AST 3162 - Spring 2014

METROPOLIS ALGORITHM

Due Date: 4/9/2014 @ 11:59 pm

- **Free-hanging necklace.** A necklace features 20 equal beads on a very light string that is suspended from both ends. Every bead can sag to any of the 20 discrete levels and thus decrease its potential energy by one unit per level. However, by doing that, it increases the spring energy to the neighbouring beads that is proportional to the square of the level difference. Calculate the shape of the necklace at different temperatures. Determine the equilibrium energy as a function of temperature. Plot a diagram showing the number of accepted steps as a function of temperature and the model coefficient.

- **Turbine optimization.** Determine the optimal positioning of turbine blades of masses $m1, m2, \ldots, m_N$ so that the center-of-mass is as close to the axis through the center of the turbine as possible. Test your program for 20 randomly chosen masses.

- **Travelling salesman problem.** As discussed in class, a salesman needs to figure out an optimal route between N addresses. Create an example topology (either randomly or by selecting some real data) and verify the robustness of the Metropolis algorithm by comparing its result to the actual lengths computed by brute force. Compare the time cost of both approaches for different number of visited cities.