

## Homework 23 (Simulated Annealing)

Please use simulated annealing which is a method of global optimization in the area of combinatorial optimization.

We will implement it both in the discrete domain on the problem of the traveling salesman.

Material for reading will include presentation of Numerical recipes.

Here you will run and document a code testing the traveling salesman problem with the number of cities being 20, 40, 100 and 200.

Compare CPU time and the constant discussed in class.

However, to prevent the system from becoming stuck in one of the local minima, uphill moves (ones with a positive change in energy) are accepted according to the Boltzmann probability distribution of  $P(E) = \exp(-\delta E/kT)$  where  $k$  is Boltzmann's constant,  $T$  is the temperature, and  $\delta E$  is the change in energy. Initially, it begins at a number that is chosen by the user. The temperature is then reduced in coordination with a temperature schedule. Usually, the temperature schedule is exponential, meaning  $T_{k+1} = a * T_k$ .

Please plot the best traveling salesman trajectory.

Also read documentation and explain flow chart of program annealf.f

b) You will find also a code for the continuous minimization of multimodal functions with continuous variables.

Please read fully attached documentation and explain the theory behind the algorithm.

Flowchart the code and try to plot the function.