

# Experiments with Travelling Salesman Problem

```
clear;  
cities = importdata('cities.csv');  
nGenes = length(cities.data);
```

## Experiment 1

Mutation: Use random swapping of cities when mutating Recombination: Use one point crossover

```
p(1).maxGenerations = 3000;  
p(1).populationSize = 20;  
p(1).crossoverRate = 0.9;  
p(1).mutationRate = 1/nGenes;  
p(1).nSpecies = p(1).populationSize/4;  
p(1).useSpeciation = true;  
p(1).useRandomMutation = true;  
p(1).useOnePointCrossover = true;  
p(1).cities = cities;  
name{1} = 'speciation random one point';
```

## Experiment 2

Mutation: Swap neighboured cities only when mutating Recombination: Use one point crossover

Speciation: kMeans

```
p(2) = p(1);  
p(2).useRandomMutation = false;  
p(2).useOnePointCrossover = true;  
name{2} = 'speciation neighbour one point';
```

## Experiment 3

Mutation: Use random swapping of cities when mutating Recombination: Use two point crossover

Speciation: kMeans

```
p(3) = p(1);  
p(3).useRandomMutation = true;  
p(3).useOnePointCrossover = false;  
name{3} = 'speciation random two point';
```

## Experiment 4

Mutation: Swap neighboured cities only when mutating Recombination: Use two point crossover

Speciation: kMeans

```
p(4) = p(1);  
p(4).useRandomMutation = false;  
p(4).useOnePointCrossover = false;  
name{4} = 'speciation neighbour two point';
```

## Experiment 5

Mutation: Swap cities randomly when mutating Recombination: Use one point crossover Speciation: none

```
p(5) = p(1);  
p(5).useRandomMutation = true;  
p(5).useOnePointCrossover = true;  
p(5).useSpeciation = false;  
name{5} = 'random one point';
```

## Experiment 6

Mutation: Use random swapping of cities when mutating Recombination: Use two point crossover Speciation: none

```
p(6) = p(1);  
p(6).useRandomMutation = true;  
p(6).useOnePointCrossover = false;  
p(6).useSpeciation = false;  
name{6} = 'random two point';
```

## Experiment 7

Mutation: Swap neighboured cities only when mutating Recombination: Use one point crossover Speciation: none

```
p(7) = p(1);  
p(7).useRandomMutation = false;  
p(7).useOnePointCrossover = true;  
p(7).useSpeciation = false;  
name{7} = 'neighbour one point';
```

## Experiment 8

Mutation: Swap neighboured cities only when mutating Recombination: Use two point crossover Speciation: none

```
p(8) = p(1);  
p(8).useRandomMutation = false;  
p(8).useOnePointCrossover = false;  
p(8).useSpeciation = false;  
name{8} = 'neighbour two point';
```

## Run Experiments

```
tic;  
for i=1:8  
    clear bestFitness medianFitness;  
    parfor run = 1:100  
        r(run) = doTsp(p(i));  
        bestFitness(run,:) = r(run).bestFitness;
```

```

        medianFitness(run,:) = r(run).medianFitness;
    end
    p(i).medianBestFitness = median(bestFitness,1);
    p(i).medianMedianFitness = median(medianFitness,1);
end
toc;

```

Elapsed time is 3543.332457 seconds.

## Plot Routes

```

for i=1:8 figure(i);clf;hold on; plotRoute(cities, r(i)); title(name{i}); end

```

## Plot Fitnesses

```

figure(1);clf;hold on;
for i=1:8
    lineHandles(i) = plot(-1*p(i).medianBestFitness, '-', 'LineWidth', 2);
    plot(-1*p(i).medianMedianFitness, '--', 'Color', get(lineHandles(i), 'Color'));
end
ylabel('travelled distance in km');
xlabel('generation');
legend(lineHandles, name, 'Location', 'NorthEast');
title('Method Effects');

```

