MÄLARDALENS HÖGSKOLA
ESKILSTUNA VÄSTERÅS

Assignment 3:

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1. Explain the important operations of the employed algorithm to solve this problem.

Creating population: The genetic algorithm starts with creating a random population from the solution space.
Fitness: Calculating the fitness value of each solution in the population by calculating the sum of each input and its corresponding weight.
Parents Selection: after calculating the fitness, we select the best fitness values which are the minimum distance through the cities as parents.
Crossover operator: In the crossover operator, we generate a new generation from the parents by selecting two parents based on their fitness order and combining them to generate new children.
Mutation: The mutation operator is used to maintain genetic diversity by randomly changing a few of the offspring value.
Stop-Point: the algorithm stops when reaching a specific distance or a set number of iterations.

2. Explain the representation of the individual solutions in your algorithm.

Based on the input data, we used the number of cities as the name of them, while each individual represents x defined as
$x = \{x1, x2, \dots, x52\}$ $xi \in \{1, 2, \dots, 52\}$ as a number of cities, so we used a real representation to show the best solution for travelling salesman problem as a root between the cities.

3. Give the equation of the fitness function used by your algorithm.

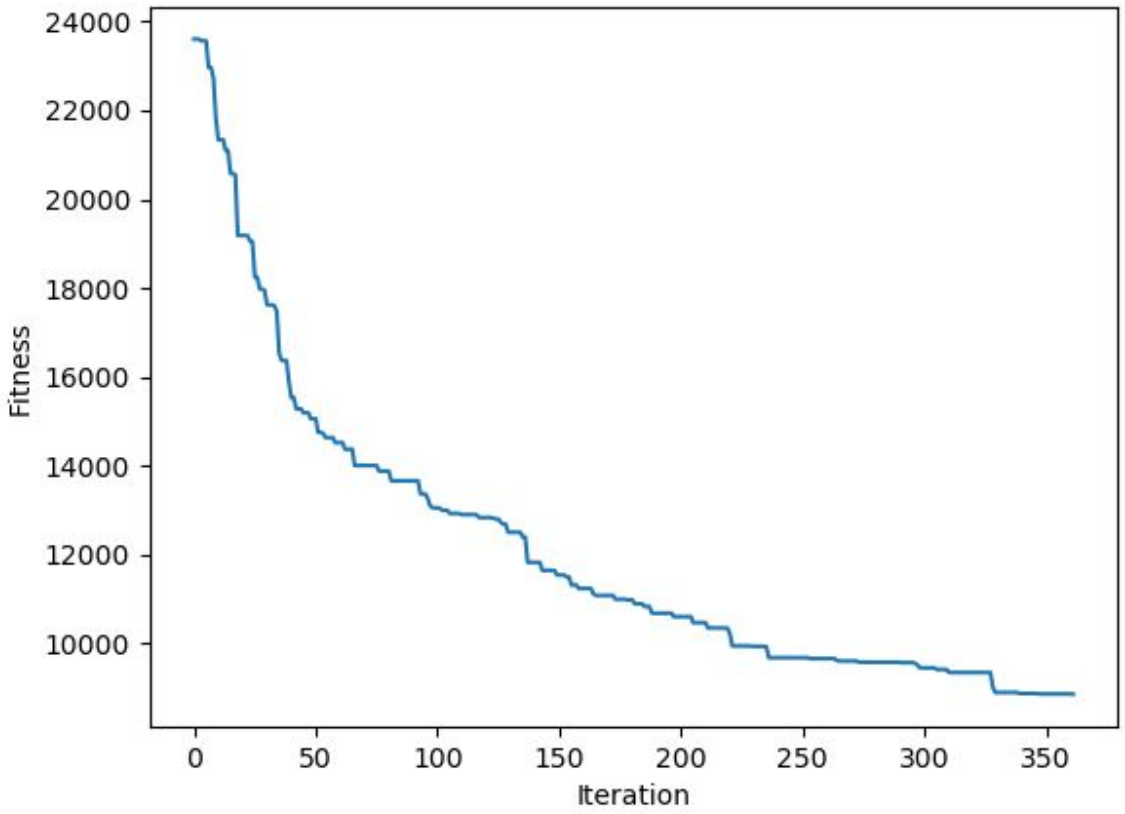
The fitness function(x) calculates the sum of distances between the nodes plus the distance from the last node to the first one. By this equation

$$distance\ (p1, p2) = \sqrt{(x2 - x1)^2 + (y2 - y1)^2}$$

4. Give the parameters used in your algorithm.

a. population size = 50
b. Elitism size = 20
c. Crossover function: take the first sequence of half the first parents and fill the rest of nodes according to other parent nodes order.
d. Mutation: choose two random index numbers between (1,51) to select a random part of nodes then reverse them regarding a random number between (0-1) if it is more than 0.5 then it will reverse the sort of the selected nodes. While the mutation affects the children by random it will give a new genetic diversity of the new mutated children.

5. Illustrate how the performance of the population evolves with generations (preferably with a figure)



6. Show the best result obtained by your algorithm (the order of locations to visit and the total distance of this route).

[22, 1, 35, 36, 49, 39, 40, 38, 37, 46, 16, 50, 20, 23, 21, 31, 32, 18, 3, 45, 19, 41, 8, 9, 10, 43, 33, 51, 11, 52, 14, 13, 47, 26, 27, 12, 28, 25, 4, 6, 24, 5, 15, 48, 34, 44, 29, 30, 2, 7, 42, 17]

Best fitness: 8845.636076626104