Solution of 0-1 Knapsack problem using Genetic Algorithm

Global variables:

- given from file
  - capacity of knsapsack
  - list of items weights
  - list of items values
- given by user
  - size of population
  - number of generation
  - crossover probability
  - number of crossover points
  - mutation probability
- defined const
  - number of genes
  - number of child

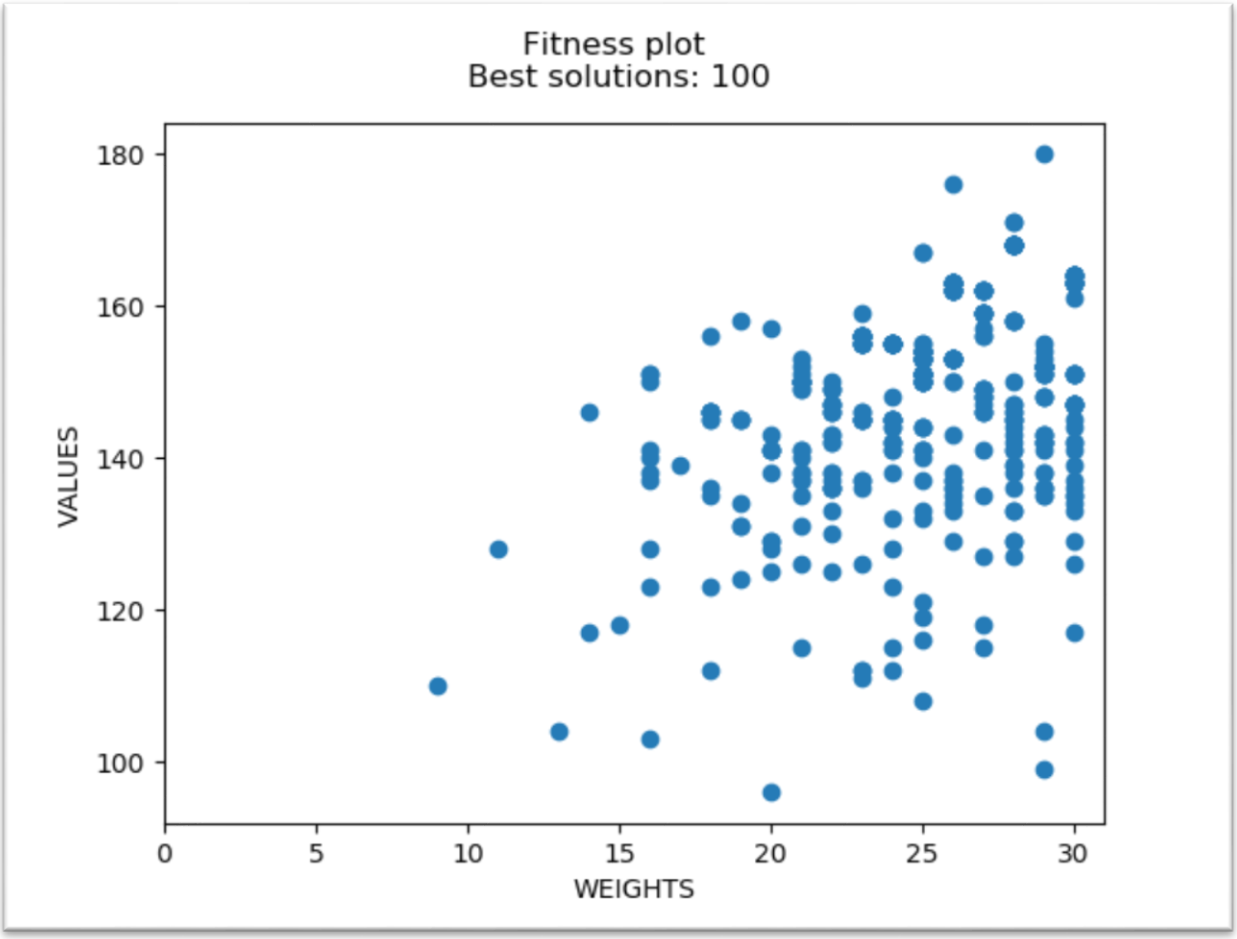
- Step 1 : Start
  Values from vary inputs are assigned to global variables.
  fetchArgvFromFile function as argument takes name of file with data and assign them to global variables
  fetchArgvFromUser function takes data from user input and assign them to global variables
- Step 2 : Generate population
  Creating list of genes respectively to weights and values.
  Creating individuals – genes randomly selected
- Step 3 : Evolution
  - Parent selection
    Measuring fitness of every individual and generate roulette wheel according to fitness values
    Random choosing parents from roulette wheel
  - Reproduction
    Random choosing number of crossover points
    Create child from genes of parents– crossingover
    Random mutation – swap two randomly chosen genes
  - Survival selection with elitism
    Removing that many individuals with the smallest fitness value as many new children are. Leave individual with the greatest fitness value.
- Step 4 : Terminate
  Terminate after given number of generation
  Return best solution

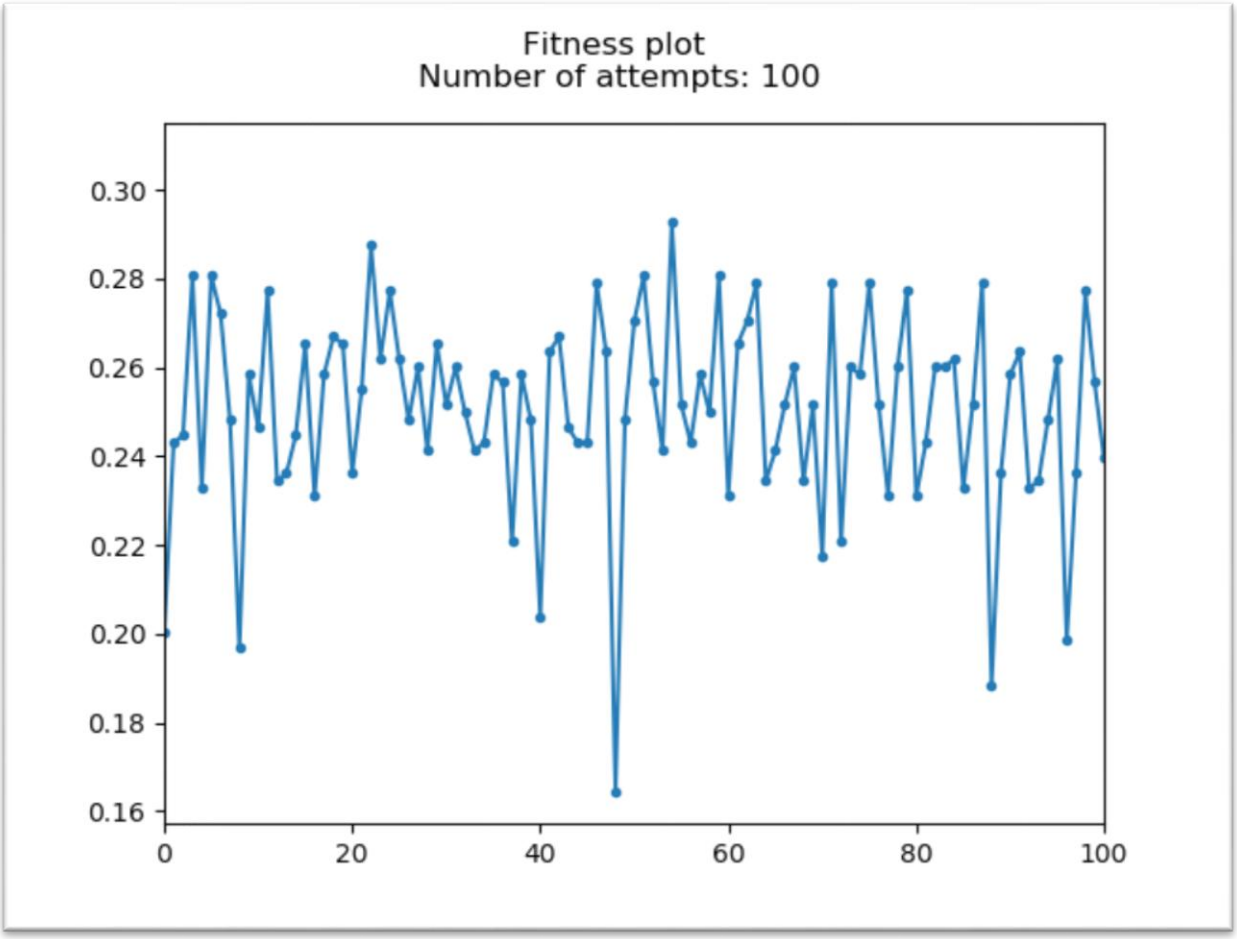
Overview of best solutions and fitness plot

Data in list means respectively:

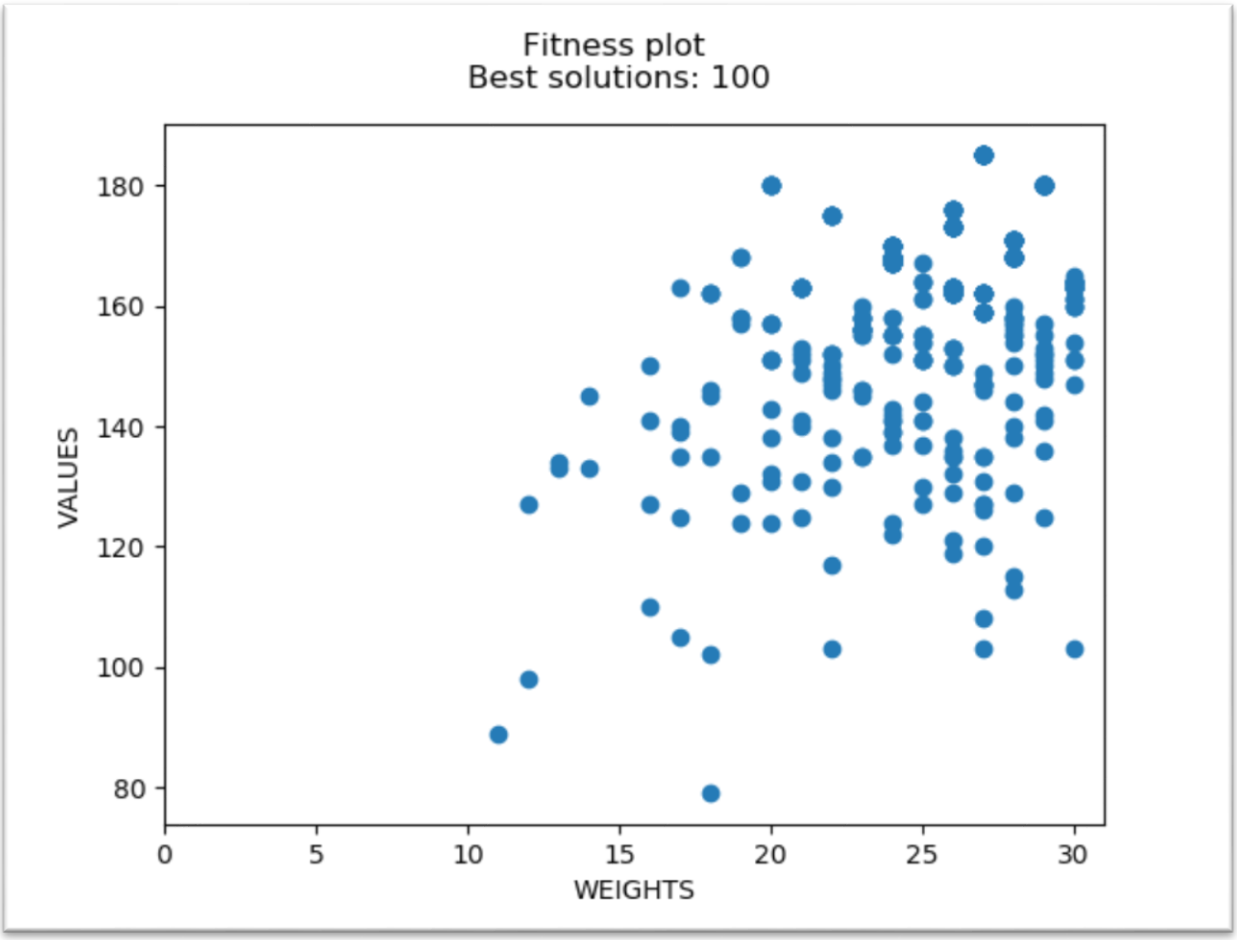
- Size of population
- Number of generation
- Crossover probability
- Number of crossover point
- Mutation probability

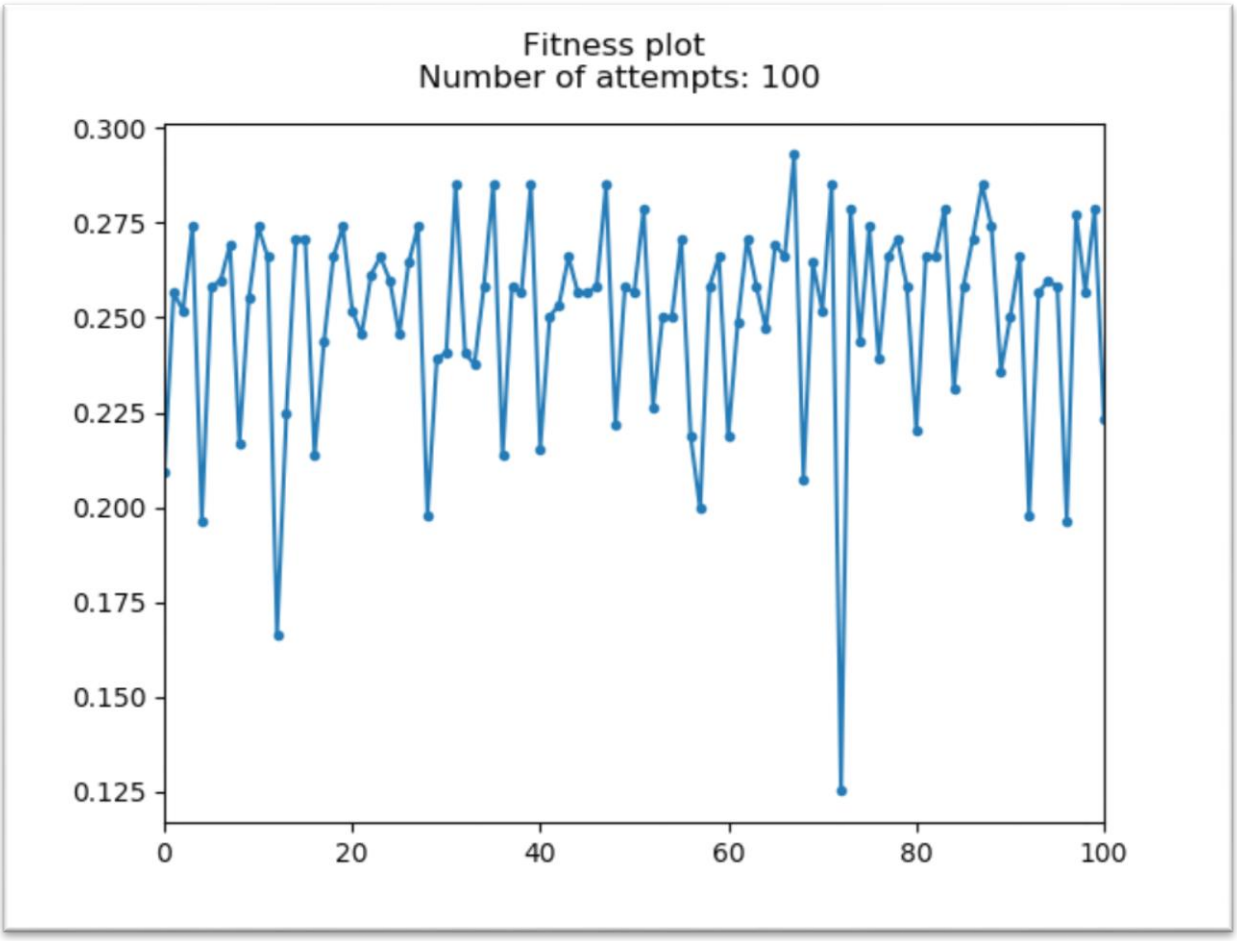
```
[10, 10, 0.9, 1, 0.1]
[50, 10, 0.9, 1, 0.1]
[100, 10, 0.9, 1, 0.1]
[200, 10, 0.9, 1, 0.1]
```



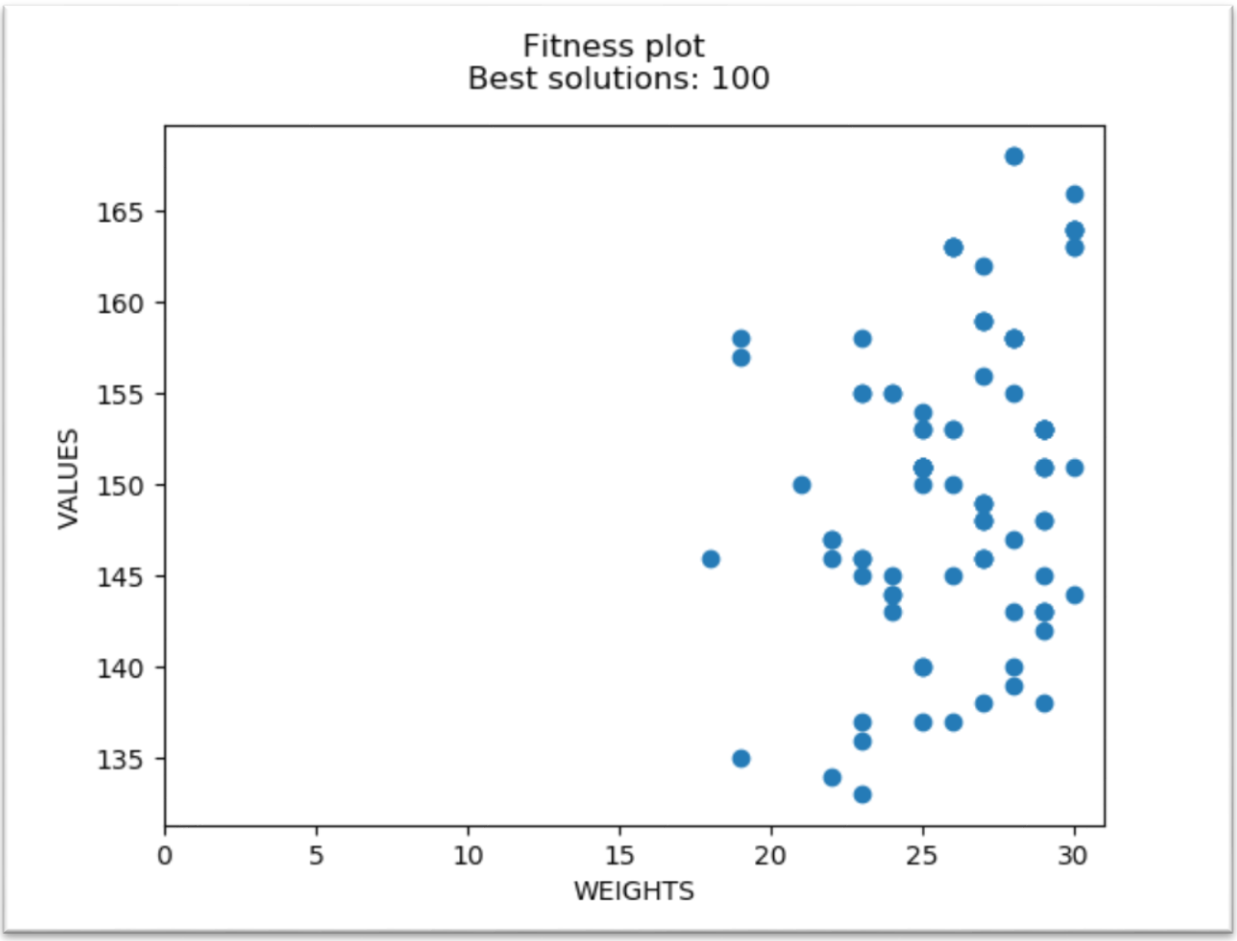


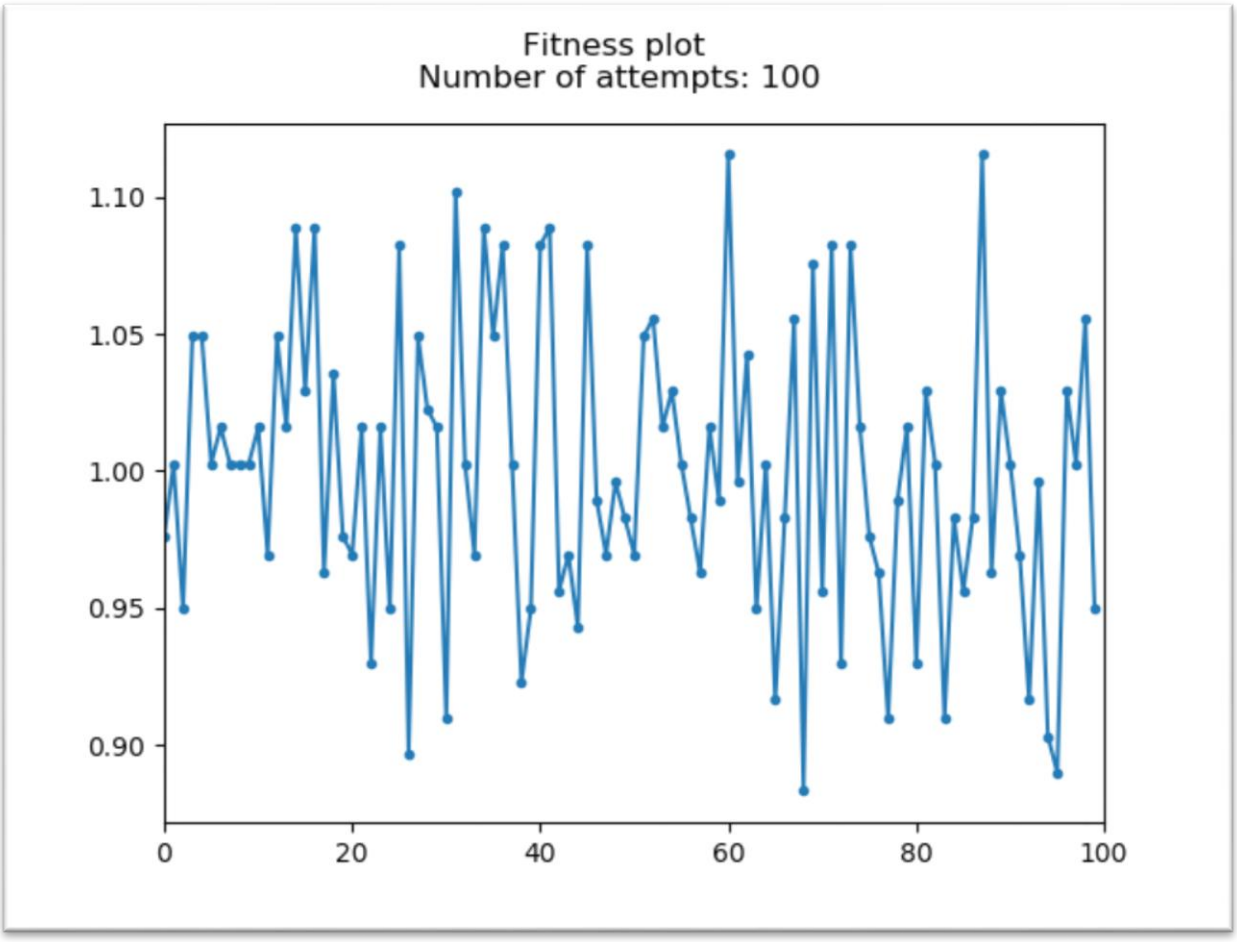
```
[10, 200, 0.9, 1, 0.1]
[50, 200, 0.9, 1, 0.1]
[100, 200, 0.9, 1, 0.1]
[200, 200, 0.9, 1, 0.1]
```



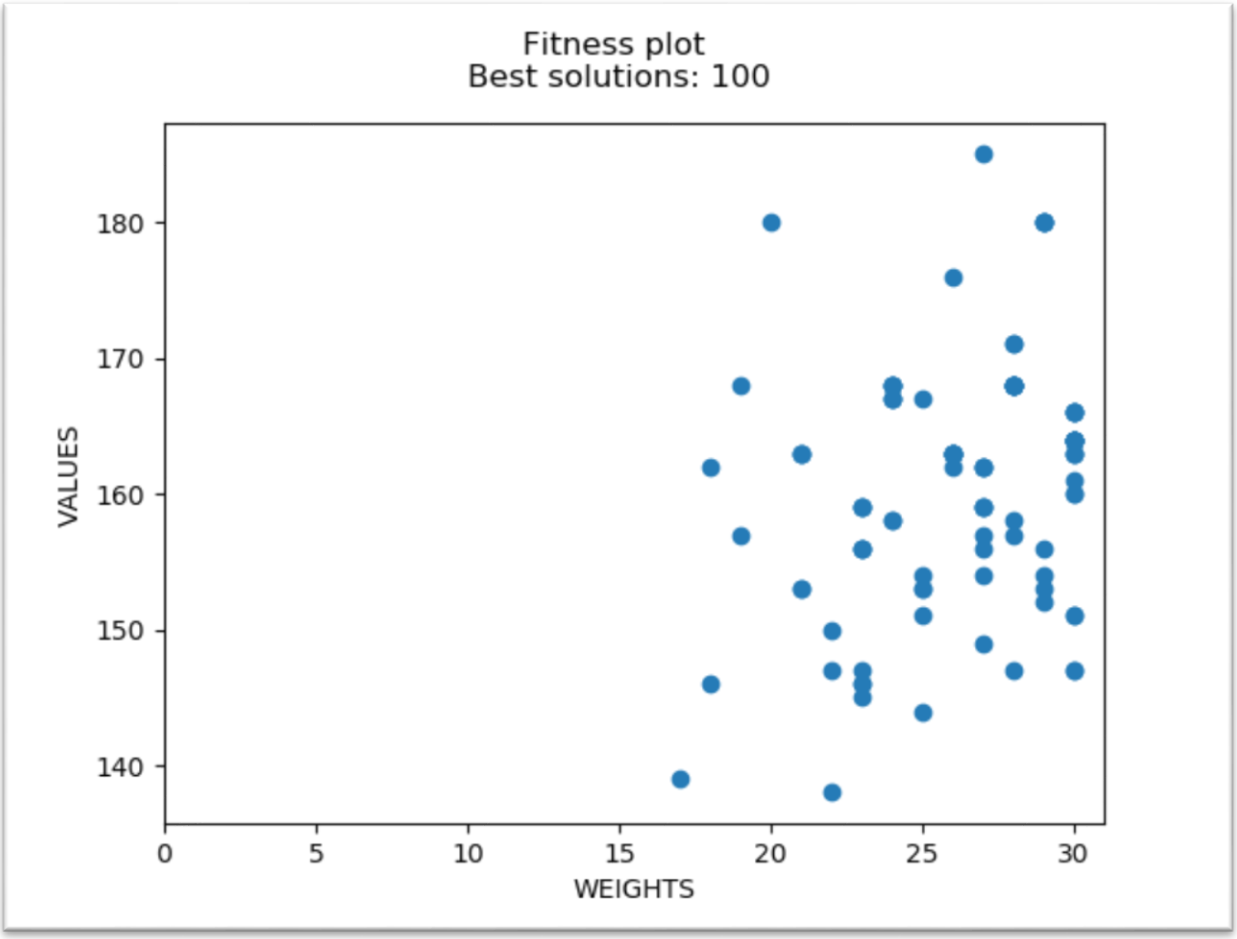


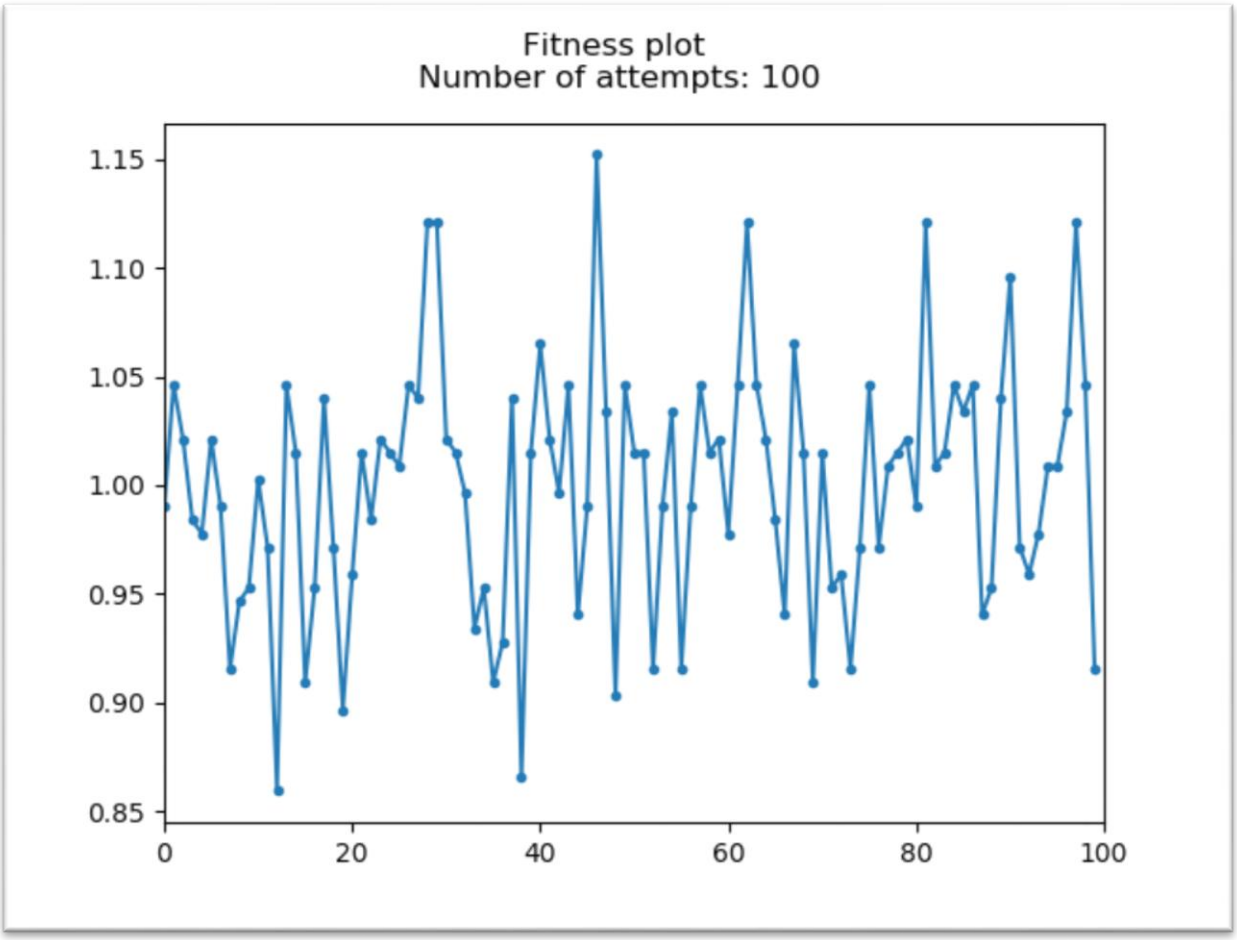
```
[100, 10, 0.9, 2, 0.1]
```


Fitness plot
Best solutions: 100
VALUES
WEIGHTS
165
160
155
150
145
140
135
0
5
10
15
20
25
30


Fitness plot
Number of attempts: 100
1.10
1.05
1.00
0.95
0.90
0
20
40
60
80
100

```
[100, 1000, 0.9, 2, 0.1]
```





Execution time

```
Test data: [10, 10, 0.9, 1, 0.1]
Execution time: 0.001000

Test data: [10, 200, 0.9, 1, 0.1]
Execution time: 0.016000

Test data: [200, 200, 0.9, 1, 0.1]
Execution time: 0.441000

Test data: [100, 100, 0.9, 2, 0.1]
Execution time: 0.096000

Test data: [100, 100, 0.9, 3, 0.1]
Execution time: 0.097000

Test data: [200, 200, 1, 3, 1]
Execution time: 0.470000

Test data: [200, 1000, 1, 3, 1]
Execution time: 2.396000
```