

Ising Model (1D spin system)

Observation

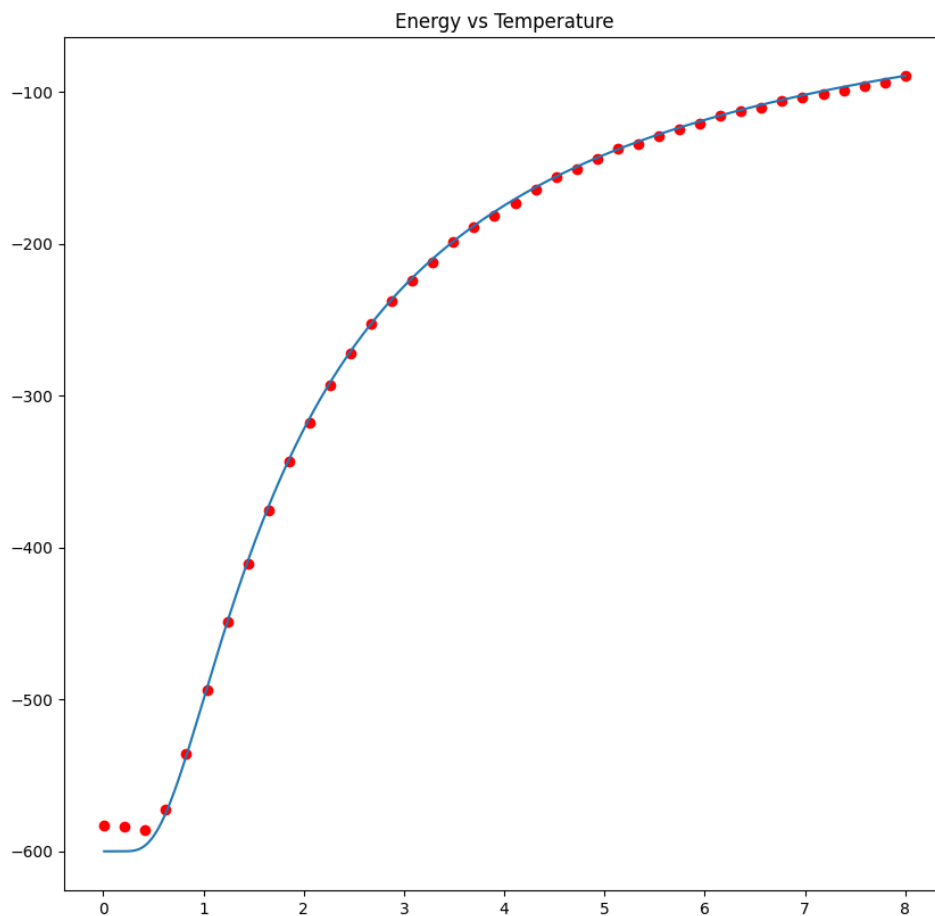
Overall we observe that :-

- Energy increases with temperature.
- Magnetization decreases with temperature.

More explanation :-

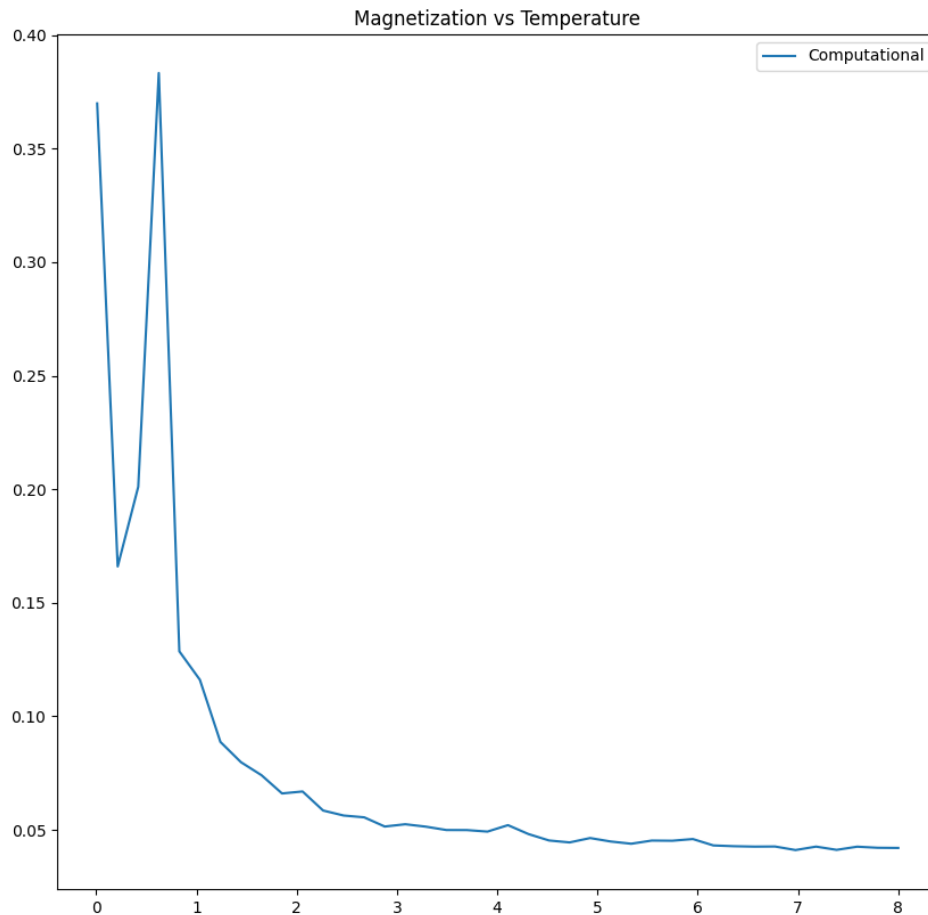
Energy vs Temperature Graph

- Dotted - Computational
- otherone - Analytical



As the temperature increased, the energy of the system began to increase. This was because as the temperature was increased, thermal effects become more and more important and the system wants to go to the most entropically favorable state. So even though the energy due to the spin-spin interactions is increasing, it is still more favorable to the system to go to the most disordered state.

Magnetisation vs Temperature Graph



At temperatures from around $T = 1 - 10$ the magnetization of the system is very close to zero. This makes sense because the 1D Ising model is not supposed to have a phase transition, and the material is supposed to be paramagnetic. At temperatures lower than $T \approx 1$ though, the magnetization is $M \approx 1$, so there appears to be a phase transition somewhere around here.

For very low temperatures the magnetization is always $M = 1$ and also for extremely low temperatures the energy is always $E = -1$, which is the energy of the system when all the spins are aligned.