Homework 07

All data files are provided at the class web page

Problem 1 (5 points)

Modify provided traveler salesman combinatorial algorithm to solve a slightly different problem. You are looking for the shortest route which goes through all cities, while starts and stops in the same city (first one), i.e. the close loop route.

Coordinates of cities are provided in
the 'cities_for_combinatorial_search.dat' file, find the shortest route. Use `load` command to import data to the matlab. First column of the data file is 'x' coordinate and second one contains 'y' coordinates. The coordinates of the start/end route city are in the first string.

What is the sequence of the cities to travel the shortest route?

What is the total length of the best route?

Problem 2 (10 points)

Implement Metropolis algorithm to solve above problem. Good way to obtain new test route is to randomly swap two cities along the route. Tweak the algorithm number of cycles, initial and final temperature (kT).

Compare this algorithm solution with the above combinatorial one.

Now load the cities coordinates from the 'cities_for_metropolis_search.dat' file. Find the shortest route for this cities.

What is the sequence of the cities to travel the shortest route?

What is the total length of the best route?

Problem 3 (5 points)

Load data from the 'hw7p3.dat' file. First column is 'x' and sencond is 'y'. Fit these data points with the model function

$$A \exp\left[-\left(\frac{x - x_0}{w}\right)^2\right]$$

where A is the peak amplitude , x_0 is the peak position, w is the peak width, and x is in depended variable.

Find fit parameters A, x_0, and w. Make plot of data points and fitted values, as well as plot of residuals, similarly to example provided during lecture.

Problem 4 (5 points)

You making speed detector based on the Doppler effect. You device detects dependence of the signal strength vs time, which recorded in the 'hw7p4.dat' file (first column is time and second is the signal strength).

Fit the data with

$$A\cos(\omega t + \phi)$$

where A, ω and ϕ are the amplitude, the frequency and the phase of the signal, and t is time.

Find fit parameters: the amplitude, the frequency and the phase of the signal.