Assignment 6: Travelling Salesman Problem

Aim: We were supposed to find a good solution to the "Travelling salesman problem".

Problem:

We have to find the shortest path when we join "n" cities

Approach:

I used simulated annealing to solve the given problem.

1. We start with a random order.
2. We start swapping any two of the random indices.
3. If the path length reduces then we consider the new path otherwise we choose it with a probability that is a function of the difference between the current and the "best" solution as well as the number of iterations.
4. The probability of choosing a worse path is high at the start but decreases exponentially with decreasing Temperature(simulated annealing is inspired by annealing).

Parameters:

1. Temperature is taken as : 10000
2. Number of iterations = 10000
3. The decay factor for temperature = 0.99

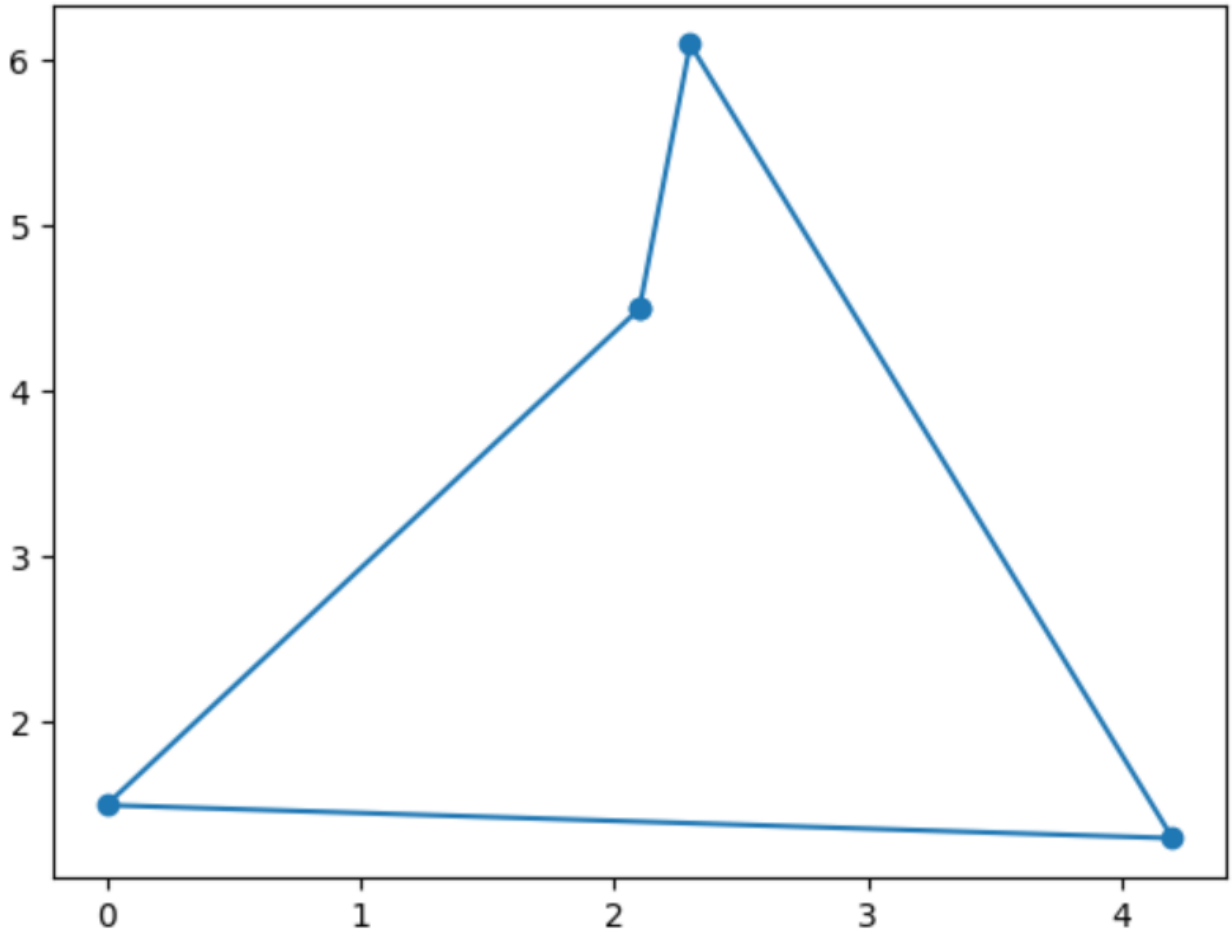
Results with given parameters and n = 4:

Minimum path distance is: 14.64154124236167 using the following order: [3, 0, 2, 1]

Initial path distance was:17.79481867442668 with the order: [0, 1, 2, 3]

Percentage improvement: 17.720199850064514%

The final plot was:



Results with given parameters and n = 40:

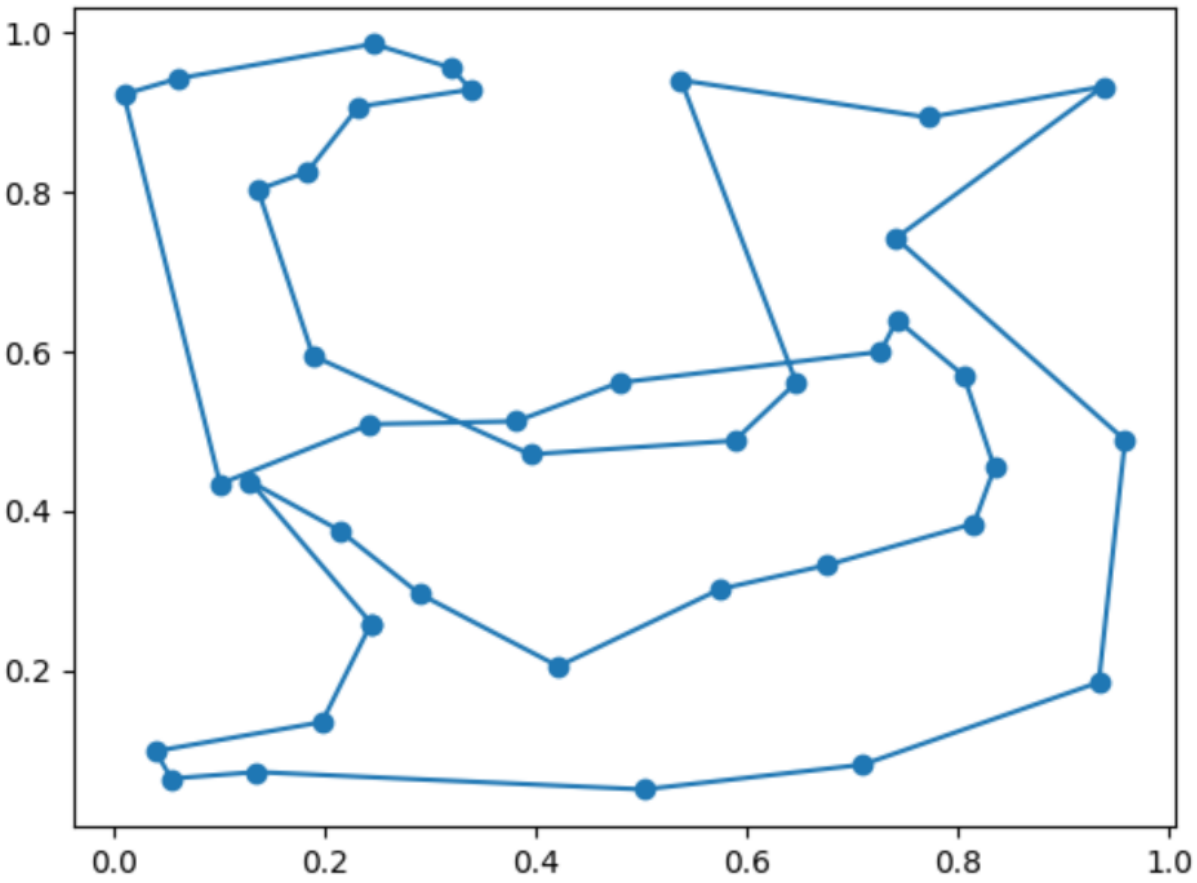
Multiple path lengths and orders were found but the best ones were:

Minimum path distance is: 6.817425362457714 using the following order: [3, 15, 14, 11, 17, 21, 26, 18, 24, 13, 8, 27, 36, 16, 25, 23, 9, 0, 5, 12, 4, 29, 37, 28, 39, 1, 6, 31, 32, 7, 2, 35, 33, 30, 20, 19, 38, 10, 22, 34]

Initial path distance was:20.12138012818315 with the order: [21, 8, 4, 27, 2, 29, 7, 11, 17, 34, 25, 23, 12, 0, 36, 26, 10, 33, 19, 22, 31, 39, 18, 35, 13, 37, 38, 16, 20, 32, 28, 1, 30, 3, 24, 5, 9, 14, 15, 6]

Percentage improvement: 66.11850022698573%

The final path is :

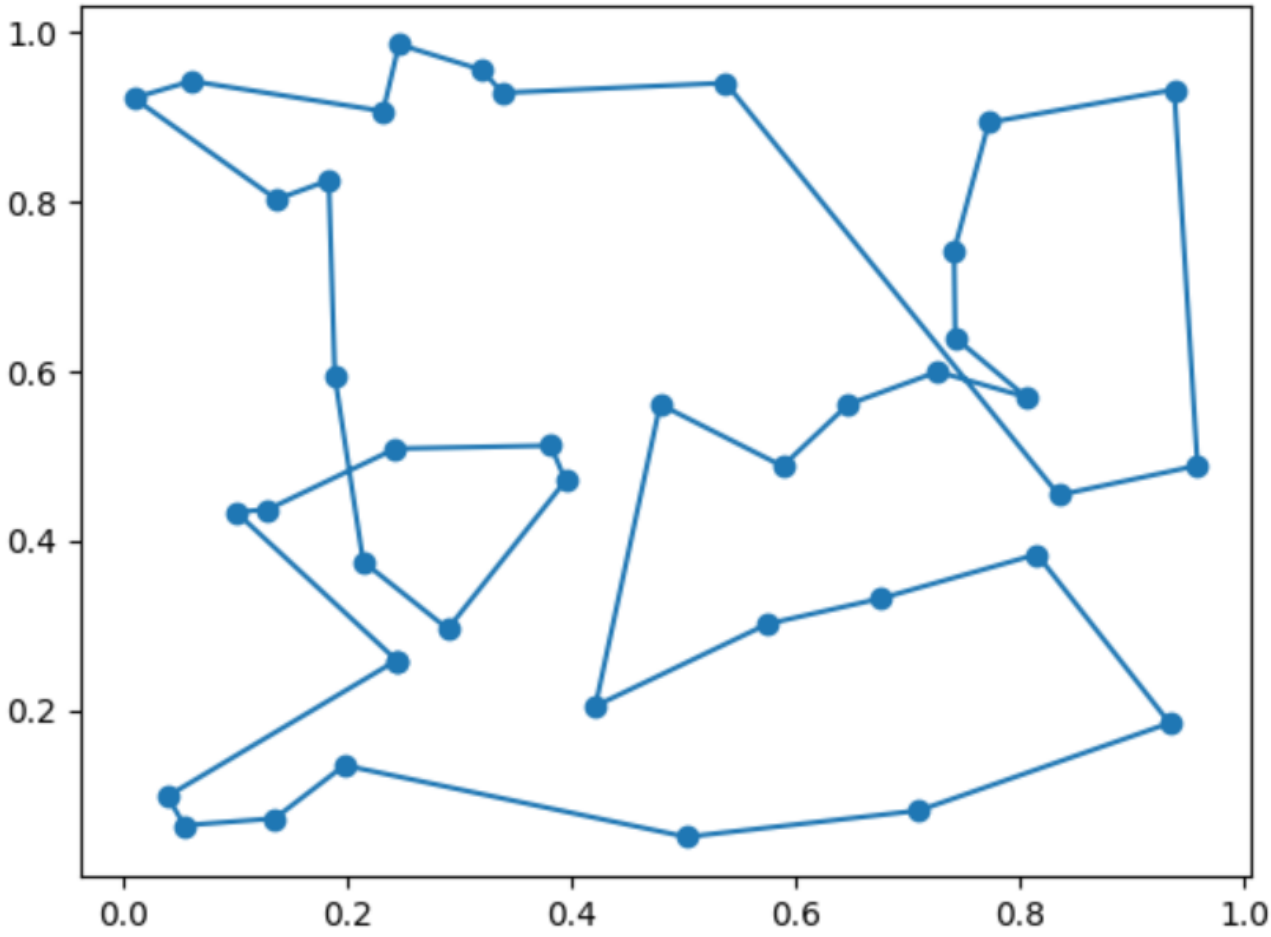


Minimum path distance is: 6.515353576836415 using the following order: [3, 23, 15, 25, 16, 1, 11, 14, 39, 37, 28, 9, 0, 29, 5, 12, 4, 32, 24, 33, 2, 7, 35, 8, 13, 27, 31, 6, 36, 17, 21, 26, 18, 30, 20, 19, 34, 38, 10, 22]

Initial path distance was:22.092599144914654 with the order: [12, 2, 13, 24, 20, 14, 7, 38, 29, 10, 17, 26, 4, 33, 9, 3, 23, 18, 32, 1, 11, 21, 16, 25, 19, 5, 15, 39, 31, 34, 30, 35, 22, 27, 36, 37, 0, 6, 28, 8]

Percentage improvement: 70.50888610208573%

The final path is :


1.0
0.8
0.6
0.4
0.2
0.0
0.2
0.4
0.6
0.8
1.0