

Statistical physics 2, homework 3

Write a Monte-Carlo simulation code for the Ising model. Please follow the steps below:

1. Use a square lattice of size $L \times L = 10 \times 10$
2. Use periodic boundary conditions. Hint: $(i + 1)\%L$ is the right, $(i + N - 1)\%L$ is the left neighbour
3. Assign each lattice a random spin of ± 1
4. The Hamiltonian is the following:

$$\mathcal{H} = -K \sum_{\langle i,j \rangle} \sigma_i \sigma_j - h \sum_i \sigma_i,$$

where the summation runs for nearest neighbours.

5. Set the following parameters: $K = 1$, $h_B T = 5$.
6. One Monte Carlo timestep consists of $L \times L$ elementary step in which a spin is chosen randomly and flipped according to the Metropolis probabilities
7. Measure the average magnetization for values of h in the range $h \in [0 : 10]$
8. Plot the $M-h$ curve
9. Measure the susceptibility on the linear part of the $M-h$ curve (simulate with small enough h)
10. Verify the susceptibility from the fluctuations of the magnetization

You may ask others for help in programming but it should be an independent work. Please submit a zip file with a pdf containing the results and you source code to torok72@gmail.com.