**2D ISING square and triangular lattices**

Consider a **2-D Ising model with only nearest-neighbor inte**raction but with the possibility of altering the sign of the interaction, i.e. making it ferromagnetic or antiferromagnetic.

Consider the **square** (already done in class; use this case to test your codes) and **triangular** lattice. Consider the temperature in UNITS of INTERACTION. Use periodic boundary conditions.

**1) Simulations of the ferromagnetic case**

For each lattice, perform Metropolis MC simulations for numerous temperatures and plot E, M, c v ,χ versus T. Determine the approximate transition temperature Tc . Show a snapshot of the spin lattices at the critical temperatures.

Hint: a) A plot of E vs. T is not enough to have an estimate of Tc for some lattices. Why?

b) For each type of lattice, you you should consider a few increasing sizes L of the simulation box. (use at least L= 4, 8, 15, 16, 32)

**2) Simulations of the antiferromagnetic case**

For this case, consider only the square and the triangular lattice.

What happens between odd and even values of L? (e.g., what do you see using L= 4, 8, 15, 16, 32 ?)

**3) Calculations of the spatial correlation function**.

For the square lattice only, calculate the correlation function in dependence of the distance r to the spin spin(0) , i.e.:

|  |
| --- |
| spin(r) =<  spin(r)spin(0) >   <  spin >2  |

Calculate it for the critical temperature and for a few temperatures below and above it. How does it looks like?

At the critical temperature you should be able to fit it with a decreasing exponential, and find the correlation length. How much is it? Are you able to estimate the correlation length also at other temperatures?