

Exercise 7: The Ising model

The Ising model is a model of ferromagnetism. It is a lattice of spins, each of which can be either up or down. The spins interact with their nearest neighbors, and the energy of the system is given by.

Part D

Upon simulating 100 times at $T = 1$, the magnetization developed was positive 53 times and negative 47 times. This is consistent with our expectation that the magnetization does not prefer a direction.

Part E

As the temperature increases (i.e., $T = 2, 3$), the magnetization developed hovers around 0, i.e., the Curie temperature of the system is between 1 and 2. This does not mean, however, that the energy is also zero. The spatial distribution of the spins can be such that the magnetization is 0 but the energy is negative (i.e., domain structure).