Question 1.

Python code (Lab11Q1.py) has been attached.

Question 2.

Python code (Lab11Q2.py) for this question’s been attached.

Question 3.

The total spontaneous magnetization can be either positive or negative from the MC-simulation results, see below plots. At set temperature, the total spontaneous magnetization is around . The reason is, spin up or spin down has equal physical meaning here. Either positive or negative, the total magnetization shows a ferromagnetization.





Question 4

Python code for this question which is modified from question 2 has been attached.

DynamicLattice.py provides animation for the lattice evolution in the monte-carlo simulation.

At low temperature, the lattice is ferromagnetic, the simulation ends up with “all black” or “all white” pattern. At higher temperature, the ferromagnetism disappears, the lattice pattern looks like a QR code pattern.