MALIS Course

1st Lab Session's Report

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Exercise 1: Chromosome genetic operators

Please notice that the crossover and mutation start and ending points are taken randomly.

Refer to Exercise1.txt.

Mutation test 0:

 Chromosome: fitness= 0.00, cities: 69 37 25 50 16 82 75 56 89 79 52 99 1 95 47 67 2 58 34 62 46 4 14 21 96 61 5 91 84 29 87 55 94 15 23 54 78 3 68 63 43 98 17 13 49 40 64 12 39 33 41 92 8 10 97 88 90 0 30 26 71 70 11 28 6 93 22 7 59 32 20 35 31 38 81 65 18 76 57 42 83 66 86 60 51 44 80 53 72 27 19 77 48 85 45 74 36 73 9 24

 Chromosome: fitness= 0.00, cities: 69 37 25 50 16 82 75 56 89 79 52 99 1 95 47 67 2 58 34 62 46 4 14 21 96 61 5 91 84 29 87 55 94 15 23 54 78 3 68 63 43 98 17 13 49 40 64 12 39 33 41 92 8 10 97 88 90 0 30 26 71 70 11 28 6 93 22 7 59 32 20 35 31 38 81 65 74 45 85 48 77 19 27 72 53 44 80 51 60 86 66 83 42 57 76 18 36 73 9 24

Mutation test 1:

 Chromosome: fitness= 0.00, cities: 5 62 57 56 29 18 70 39 32 97 63 2 72 44 27 50 55 77 34 66 31 43 36 47 91 12 52 45 41 16 58 60 79 49 84 67 22 20 93 53 46 94 82 38 37 7 9 80 81 98 21 88 33 6 8 28 48 75 65 78 30 51 54 83 95 68 87 64 71 24 99 73 74 59 35 19 0 96 23 90 69 14 1 10 42 11 61 40 86 89 85 25 17 4 13 92 76 26 15 3

 Chromosome: fitness= 0.00, cities: 5 62 57 56 29 18 70 39 32 97 63 2 72 44 27 50 55 77 34 66 31 43 36 47 91 12 52 45 41 16 58 60 79 49 84 67 22 20 93 53 46 94 82 38 37 7 9 80 81 98 21 88 33 6 8 28 48 75 65 78 30 51 92 13 4 17 25 85 89 86 40 61 11 42 10 1 14 69 23 90 96 0 19 35 59 74 73 99 24 71 64 87 68 95 83 54 76 26 15 3

Mutation test 2:

 Chromosome: fitness= 0.00, cities: 1 93 56 71 76 24 60 38 63 4 78 91 0 5 14 57 84 88 53 51 92 19 54 44 39 18 96 37 43 99 26 81 86 61 11 70 73 64 98 69 6 59 35 62 74 45 72 41 25 7 65 46 66 40 95 22 79 90 48 27 50 16 23 17 30 58 8 9 87 33 89

29 97 77 28 3 82 52 34 47 94 21 10 31 15 55 32 2 13 36 49 83 42 67 20 75 12 80
68 85

  Chromosome: fitness= 0.00, cities: 1 93 56 71 76 24 60 38 63 4 78 91 0 5 14 57 84
88 53 51 92 19 54 44 39 18 40 66 46 65 7 25 41 72 45 74 62 35 59 69 6 98 64 73
70 11 61 86 81 26 99 43 37 96 95 22 79 90 48 27 50 16 23 17 30 58 8 9 87 33 89
29 97 77 28 3 82 52 34 47 94 21 10 31 15 55 32 2 13 36 49 83 42 67 20 75 12 80
68 85

Mutation test 3:

  Chromosome: fitness= 0.00, cities: 90 54 56 75 6 43 40 1 21 70 17 68 78 23 38 59 29
45 76 96 13 60 85 24 57 28 48 97 49 32 65 15 86 61 27 39 67 80 20 63 66 64 94 95
11 9 10 83 99 26 5 46 53 35 0 47 41 93 8 51 73 58 84 3 14 44 77 12 98 91 42
52 33 19 25 79 34 2 22 72 18 55 89 16 71 92 62 31 74 30 87 4 50 82 37 69 36 88
 7 81

  Chromosome: fitness= 0.00, cities: 90 54 56 75 6 43 40 1 21 70 17 68 78 81 7 88 36
69 37 82 50 4 87 30 74 31 62 92 71 16 89 55 18 72 22 2 34 79 25 19 33 52 42 91
98 12 77 44 14 3 84 58 73 51 8 93 41 47 0 35 53 46 5 26 99 83 10 9 11 95 94
64 66 63 20 80 67 39 27 61 86 15 65 32 49 97 48 28 57 24 85 60 13 96 76 45 29 59
38 23

Crossover test 1:

  Chromosome: fitness= 0.00, cities: 78 55 67 11 61 19 95 22 31 40 28 33 84 49 46 44 2
79 98 13 36 92 60 68 34 0 16 80 1 30 59 53 58 97 51 54 93 35 24 26 4 45 42 86
91 56 63 88 69 57 47 90 50 15 32 18 77 27 23 76 48 5 83 38 43 85 81 94 14 10 71
37 20 72 21 82 65 89 8 70 29 12 25 96 99 39 62 52 17 66 41 64 73 74 7 3 9 75
87 6

  Chromosome: fitness= 0.00, cities: 15 40 19 81 69 47 50 5 27 43 82 95 61 87 36 94 57
80 59 2 31 4 48 41 76 33 0 25 3 53 74 18 1 49 7 10 96 90 83 32 72 68 46 54 89
17 14 93 62 16 75 39 6 86 26 23 22 9 8 77 56 60 99 73 91 55 30 92 98 45 13 63
12 44 35 84 65 88 70 38 66 78 20 64 79 21 85 71 34 67 52 37 29 11 97 42 51 28 58
24

  Chromosome: fitness= 0.00, cities: 15 40 19 81 69 47 50 5 27 43 82 95 61 87 36 94 57
80 59 2 31 4 48 41 76 33 0 3 53 74 18 1 49 7 10 90 83 32 72 68 46 54 89 17 14
93 16 75 6 86 26 23 22 9 8 77 56 60 73 91 55 30 92 98 45 13 63 44 35 84 65 88
38 66 78 20 64 79 21 70 29 12 25 96 99 39 62 85 71 34 67 52 37 11 97 42 51 28 58
24

Crossover test 2:

  Chromosome: fitness= 0.00, cities: 81 88 93 17 55 28 43 42 69 95 56 87 74 36 32 79 37
82 2 41 51 22 60 9 75 92 94 53 70 24 7 1 0 20 97 62 26 8 59 91 44 46 61 4 99
35 57 34 72 96 45 50 11 66 78 84 89 77 25 23 30 5 49 16 71 58 98 47 52 80 65 27
18 67 13 29 14 86 73 33 19 48 83 38 3 90 15 21 31 63 10 64 85 6 54 68 12 40 39
76

Chromosome: fitness= 0.00, cities: 42 84 65 31 58 51 61 37 92 52 32 94 62 73 53 71 21 75 12 18 3 36 10 93 9 28 55 44 40 34 74 49 97 20 82 95 77 81 1 30 17 86 78 15 11 80 41 46 57 43 6 98 67 33 54 4 16 2 19 39 0 27 5 96 87 85 25 90 88 23 8 76 68 83 7 69 72 29 48 89 45 63 64 70 50 59 79 14 99 24 38 35 13 26 66 91 56 22 47 60

Chromosome: fitness= 0.00, cities: 42 31 51 37 92 32 94 21 75 12 3 36 10 93 9 28 55 40 74 82 95 81 17 15 41 43 6 53 70 24 7 1 54 20 97 62 26 8 59 91 44 46 61 4 99 35 57 34 72 96 45 50 11 66 78 84 89 77 25 23 30 5 49 16 71 58 98 47 52 80 65 27 18 67 13 29 14 86 73 33 19 48 83 2 39 0 87 85 90 88 76 68 69 63 64 79 38 56 22 60

Crossover test 3:

Chromosome: fitness= 0.00, cities: 24 96 64 4 56 82 99 31 70 78 19 35 90 91 51 22 88 95 44 61 7 69 65 76 12 6 2 37 26 54 20 89 0 86 58 15 38 39 85 13 36 18 34 83 47 23 68 17 3 67 25 21 98 10 74 77 5 32 84 72 48 28 60 55 53 16 52 29 59 63 97 1 93 43 94 92 33 49 40 87 80 81 73 8 50 46 62 79 27 71 45 75 41 57 30 11 9 66 42 14

Chromosome: fitness= 0.00, cities: 85 86 46 43 83 89 69 59 58 53 10 28 42 55 48 12 9 72 23 25 32 67 65 5 37 13 82 11 76 14 34 41 87 0 66 44 8 31 47 68 62 97 4 22 27 95 16 2 74 39 18 7 30 52 33 56 60 73 49 57 99 1 92 94 26 6 29 54 35 19 24 91 45 21 93 70 96 81 77 64 17 51 38 88 63 79 15 71 61 3 20 36 84 50 80 90 98 40 78 75

Chromosome: fitness= 0.00, cities: 85 86 83 89 69 58 10 28 42 48 12 72 23 25 32 67 65 5 37 13 82 76 14 34 0 66 44 31 47 68 4 22 95 2 74 39 18 7 56 99 26 6 54 35 19 24 91 21 70 96 77 64 17 51 38 88 15 61 3 20 36 84 60 55 53 16 52 29 59 63 97 1 93 43 94 92 33 49 40 87 80 81 73 8 50 46 62 79 27 71 45 75 41 57 30 11 9 90 98 78

Exercise 2: Population evolution on a circle

Mutation rate: 0.100, Population size: 500

Generation: 0, population size: 500, Round-trip length: 4150.056, best 4150.056

Generation: 2, population size: 500, Round-trip length: 3956.987, best 3956.987

Generation: 8, population size: 500, Round-trip length: 3719.450, best 3719.450

Generation: 33, population size: 500, Round-trip length: 3413.822, best 3413.822
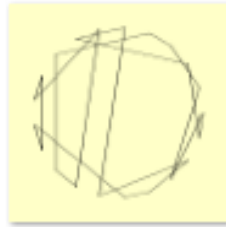
Generation: 150, population size: 500, Round-trip length: 3293.180, best 3293.180

route_0000_4150.
06.gif

route_0002_3956.
99.gif

route_0008_3719.
45.gif

route_0033_3413.
82.gif

route_0150_3293.
18.gif

Trying for only 500 generations did not satisfy me. I ran the same exercise for millions of generations, so that I confirm my solutions are getting better and my code has no memory leak.

Here are some other solutions from 10 million generations with over 8 hours of running time:
(Low Mutation)
Mutation rate: 0.010, Population size: 500
Generation: 0, population size: 500, Round-trip length: 4155.778, best 4155.778
Generation: 2, population size: 500, Round-trip length: 4068.617, best 4068.617
Generation: 3, population size: 500, Round-trip length: 4057.294, best 4057.294
Generation: 8, population size: 500, Round-trip length: 4047.540, best 4047.540
Generation: 9, population size: 500, Round-trip length: 3702.992, best 3702.992
Generation: 18, population size: 500, Round-trip length: 3699.827, best 3699.827
Generation: 21, population size: 500, Round-trip length: 3681.108, best 3681.108
Generation: 27, population size: 500, Round-trip length: 3540.602, best 3540.602
Generation: 64, population size: 500, Round-trip length: 3391.158, best 3391.158
Generation: 226, population size: 500, Round-trip length: 3367.616, best 3367.616
Generation: 357, population size: 500, Round-trip length: 3254.417, best 3254.417
Generation: 872, population size: 500, Round-trip length: 3217.742, best 3217.742
Generation: 968, population size: 500, Round-trip length: 3201.777, best 3201.777
Generation: 3326, population size: 500, Round-trip length: 3063.816, best 3063.816
Generation: 7908, population size: 500, Round-trip length: 2921.241, best 2921.241
Generation: 13721, population size: 500, Round-trip length: 2911.616, best 2911.616
Generation: 39148, population size: 500, Round-trip length: 2887.648, best 2887.648
Generation: 45565, population size: 500, Round-trip length: 2870.391, best 2870.391
Generation: 81345, population size: 500, Round-trip length: 2852.284, best 2852.284
Generation: 83761, population size: 500, Round-trip length: 2472.613, best 2472.613
Generation: 1805169, population size: 500, Round-trip length: 2366.641, best 2366.641

route_0000_4155.
78.gif

route_0002_4068.
62.gif

route_0003_4057.
29.gif

route_0008_4047.
54.gif

route_0009_3702.
99.gif

route_0018_3699.
83.gif

route_0021_3681.
11.gif
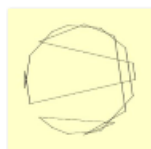
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route_0064_3391.
16.gif

route_0226_3367.
62.gif

route_0357_3254.
42.gif

route_0872_3217.
74.gif

route_0968_3201.
78.gif

route_3326_3063.
82.gif

route_7908_2921.
24.gif

route_13721_2911
.62.gif

route_39148_2887
.65.gif

route_45565_2870
.39.gif

route_81345_2852
.28.gif

route_83761_2472
.61.gif

route_1805169_23
66.64.gif

(High Mutation)

route_0000_4182. 39.gif	route_0001_3651. 76.gif	route_0005_3629. 03.gif	route_0022_3537. 43.gif	route_0054_3472. 36.gif	route_0061_3413. 41.gif	route_0063_3319. 39.gif
route_0135_3059. 34.gif	route_0286_3038. 62.gif	route_0534_3033. 92.gif	route_0602_2925. 51.gif	route_0603_2913. 96.gif	route_13968_2818 .21.gif	route_37766_2799 .40.gif
route_40828_2754 .82.gif	route_111070_275 3.84.gif	route_121503_267 7.04.gif	route_295761_265 1.03.gif	route_409312_258 7.04.gif	route_468661_254 2.93.gif	route_1134964_23 59.78.gif

Lowest distance ever calculated randomly is 2359.78 after 1 million generations.

Exercise 3: Population evolution on cities in France

In this exercise, run the experiments 3 times (with different random starting points) for each set of parameter values and provide all 3 results.

When exercise3.cpp is ran, the program will run each test 3 times. Then ask for user to press a button to start the next test until it is over. Results in the end are listed below.

Mutation rate

1. Mutation rate 0.01, Population Size 100

- Mutation rate: 0.010, Population size: 100

Generation: 0, population size: 100, Round-trip length: 3824.447, best 3824.447

Generation: 12, population size: 100, Round-trip length: 3676.095, best 3676.095

Generation: 14, population size: 100, Round-trip length: 3611.360, best 3611.360

Generation: 29, population size: 100, Round-trip length: 3494.644, best 3494.644

Generation: 56, population size: 100, Round-trip length: 3353.295, best 3353.295

Generation: 127, population size: 100, Round-trip length: 3340.187, best 3340.187

Generation: 128, population size: 100, Round-trip length: 3026.228, best 3026.228

- Mutation rate: 0.010, Population size: 100

Generation: 0, population size: 100, Round-trip length: 3917.614, best 3917.614

Generation: 1, population size: 100, Round-trip length: 3679.913, best 3679.913

Generation: 31, population size: 100, Round-trip length: 3564.594, best 3564.594

Generation: 43, population size: 100, Round-trip length: 3495.626, best 3495.626

Generation: 58, population size: 100, Round-trip length: 3492.025, best 3492.025

Generation: 74, population size: 100, Round-trip length: 3363.313, best 3363.313

- Mutation rate: 0.010, Population size: 100

Generation: 0, population size: 100, Round-trip length: 3312.831, best 3312.831

Generation: 48, population size: 100, Round-trip length: 3255.181, best 3255.181

2. Mutation Rate 0.1, Population Size 100

- Mutation rate: 0.100, Population size: 100

Generation: 0, population size: 100, Round-trip length: 3838.720, best 3838.720

Generation: 2, population size: 100, Round-trip length: 3757.135, best 3757.135

Generation: 13, population size: 100, Round-trip length: 3596.824, best 3596.824

Generation: 23, population size: 100, Round-trip length: 3297.351, best 3297.351

Generation: 146, population size: 100, Round-trip length: 3243.007, best 3243.007

Generation: 329, population size: 100, Round-trip length: 3002.941, best 3002.941

- Mutation rate: 0.100, Population size: 100

Generation: 0, population size: 100, Round-trip length: 4209.410, best 4209.410

Generation: 1, population size: 100, Round-trip length: 4103.241, best 4103.241

Generation: 2, population size: 100, Round-trip length: 3760.161, best 3760.161

Generation: 16, population size: 100, Round-trip length: 3504.625, best 3504.625

Generation: 46, population size: 100, Round-trip length: 3498.065, best 3498.065

Generation: 124, population size: 100, Round-trip length: 3347.527, best 3347.527

- Mutation rate: 0.100, Population size: 100

Generation: 0, population size: 100, Round-trip length: 4141.580, best 4141.580

Generation: 1, population size: 100, Round-trip length: 4127.036, best 4127.036

Generation: 2, population size: 100, Round-trip length: 3825.003, best 3825.003

Generation: 4, population size: 100, Round-trip length: 3809.046, best 3809.046

Generation: 5, population size: 100, Round-trip length: 3598.742, best 3598.742

Generation: 24, population size: 100, Round-trip length: 3558.459, best 3558.459

Generation: 67, population size: 100, Round-trip length: 3549.530, best 3549.530

Generation: 90, population size: 100, Round-trip length: 3497.596, best 3497.596

Generation: 195, population size: 100, Round-trip length: 3435.110, best 3435.110

Generation: 261, population size: 100, Round-trip length: 3354.628, best 3354.628

3. Mutation Rate 0.5, Population size 100

- Mutation rate: 0.500, Population size: 100

Generation: 0, population size: 100, Round-trip length: 3573.328, best 3573.328

Generation: 1, population size: 100, Round-trip length: 3353.388, best 3353.388

- Mutation rate: 0.500, Population size: 100

Generation: 0, population size: 100, Round-trip length: 4136.339, best 4136.339

Generation: 1, population size: 100, Round-trip length: 3920.241, best 3920.241

Generation: 3, population size: 100, Round-trip length: 3699.462, best 3699.462

Generation: 15, population size: 100, Round-trip length: 3504.663, best 3504.663

Generation: 24, population size: 100, Round-trip length: 3420.412, best 3420.412

Generation: 73, population size: 100, Round-trip length: 3136.760, best 3136.760

- Mutation rate: 0.500, Population size: 100

Generation: 0, population size: 100, Round-trip length: 4232.483, best 4232.483

Generation: 1, population size: 100, Round-trip length: 3863.837, best 3863.837

Generation: 2, population size: 100, Round-trip length: 3606.655, best 3606.655

Generation: 33, population size: 100, Round-trip length: 3540.311, best 3540.311

Generation: 64, population size: 100, Round-trip length: 3531.827, best 3531.827

Generation: 65, population size: 100, Round-trip length: 3332.326, best 3332.326

Generation: 299, population size: 100, Round-trip length: 3330.029, best 3330.029

Generation: 352, population size: 100, Round-trip length: 3223.159, best 3223.159

Population size

1) Mutation Rate 0.1, Population Size 10

- Mutation rate: 0.100, Population size: 10

Generation: 0, population size: 10, Round-trip length: 4370.539, best 4370.539

Generation: 11, population size: 10, Round-trip length: 4185.287, best 4185.287

Generation: 49, population size: 10, Round-trip length: 3942.199, best 3942.199

Generation: 91, population size: 10, Round-trip length: 3757.831, best 3757.831

Generation: 96, population size: 10, Round-trip length: 3442.273, best 3442.273

- Mutation rate: 0.100, Population size: 10

Generation: 0, population size: 10, Round-trip length: 4610.345, best 4610.345

Generation: 2, population size: 10, Round-trip length: 4583.774, best 4583.774

Generation: 3, population size: 10, Round-trip length: 4500.458, best 4500.458

Generation: 7, population size: 10, Round-trip length: 4494.708, best 4494.708

Generation: 15, population size: 10, Round-trip length: 4299.504, best 4299.504

Generation: 28, population size: 10, Round-trip length: 4198.314, best 4198.314

Generation: 72, population size: 10, Round-trip length: 4073.077, best 4073.077

Generation: 73, population size: 10, Round-trip length: 3999.342, best 3999.342

Generation: 75, population size: 10, Round-trip length: 3726.895, best 3726.895

- Mutation rate: 0.100, Population size: 10

Generation: 0, population size: 10, Round-trip length: 4216.372, best 4216.372

Generation: 5, population size: 10, Round-trip length: 3852.658, best 3852.658

Generation: 260, population size: 10, Round-trip length: 3673.550, best 3673.550

Generation: 261, population size: 10, Round-trip length: 3596.708, best 3596.708

Generation: 342, population size: 10, Round-trip length: 3429.687, best 3429.687

2) Mutation Rate 0.1, Population Size 50

- Mutation rate: 0.100, Population size: 50

Generation: 0, population size: 50, Round-trip length: 3977.523, best 3977.523

Generation: 1, population size: 50, Round-trip length: 3930.636, best 3930.636

Generation: 2, population size: 50, Round-trip length: 3804.345, best 3804.345

Generation: 8, population size: 50, Round-trip length: 3780.088, best 3780.088

Generation: 11, population size: 50, Round-trip length: 3648.863, best 3648.863

Generation: 67, population size: 50, Round-trip length: 3531.775, best 3531.775

Generation: 104, population size: 50, Round-trip length: 3524.486, best 3524.486

Generation: 144, population size: 50, Round-trip length: 3201.737, best 3201.737

- Mutation rate: 0.100, Population size: 50

Generation: 0, population size: 50, Round-trip length: 4278.855, best 4278.855

Generation: 1, population size: 50, Round-trip length: 3900.033, best 3900.033

Generation: 17, population size: 50, Round-trip length: 3874.219, best 3874.219

Generation: 19, population size: 50, Round-trip length: 3840.264, best 3840.264

Generation: 20, population size: 50, Round-trip length: 3704.030, best 3704.030

Generation: 60, population size: 50, Round-trip length: 3313.537, best 3313.537

- Mutation rate: 0.100, Population size: 50

Generation: 0, population size: 50, Round-trip length: 4196.970, best 4196.970

Generation: 1, population size: 50, Round-trip length: 4015.602, best 4015.602

Generation: 9, population size: 50, Round-trip length: 3994.775, best 3994.775

Generation: 11, population size: 50, Round-trip length: 3688.073, best 3688.073

Generation: 12, population size: 50, Round-trip length: 3502.827, best 3502.827

Generation: 13, population size: 50, Round-trip length: 3466.805, best 3466.805

Generation: 37, population size: 50, Round-trip length: 3418.312, best 3418.312

Generation: 378, population size: 50, Round-trip length: 3411.458, best 3411.458

Generation: 379, population size: 50, Round-trip length: 3236.156, best 3236.156

Generation: 446, population size: 50, Round-trip length: 3107.844, best 3107.844

Generation: 447, population size: 50, Round-trip length: 3040.318, best 3040.318

3) Mutation Rate 0.1, Population Size 100

- Mutation rate: 0.100, Population size: 100

Generation: 0, population size: 100, Round-trip length: 3711.531, best 3711.531

Generation: 10, population size: 100, Round-trip length: 3689.419, best 3689.419

Generation: 20, population size: 100, Round-trip length: 3626.800, best 3626.800

Generation: 35, population size: 100, Round-trip length: 3606.938, best 3606.938

Generation: 51, population size: 100, Round-trip length: 3349.400, best 3349.400

Generation: 144, population size: 100, Round-trip length: 3325.442, best 3325.442

- Mutation rate: 0.100, Population size: 100

Generation: 0, population size: 100, Round-trip length: 4179.768, best 4179.768

Generation: 1, population size: 100, Round-trip length: 4107.611, best 4107.611

Generation: 4, population size: 100, Round-trip length: 3970.176, best 3970.176

Generation: 6, population size: 100, Round-trip length: 3859.625, best 3859.625

Generation: 8, population size: 100, Round-trip length: 3764.572, best 3764.572

Generation: 27, population size: 100, Round-trip length: 3622.085, best 3622.085

Generation: 38, population size: 100, Round-trip length: 3612.584, best 3612.584

Generation: 60, population size: 100, Round-trip length: 3594.091, best 3594.091

Generation: 77, population size: 100, Round-trip length: 3027.271, best 3027.271

- Mutation rate: 0.100, Population size: 100

Generation: 0, population size: 100, Round-trip length: 3833.221, best 3833.221

Generation: 8, population size: 100, Round-trip length: 3779.688, best 3779.688

Generation: 14, population size: 100, Round-trip length: 3572.314, best 3572.314

Generation: 25, population size: 100, Round-trip length: 3189.725, best 3189.725

Generation: 280, population size: 100, Round-trip length: 3143.457, best 3143.457

Generation: 281, population size: 100, Round-trip length: 3141.755, best 3141.755

4) Mutation Rate 0.1, Population Size 500

- Mutation rate: 0.100, Population size: 500

Generation: 0, population size: 500, Round-trip length: 3739.768, best 3739.768

Generation: 5, population size: 500, Round-trip length: 3678.340, best 3678.340

Generation: 11, population size: 500, Round-trip length: 3598.372, best 3598.372

Generation: 19, population size: 500, Round-trip length: 3562.101, best 3562.101

Generation: 21, population size: 500, Round-trip length: 3519.375, best 3519.375

Generation: 22, population size: 500, Round-trip length: 3515.576, best 3515.576

Generation: 44, population size: 500, Round-trip length: 3499.493, best 3499.493

Generation: 54, population size: 500, Round-trip length: 3490.706, best 3490.706

Generation: 56, population size: 500, Round-trip length: 3427.179, best 3427.179

Generation: 69, population size: 500, Round-trip length: 3360.302, best 3360.302

Generation: 70, population size: 500, Round-trip length: 3194.799, best 3194.799

Generation: 78, population size: 500, Round-trip length: 3147.620, best 3147.620

- Mutation rate: 0.100, Population size: 500

Generation: 0, population size: 500, Round-trip length: 3704.186, best 3704.186

Generation: 1, population size: 500, Round-trip length: 3668.261, best 3668.261

Generation: 3, population size: 500, Round-trip length: 3634.418, best 3634.418

Generation: 4, population size: 500, Round-trip length: 3594.118, best 3594.118

Generation: 6, population size: 500, Round-trip length: 3191.056, best 3191.056

Generation: 81, population size: 500, Round-trip length: 3131.314, best 3131.314

Generation: 418, population size: 500, Round-trip length: 2922.524, best 2922.524

- Mutation rate: 0.100, Population size: 500

Generation: 0, population size: 500, Round-trip length: 3709.467, best 3709.467

Generation: 1, population size: 500, Round-trip length: 3657.338, best 3657.338

Generation: 3, population size: 500, Round-trip length: 3546.251, best 3546.251

Generation: 6, population size: 500, Round-trip length: 3520.477, best 3520.477

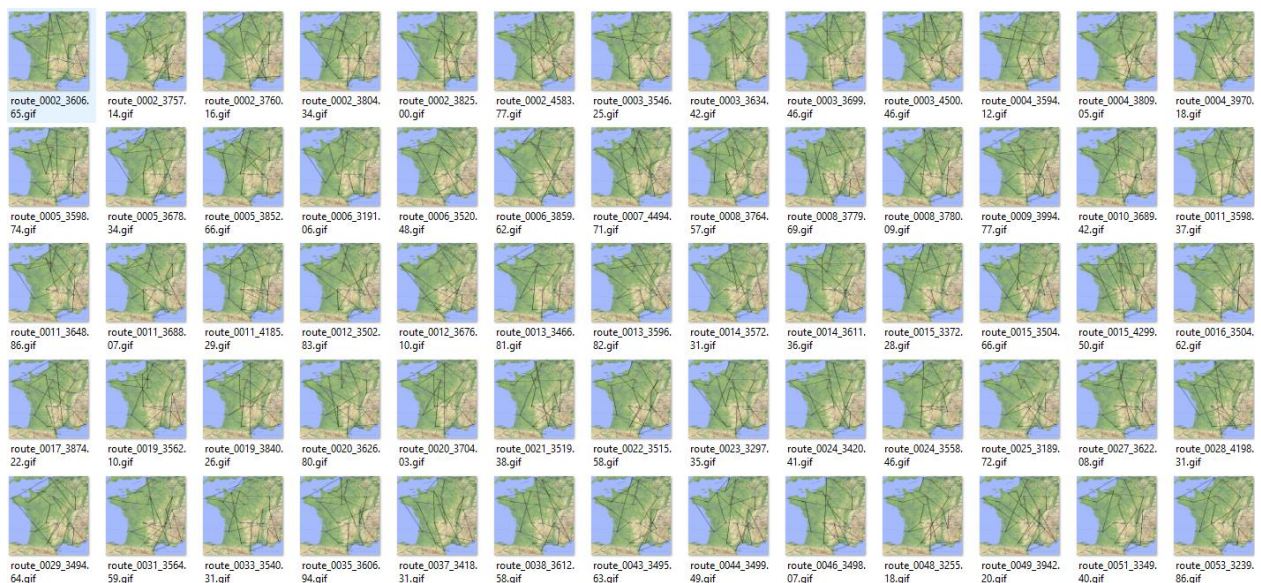Generation: 15, population size: 500, Round-trip length: 3372.283, best 3372.283

Generation: 53, population size: 500, Round-trip length: 3239.863, best 3239.863

Generation: 217, population size: 500, Round-trip length: 3229.550, best 3229.550

Generation: 310, population size: 500, Round-trip length: 3188.354, best 3188.354

More population size brings more mutation to occur even on the same mutation ratio. And more mutation brings the possibility of better crossovers, which leads to more improvement steps (around almost one every 50 generations till 500).

Overview of all routes found during the experiment 3:

Best route

My best solution was found in the test of Mutation rate: 0.100, Population size: 500 on the 418th generation with the minimum distance of 2922.524.

Log:
Generation: 418, population size: 500, Round-trip length: 2922.524, best 2922.524

Image: route_0418_2922.52.GIF