Computational Physics II: Assignment 6

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1 BUFFON'S NEEDLE PROBLEM

Stredagy :

- For each substrates glass and KCl (100), following procedure will be repeated.
- For a simulation, a region $\pm d/2$ from a gap of strip is considered
- A generation of random number in $[0, d)$ determines a distance(a) between an end of needle position and the gap. In Fig 1.1, P point represents the end of needle.
- The other end of the need is in the circle given center P and radius needle length (l)

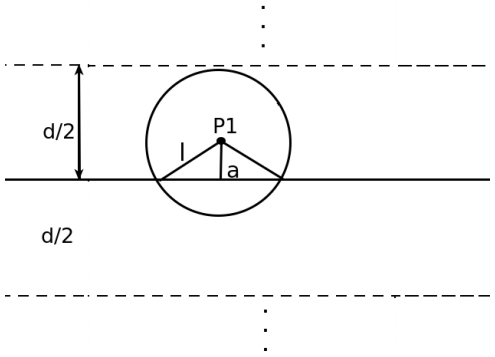

Figure 1.1

- Probability for the needle cross the gap with the point P(a) : $\cos^{-1}(a/l)/\pi$
- Total probabilty for the event, cross the gap by a dropped needle, is

$$\text{Prob}_{\text{needle cross}} = \sum \Theta(l - |a|)P(a) = \sum_i \Theta(l - |x_i - d/2|)\cos^{-1}(|x_i - d/2|/l)/\pi \quad (1.1)$$

Simulation results : As seen in Figure 1.2, high ratio l/d gives high posibilty to cross the gap as expected. When the ratio is close to zero, probability density fluctuates since divider is too small. As increasing the ratio to 0.5 , probability density seems to converge about 0.3. Ater then the probability density is decreased as the ratio is increased.

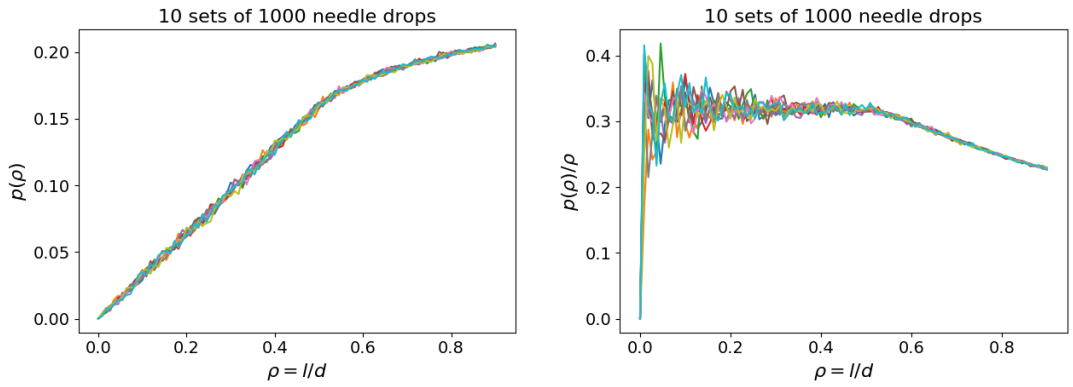

Figure 1.2: Simulation results

2 TRAVELLING SALESMAN: EXACT SOLUTION

The implement results for Travelling salesman with 3-9 cities are represented Figure 2.1 and Figure 2.2. The case with 2 cities is not simulated since one travel plan is possible. The simulstion perfomed with initial temperature as 1 to final temparture 0.001. Temperature steps are choosen with geometric progression. For each temperature steps, 10 times of city exchange are checked with Metropolis algorithm. Most of case, travelling path is converged $T > 0.01$. The final travelling plans by the simulation are given in Figure 2.2.

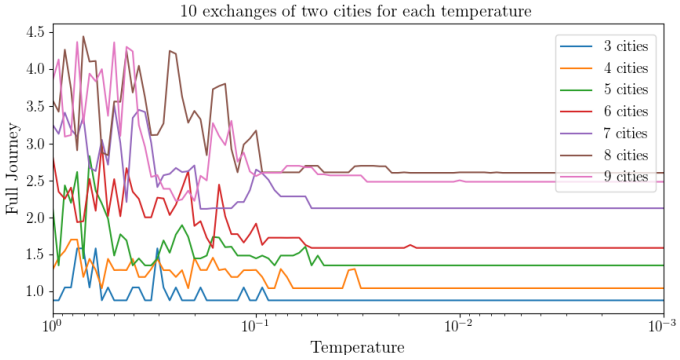

Figure 2.1: Salesman simulation with metropolis algorithm as decreasing temperature

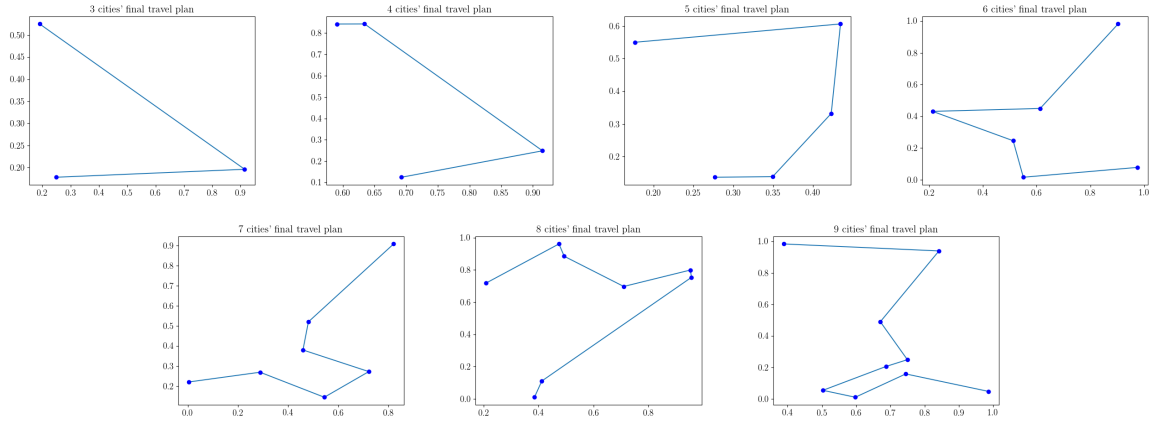

Figure 2.2: Optimized travel plan of salesman problem with metropolis algorithm as decreasing temperature