Evolutionary Computation Theory and Application Assignment 2: Traveling Salesman Problem

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1 Parameter used for solution

Parameter	**Value**
Population size	50
Crossover Rates	0.01, 0.1, 0.99, **0.98**
Mutation Rates	0.01, 0.1, 0.99, **0.25**
Repetitions	30
Generations	1000
Average best fitness	59.2327
Best fitness	55.8960
Plot	Figure 4 and 6

Table 1: Parameters for Experiments

Parameter	**Value**
Population size	100
Fitness	50.7048
Generations	3000
Crossover rate	0.99
Mutation rate	0.1
Map image	Figure 1 and 5

Table 2: Parameters for Absolute best result

2 Results

Figure 1: Absolute best map

2.1 Different crossover rates

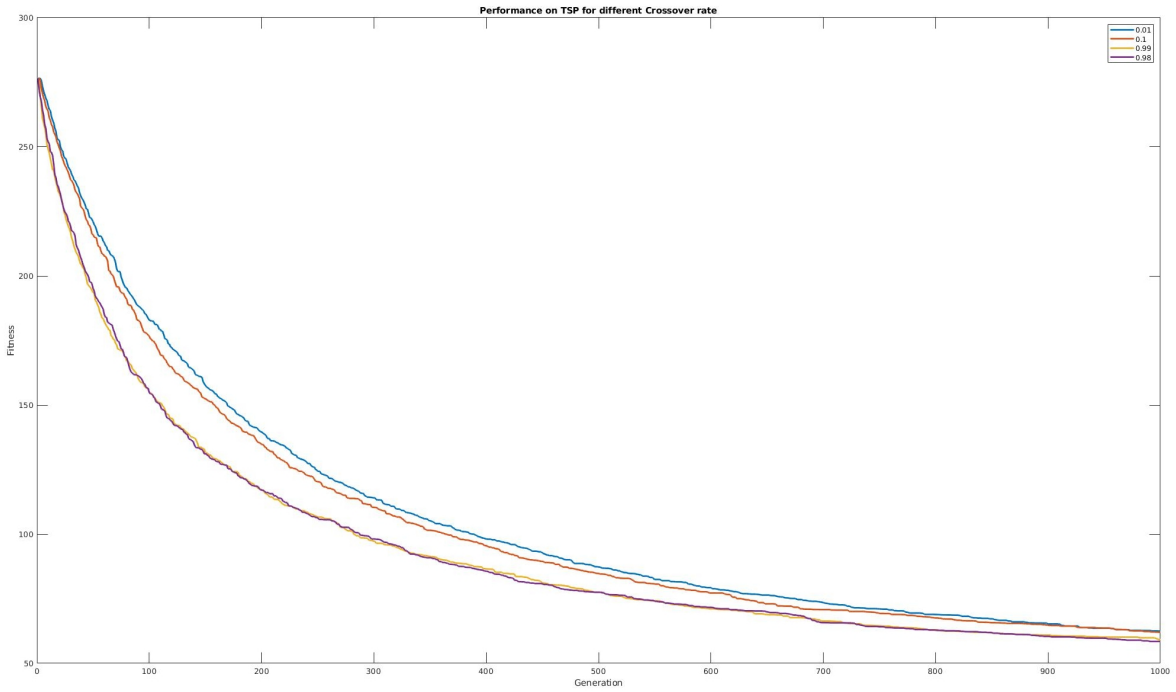

Figure 2: Crossover rate comparision

- We perform single point crossover.
- We choose `sp` individuals and select one with best fitness as father. We choose the mother in the same way.
- We select a `crossPoint` at random and select `1:crossPoint` genes from father's genotype and remaining available genes are added in the order in which they appear in mother's genotype.
- We have discovered that crossover rate of 98% performs best over 1000 generations.
- As the crossover rate increases, the means fitness becomes better and better. This is expected, because when the rate is high, the child will have higher chance of being better than its parents but when the rate is low, child will probably be just a copy of father.
- As it is seen in Figure 2, 98% crossover rate experiment performs almost same with 99% but slightly better at the very end of 1000 generations.

2.2 Different mutation rates

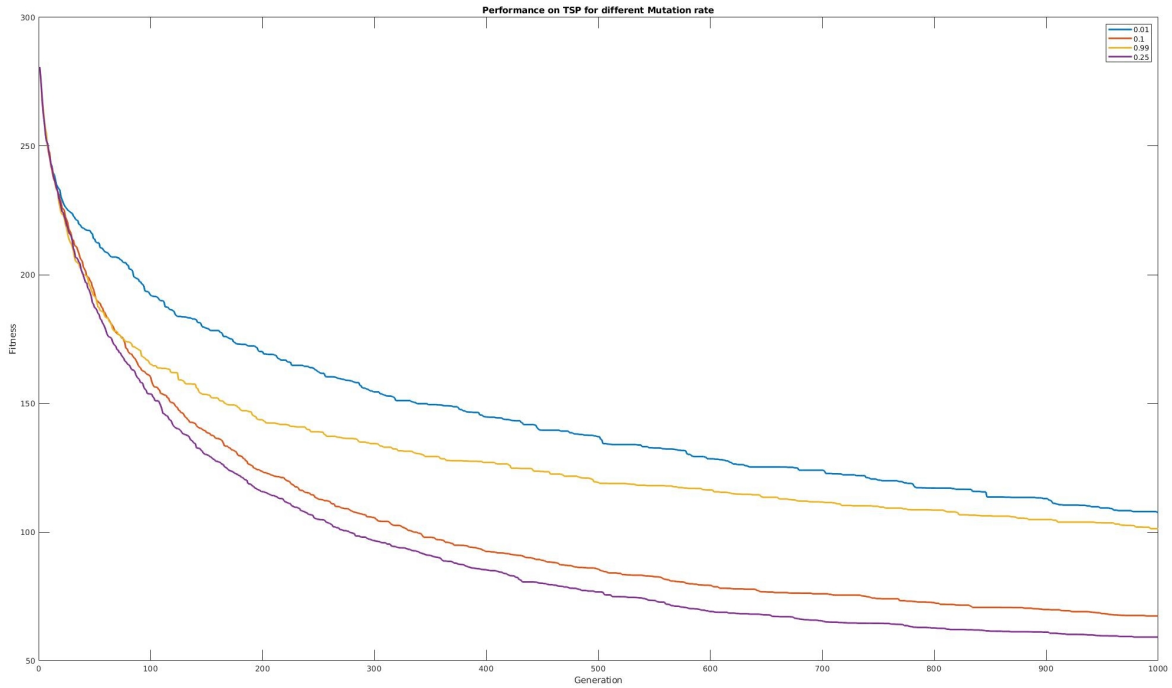

Figure 3: Mutation rate comparision

- We perform *partial shuffle mutation*.
- We mutate an individual with `mutProb` probability.
- We select two points *i,j*. We reverse the gene string between i and j and retain the parts of the gene string before i and after j.
- We have discovered that mutation rate of 25% performs best over 1000 generations.
- From the experiment the choice of mutation rate of 25% seems to be optimal over 1000 generations. If the rate is higher than 25% then it disrupts the progress made till that generation and if it is lower than 25% then it doesn't edit the gene string enough to show substantial progress.
- As seen from Figure 3, mutation rate of 25% performs best from the beginning till end of 1000 generations.

2.3 Best and median fitness variation over 30 experiments

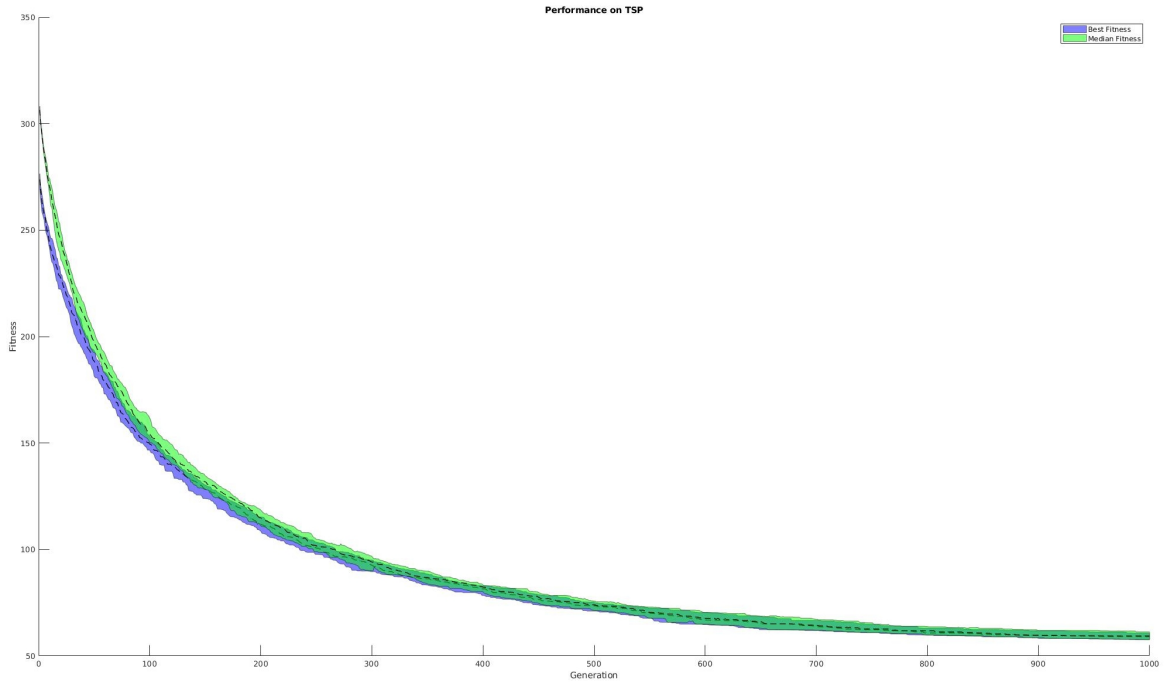

Figure 4: Best and median fitness over 30 Experiments

3 Comparision between absolute best for different generation

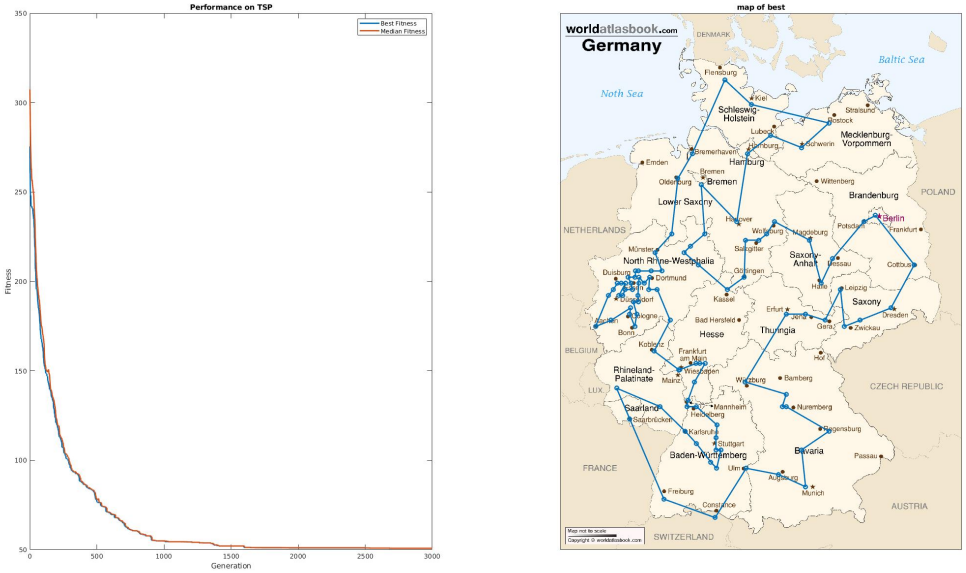

Figure 5: Plot and map for experiment over 3000 generations

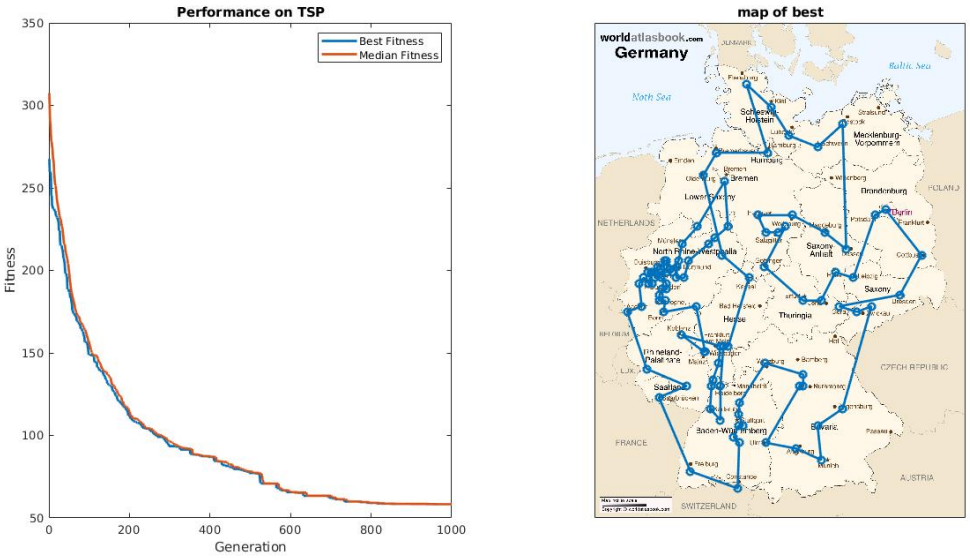

Figure 6: Plot and map for experiment over 1000 generations