Phase transitions and the ising model

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0.1 Level 1

Use the blocks below to generate a random configuration for the spins of the Ising model. Then calculate the average spin for this particular configuration. Once you have the average spin you should be able to calculate the energy using the mean field Hamiltonian for this system. Calculate the energy and then use the print block to print the energy to screen.

0.2 Level 2

Calculating the energy and the average spin using blockly directly is rather slow so for this next exercise I have written some blocks that you can call directly to calculate the energy and the average spin. Use these blocks and the other blocks here to generate a random configuration for the spins of the Ising model. Then make your code repeat the process of flipping one randomly chosen spin a total of 10 times. Calculate the average spin for each of the configurations you visit and then use the new plotting block to make a graph showing average spin versus time.

0.3 Level 3

Now add the Metropolis accept reject criterion into your code so that you can sample from the Boltzmann distribution at finite temperature. As in the previous exercise use the plotting block to make a graph showing how the average spin changes with time. Notice, however, that you should only plot the average spin if the move is accepted. You should not plot average spins for configurations that have been rejected. Use the code you have written to investigate how the average spin changes when the temperature is high and when the temperature is low and when a magnetic field is present and when it is not.