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 = 1000;
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
    tic;
    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);
    toc;
end
```

```
Elapsed time is 182.281613 seconds.
Elapsed time is 172.218165 seconds.
Elapsed time is 179.260724 seconds.
Elapsed time is 166.719061 seconds.
Elapsed time is 108.512545 seconds.
Elapsed time is 106.286748 seconds.
Elapsed time is 96.337086 seconds.
Elapsed time is 96.587862 seconds.
```

```
toc;
```

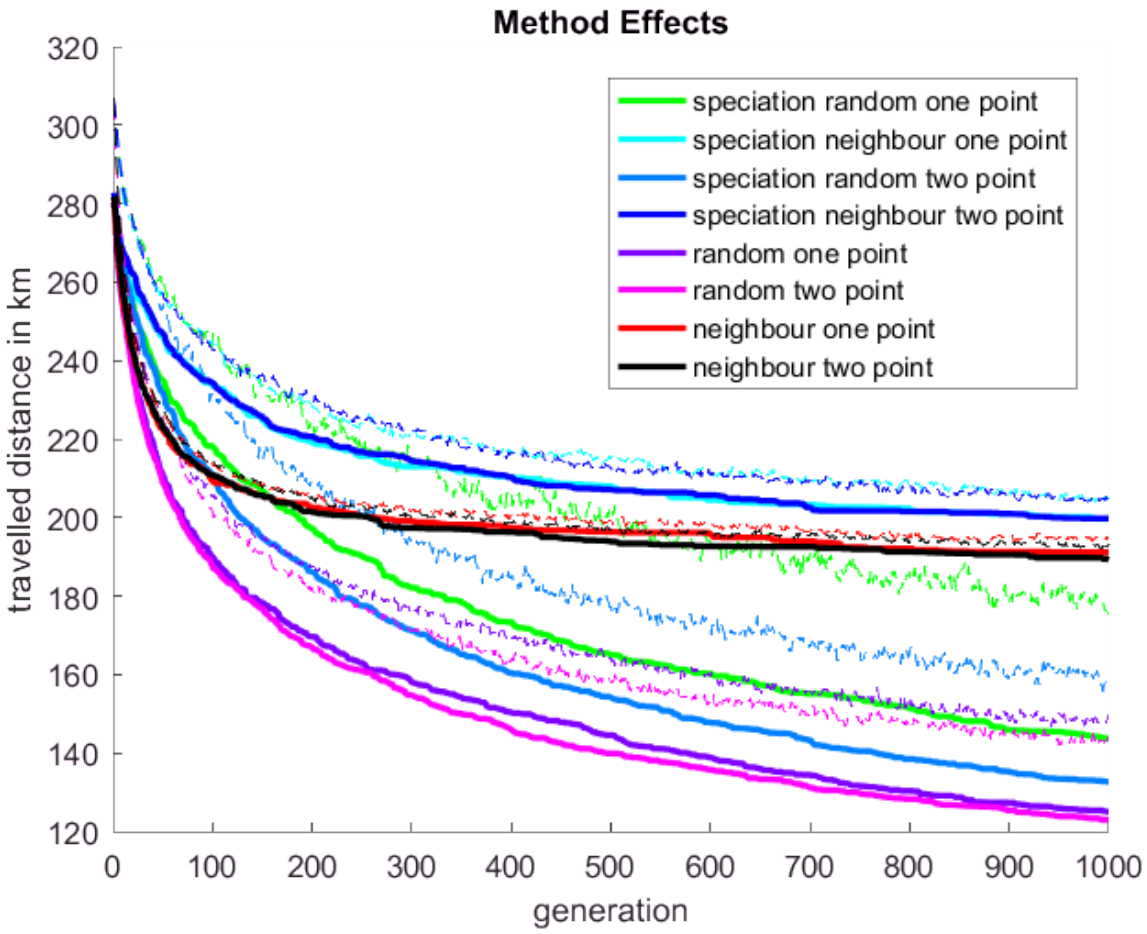
```
Elapsed time is 96.595433 seconds.
```

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;
% Helper Library for a better color distribution over plots
colorSet = varycolor(8);
for i=1:8
    lineHandles(i) = plot(-1*p(i).medianBestFitness,'-','LineWidth',2,'Color',colorSet(i,:));
    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');
```


Method Effects
speciation random one point
speciation neighbour one point
speciation random two point
speciation neighbour two point
random one point
random two point
neighbour one point
neighbour two point
travelled distance in km
generation
320
300
280
260
240
220
200
180
160
140
120
0
100
200
300
400
500
600
700
800
900
1000