PHY 68/118 - Computational Physics Project 3

Micah Baum, Parker Chandik, Kinan Rabbat, Sam J. Rayev

Hi! Here's a quick readme to describe what the different programs do, as well as some pictures to highlight certain results we found interesting.

Adjacency data stored via array indexing:

- `demo.py` was an initial attempt at having a working Metropolis simulation, and we did get it working, but to allow for more diverse lattice types, we moved on to `demo2.py`

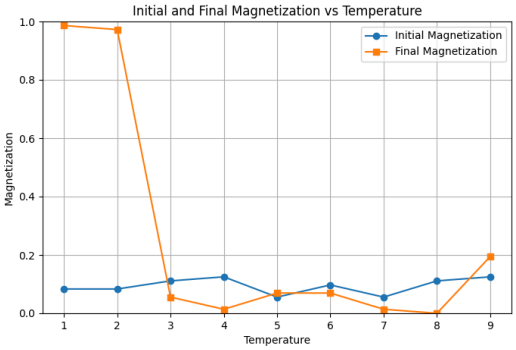
Adjacency data stored in a list of neighbors:

- `demo2.py` simulates both square and triangular lattices. It can produce plots of initial vs final magnetizations at various temperatures, as well as depictions of the lattices visually if desired.

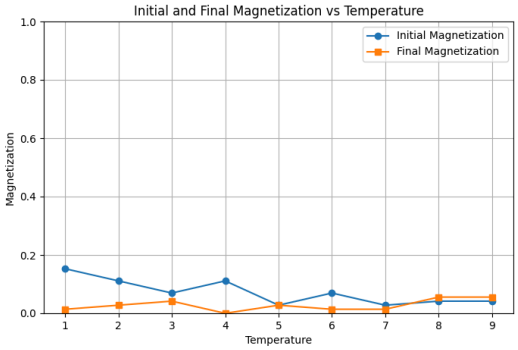
Adjacency data stored in an adjacency matrix:

- `LatticeNeighborsSim.py` was where we tested out use of an adjacency matrix, as well as plotting of the data
- `Square_and_triangle.py` is largely a reimplementation of LatticeNeighborsSim.py, which also enables triangular matrices. There is some functionality for hexagonal matrices in it, but it is not currently complete/functioning as desired.

Initial and Final Magnetizations at Different Temperatures

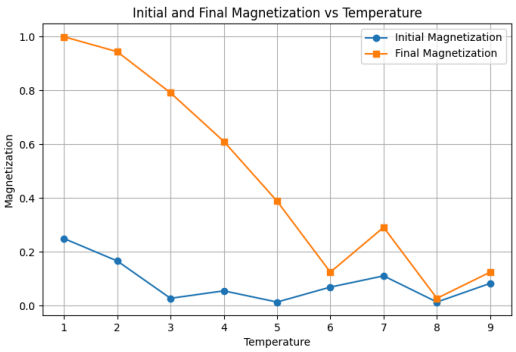


Ferromagnetic

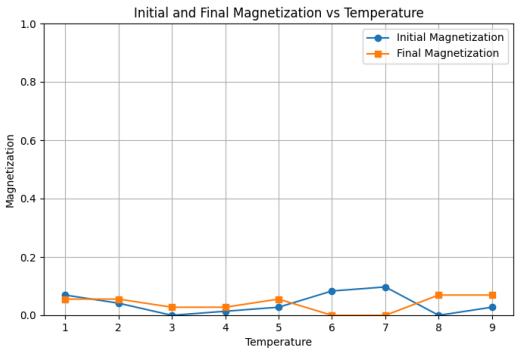


Antiferromagnetic

Figure 1: Square Lattice



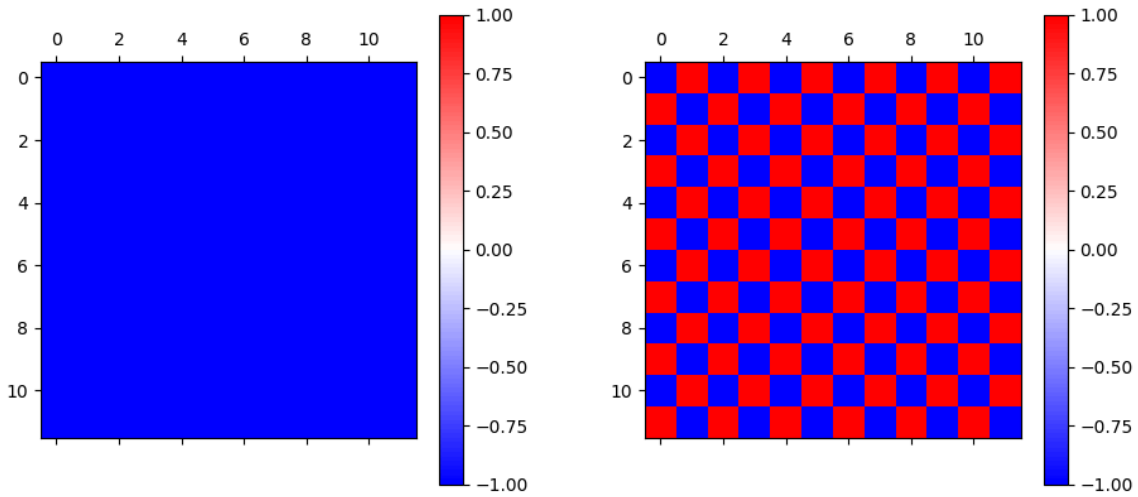
Ferromagnetic



Antiferromagnetic

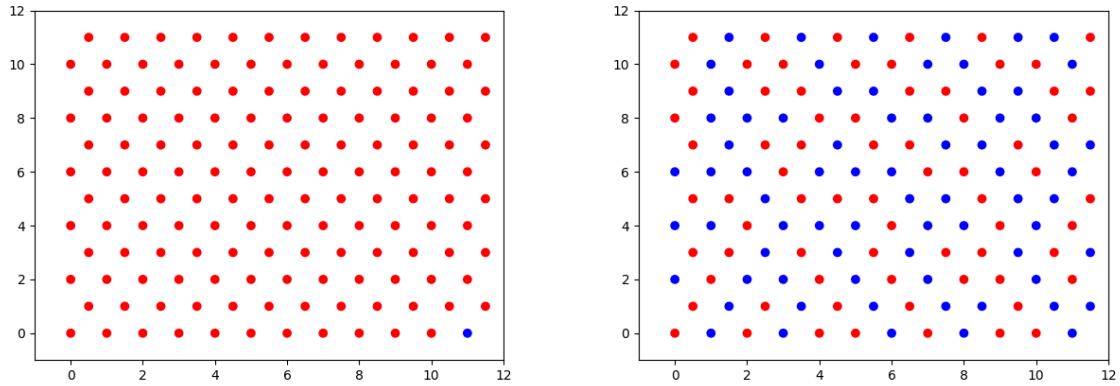
Figure 2: Square Lattice

Final Magnetization of Ferromagnets and Antiferromagnets



Ferromagnetic Antiferromagnetic

Figure 3: Square Lattice



Ferromagnetic Antiferromagnetic

Figure 4: Square Lattice