

Assignment 3: The Travelling Salesman Problem- Computer Simulation

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Part 1: 30 random cities

a) Map of the initial guess



Figure 1.1

Figure of the initial path taken around the cities of the globe.

This Plot, as expected, is clearly flawed. The initial path taken around the globe is not optimal and this is reflected in the number large distance travelled before convergence, shown in figure 1.3

b) Map of the optimal route

Map of route taken around the globe



Figure 1.2

Plot of the optimal route to cities around the world.

Here we see the clear improvement in the path taken, which has most likely reached an optimal point. 51,000 iterations were used for this plot.

c) Plot of convergence versus iterations

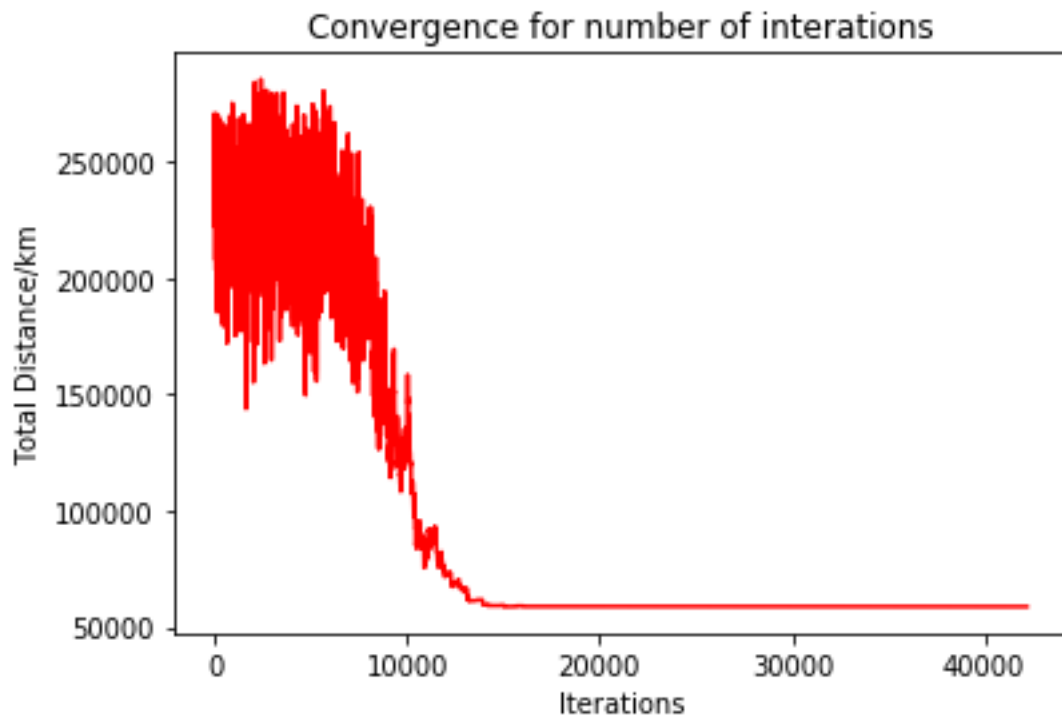


Figure 1.3

Plot of the convergence with iterations for cities around the world.

As expected, there is a high distance travelled for a small number of iterations. As the number of iterations is increased, the total distance travelled decreases to a minimum of just above 50,000km.

Part 2: Irish cities

a) Initial guess of route around Ireland

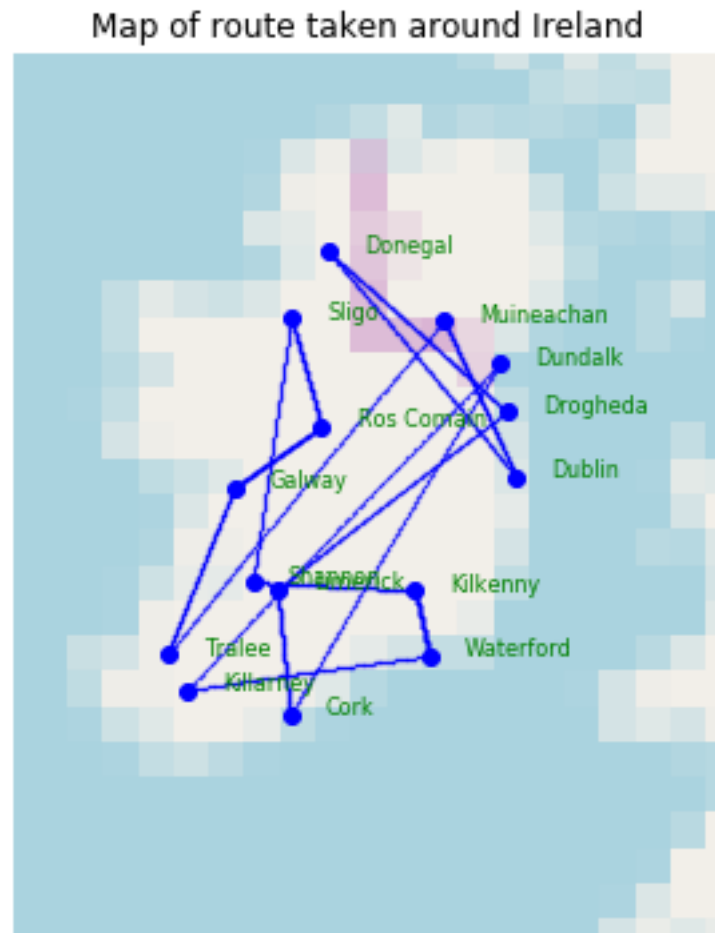


Figure 2.1

Plot of the initial path taken across Ireland

For these plots, x and y limits were imposed on the global map in order to produce a zoomed in image of Ireland. Here, a for loop was generated as shown below.

```
#for i in range(len(full_names)):
#    if country[i]=='Ireland':
#        path_names.append(full_names[i])
#        path_lats.append(full_lats[i])
#        path_lons.append(full_lons[i])
```

One will note that these commands have been commented out. This was done in order to plot purely the global map and the corresponding cities.

b) Plot of the optimal route taken around Ireland



Figure 2.2

Plot of the optimal path taken across Ireland

Here, the limits set on the global map are shown below. Again, one will note the use of comments in order to refrain from zooming in on Ireland when plotting the cities across the globe.

```
ax.plot(px1, py1, 'ob', ms=0.3)
#here we zoom in on Ireland
#plt.xlim(480,500)
#plt.ylim(345,320)
plt.title('Map of route taken around the globe')
return fig, ax
```

c) Plot of convergence versus iteration

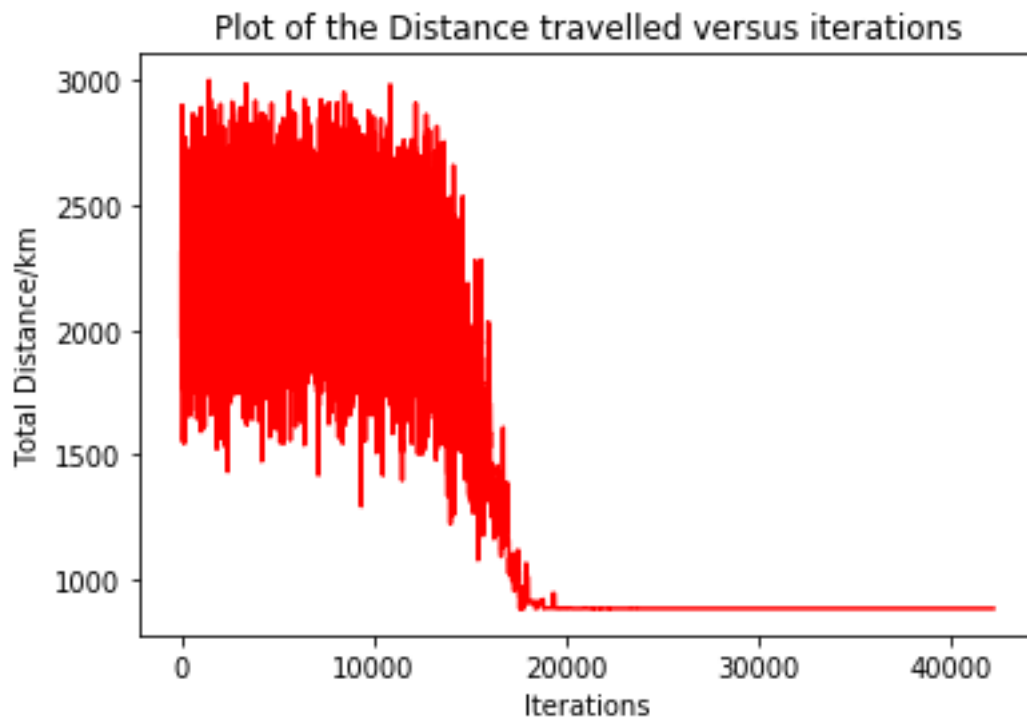


Figure 2.3

Plot of the convergence trend versus iterations for the path across Ireland

Here, the convergence for the paths taken around Ireland was plotted. One will note the y axis is of substantially smaller maximum value than that for the convergence plot of the globe. It takes just less than 20000 iterations to arrive at an optimal route around Ireland. Here, the distance travelled is less than 1000km.