Lab-18

1. Q1. Consider the 2 D X Y model on a square lattice. The Hamiltonian is H = -J $\sum_{<ij>} \cos(\theta_i - \theta_j)$(you can take J to be 1, which basically means we will be measuring all energies in the problem in units of J), where $\{\theta_i\}$ are angles describing the orientation of the spins in the XY plane and can take values lying between 0 and 2π. Set up a Monte-Carlo simulation using Metropolis algorithm to study the thermodynamics of this system and find the variation of the following quantities with temperature/field:

   Energy per particle u $= \frac{<E>}{N} Vs. k_B T$ Specific heat, $\frac{c_v}{k_B} Vs. k_B T$. Note that $\frac{c_v}{k_B} = \frac{1}{N^2}(< E^2 > - < E >^2)\beta^2$

   Few notes:

   Find the averges for temperatues [0.1:0.2:2]. After ensuring the code is giving reasonable results run for a 30×30 lattice for 50,000 MC runs at each temperature.