment 2 - Exercise 1

Vincent de Vos (0741795)
v.j.h.d.vos@student.tue.nl

Thom Hurks (0828691)
t.p.hurks@student.tue.nl

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10. John is trying to decide the amount of food (x1) and drinks (x2) to buy for the party. Since the group is quite heterogeneous, Sami has devised a mathematical function to calculate the cost of the food, taking the form:

$$R(x) = 20 + x_1^2 + x_2^2 - 10(cos2\pi x_1 + cos2\pi x_2).$$

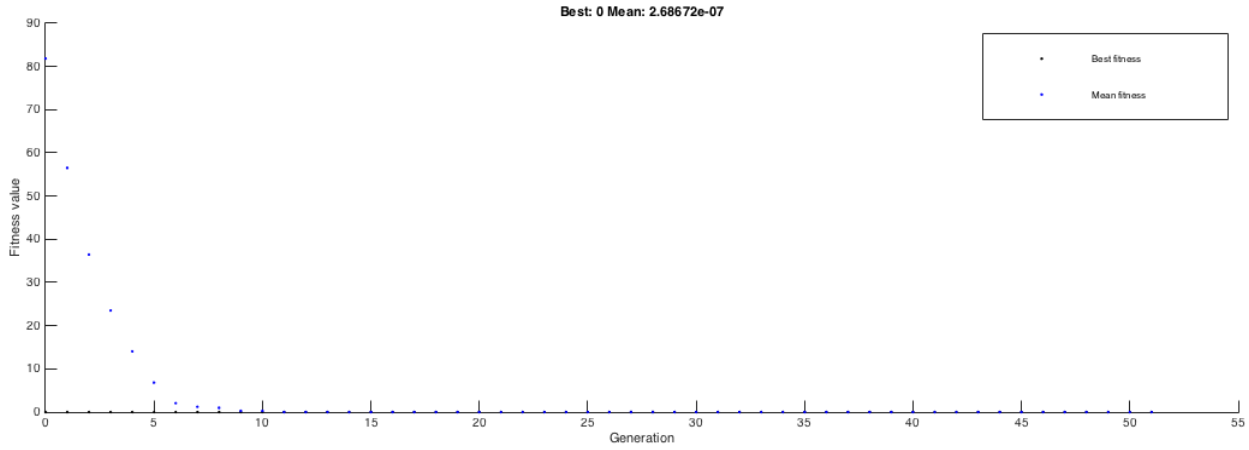
- **Find the minimum of food cost using the genetic algorithm toolbox. Use crossover in a singlepoint and uniform mutation.**
- **Use as starting point the best solution found using genetic algorithm, use constrained minimization, fmincon to try to find a better solution.**
- **Increase the number of iterations for the genetic algorithm and check if you obtain a lower cost.**
- **Plot the obtained optimization results. Include all intermediary iterations and comment on your findings. Highlight the final solution of each algorithm (with a different color and adequate legend).**

1) After running the genetic algorithm in “q10_solution_027.m”, the output is that x1=2.750375225901713e-06 and x2=0.995016897132327 with fval=0.994959731636413.

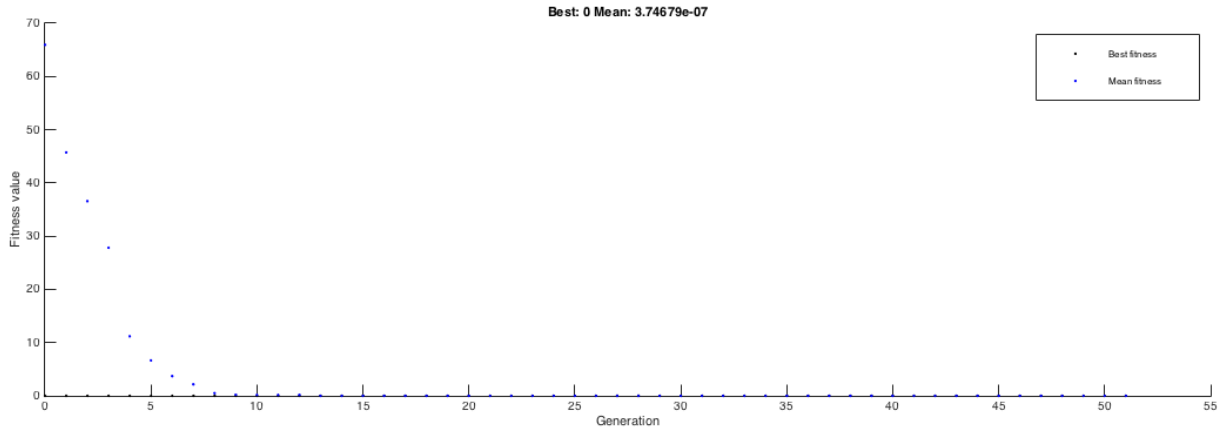
2) After running fmincon, the values are x1=5.142124249535993e-10 and x2=0.994958633381057 with fval=0.994959057093293 which is slightly better than the previous solution.

3) We now run the genetic algorithm in the script again, but now want to increase the number of iterations. We cannot set the number of iterations directly (only the maximum number), but we can set the StallGenLimit variable to a higher number and the TolFun variable to a lower number. This will make sure that the average change in fitness function value (TolFun) needs to be lower over a higher number (StallGenLimit) of last iterations. This will make sure the number of generations increases. After doing this, we get that x1=0 and x2=5.650204302098949e-06 with fval=6.333628732591023e-09, which means that all values are equal to or approaching 0.

4) Plots of the various results:
Plot for the initial run of the genetic algorithm:



Plot for the run of FMINCON:



Plot for the third run of the genetic algorithm with more iterations: