Computational Physics: Problem Set 11

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1 Init() Function

This function takes the size of the matrix, the temperature and J as input, then it returns a matrix filled with randomized numbers and also returns an array with the calculated probability states which we will use later to reduce run time.

2 energy() function

This function takes the coordinates of an element in the matrix then, the matrix, the size of the matrix and the array of probabilities as input, then it calculates the change in energy by flipping the spin of that element and returns a value of probability from the pre-calculated array.

3 step() function

This function takes the probability, the matrix and the matrix size as input, then applies using the metropolis rule, it advances the system by one step and returns the resulting matrix.

4 Main Loop

The main loop is simple and its just a for loop that advances the state of the system by a number of steps. The results are as follows:

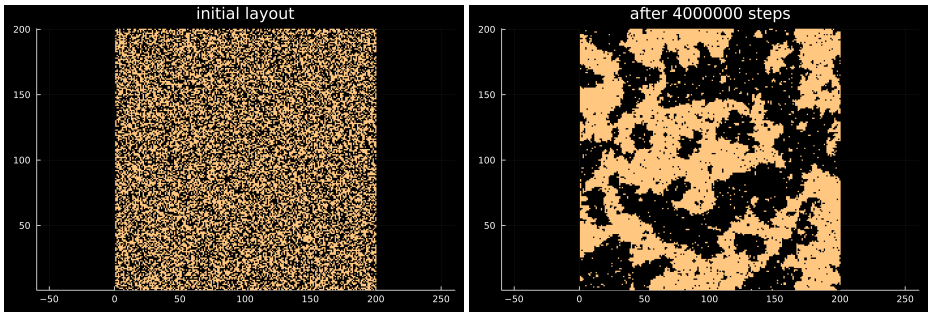

Figure 1: How the matrix changes after a number of steps.

5 magnetization() function

The magnetization parameter is defined as below:

$$M = \sum_i \sum_j M[i, j]$$

The magnetization function takes the matrix and the matrix size as input, then it returns the value of magnetization as output. By running the simulation for four different array sizes over multiple runs and averaging, we get the following.

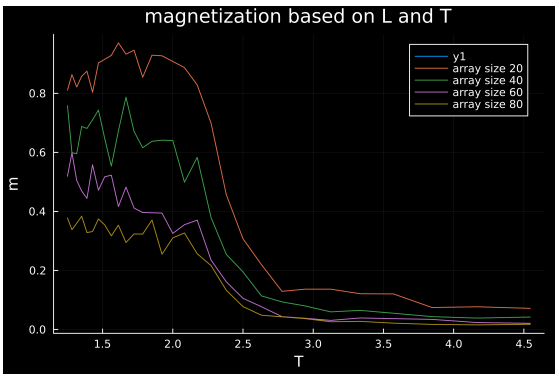

Figure 2: Magnetization for multiple matrix sizes.