Genetic Algorithm
MALIS

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1 Chromosome genetic operators

Mutation Test

```
Mutation test 0:
  Chromosome: fitness= 0.00, cities:   3   5   4   2   0   1
  Chromosome: fitness= 0.00, cities:   3   5   4   0   2   1
                                                   ^   ^

Mutation test 1:
  Chromosome: fitness= 0.00, cities:   3   2   4   1   5   0
  Chromosome: fitness= 0.00, cities:   3   2   4   0   5   1
                                                   ^       ^

Mutation test 2:
  Chromosome: fitness= 0.00, cities:   3   4   0   2   5   1
  Chromosome: fitness= 0.00, cities:   3   4   0   1   5   2
                                                   ^       ^

Mutation test 3:
  Chromosome: fitness= 0.00, cities:   3   4   5   1   2   0
  Chromosome: fitness= 0.00, cities:   3   4   5   1   0   2
                                                       ^   ^
```

Crossover Test

```
Crossover test 0:
  Chromosome: fitness= 0.00, cities:   2   0   3   5   1   4
  Chromosome: fitness= 0.00, cities:   2   5   0   3   4   1
  Chromosome: fitness= 0.00, cities:   2   0   3   5   4   1
                                       ^           ^
Crossover test 1:
  Chromosome: fitness= 0.00, cities:   3   5   2   4   1   0
  Chromosome: fitness= 0.00, cities:   2   0   3   1   4   5
  Chromosome: fitness= 0.00, cities:   0   5   2   4   1   3
                                           ^           ^
Crossover test 2:
  Chromosome: fitness= 0.00, cities:   4   1   2   0   3   5
  Chromosome: fitness= 0.00, cities:   3   0   4   1   2   5
  Chromosome: fitness= 0.00, cities:   4   1   2   0   3   5
                                       ^                   ^
Crossover test 3:
  Chromosome: fitness= 0.00, cities:   3   1   2   0   4   5
  Chromosome: fitness= 0.00, cities:   3   2   0   5   4   1
  Chromosome: fitness= 0.00, cities:   3   1   2   0   5   4
                                       ^           ^
```

2 Population evolution on a circle

```
Mutation rate: 0.100, Population size: 100
Generation:     0, length: 4400.545, best 4400.545
Generation:     1, length: 3858.581, best 3858.581
Generation:     6, length: 3285.575, best 3285.575
Generation:     9, length: 3250.057, best 3250.057
Generation:    21, length: 3245.444, best 3245.444
Generation:    26, length: 3147.703, best 3147.703
Generation:    28, length: 2938.125, best 2938.125
Generation:    36, length: 2930.445, best 2930.445
Generation:    42, length: 2593.538, best 2593.538
Generation:   214, length: 2549.924, best 2549.924
Generation:  2188, length: 2469.794, best 2469.794
Generation:  2886, length: 2465.225, best 2465.225
Generation:  3035, length: 2459.436, best 2459.436
Generation:  3040, length: 2160.005, best 2160.005
Generation:  3047, length: 2150.879, best 2150.879
Generation:  9724, length: 2138.629, best 2138.629
Generation: 12340, length: 2017.892, best 2017.892
Generation: 53563, length: 1939.148, best 1939.148
Generation: 91516, length: 1936.308, best 1936.308
Generation: 96079, length: 1820.814, best 1820.814
```

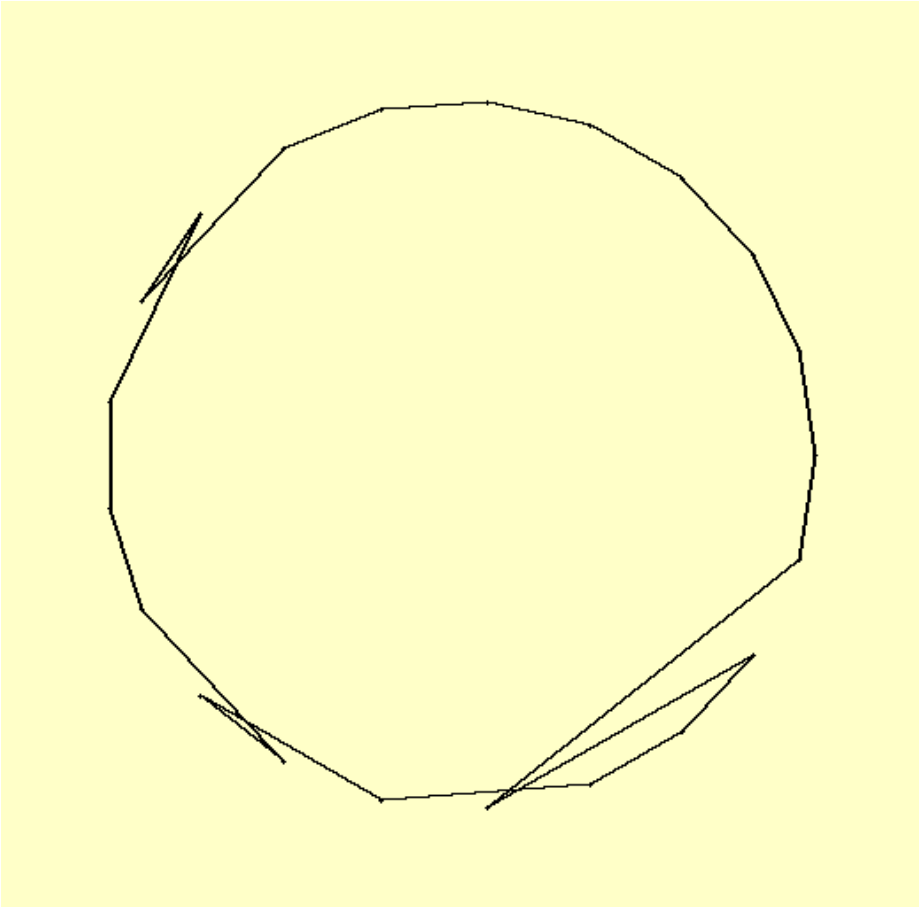

Figure 1: Best result after 96079 generations

3 Population evolution on cities in France

In the next table, we will report the best result out of three runs of every combinations between mutation rate and population size (the complete dump of the experiment can be found in the `./result/` directory).
As result, it seems that the best combination in our case is the one with a population size of 10 and a mutation rate of 0.01%. In general, according to these results, increasing the population size doesn't heavly change the final result; on the contrary, decreasing mutation rate, the overall performance seems to increase.

Table 1: Results using different combinations of mutation rate (columns) and population size (rows)

	10	**50**	**100**	**500**
0.01	1944	1962	2013	1983
0.1	2076	2159	2117	2144
0.5	2264	2259	2296	2217

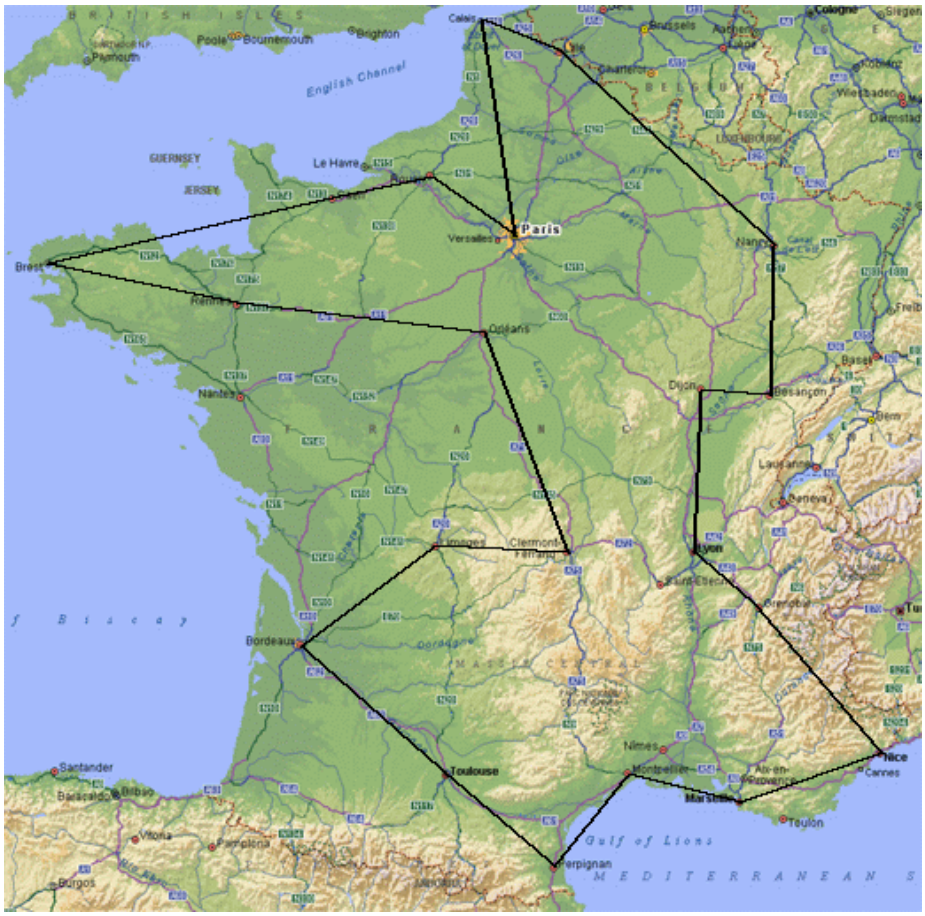

Figure 2: Best result out of 36 different run with 12 different combinations of parameters