



PH 366 Day 14: Spin Energies and Distributions



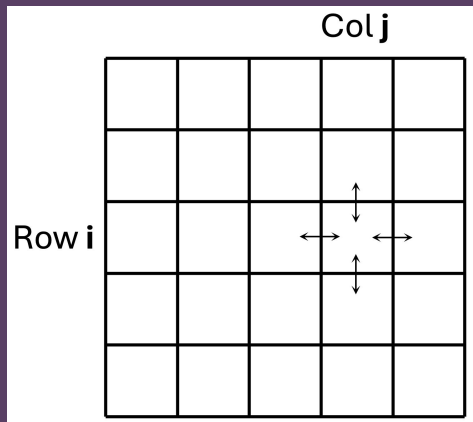
24 Feb 2025



dE vs. total E

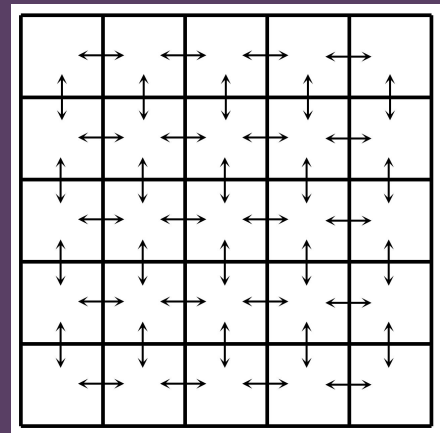
$$dE_{i,j} = 2s_{i,j} \sum_{\text{neighbors of } i,j} s_{\text{neighbor}}$$

Multiply one spin with all of its neighbors



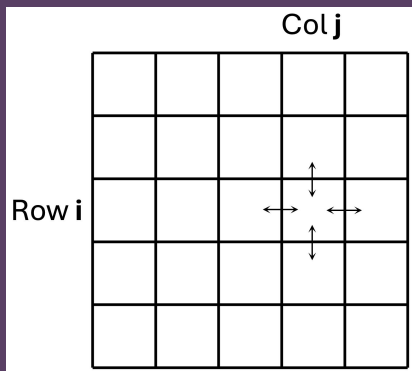
$$E_{\text{total}} = - \sum_{\text{adjacently neighboring pairs } \langle a,b \rangle} s_a s_b$$

Multiply every pair of neighbors in the lattice



dE vs. total E

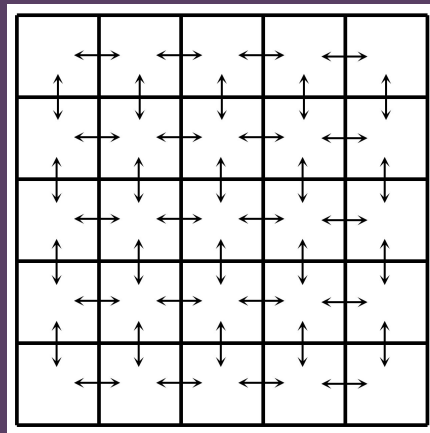
dE



Start with: `lattice`, `i`, `j`

Multiply spin at `(i, j)` with spins at `(i-1, j)`, `(i, j-1)`, `(i, j+1)`, and `(i+1, j)`

Total E

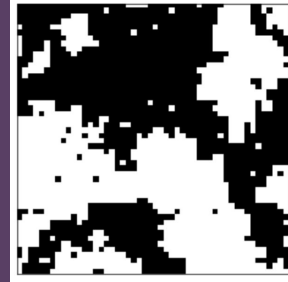
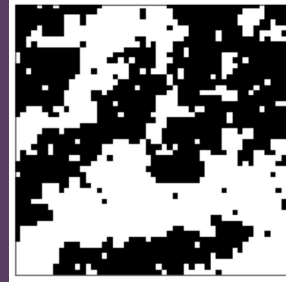
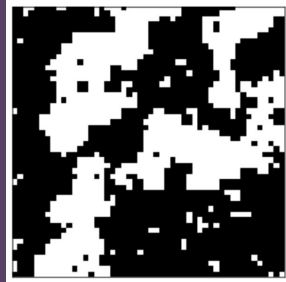
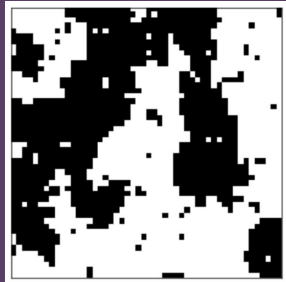
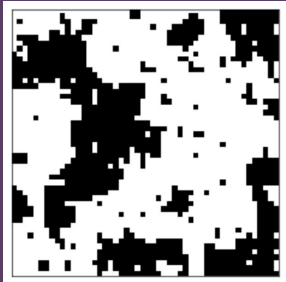
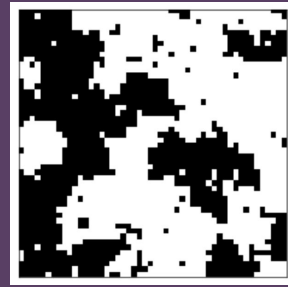
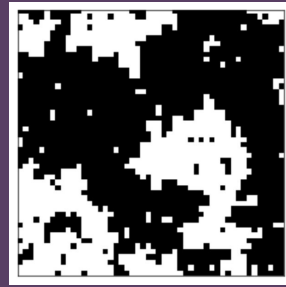
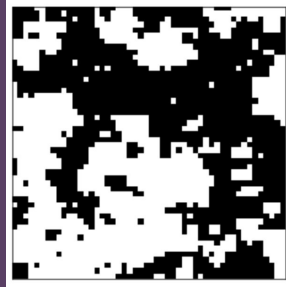
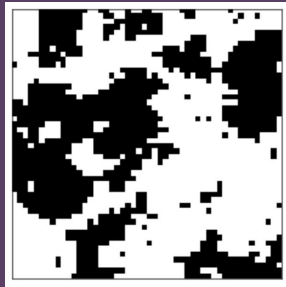
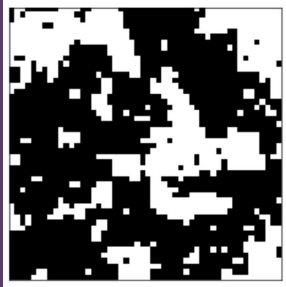


Start with: `lattice`

Go through every **pair of neighbors** – adjacent pairs in **every row** and **every column** of the lattice

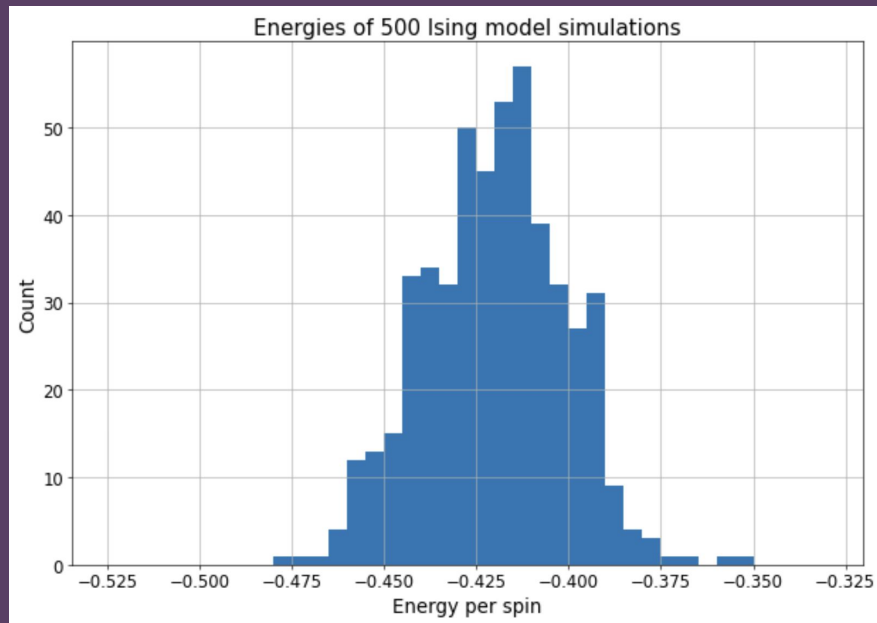
Many Ising model simulations

Each simulation is unique!



Simulations can have different energy values

Today: Make a histogram of energy values from many simulations



Evaluating probability from a histogram

Similar to integrating

Probability of picking a simulation with energy between **-0.4** and **-0.375**...

...is area of the **bars**, divided by total area of the **histogram**

