Monte Carlo simulations 2004. Exercise 6

To be handed in Tue Apr 20, solutions given Thu Apr 22 10:15.

1. (30 p) You are a salesman or -woman who needs to sell 1 vacuum cleaner in 19 Finnish cities every day. You have a helicopter and free access to Finnish airspace at your disposal.

To manage this without being away too much from your family, you want to optimize your travel route. Hence you need to write an MC code to solve the traveling salesman problem for an arbitrary set of N points in 2D (since the number of cities may increase in the future, you want to have arbitrary N). The program should either (a) read in the points, (b) generate the points randomly in the unit square ([0,1],[0,1]) or (c) generate points randomly on the unit circle $r = 1$.

Use option (c) (where the right answer is obvious) and option (b) with very small N to test your program and optimize the annealing heat treatment scheme. When you are certain it works, apply it on the coordinates (in km) of the 20 largest Finnish cities given on the course home page.

If you travel by helicopter directly from one city to another at a speed of 300 km/h, and 20 minutes to sell one vacuum cleaner in each city, how long does it take for you to travel through all the cities and return home? Your home is in one of the cities given, but you do not need to sell a vacuum cleaner in your home city (all your neighbours have already bought one from you and will hate you if you try to peddle another one for them).

Report the distance travelled, time needed for your daily sales route, and send in the code. Describe in words how your annealing sequence works.

2. (2 p). What do you think of the business model in exercise 1?

Hint. In Unix, the command `xgraph -P positions.dat` can be easily used to plot the point positions and lines joining them. The file `positions.dat` should contain data in the form

x1 y1
x2 y2
x3 y3
...