Answers to Homework 7

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1 Question 2

The change in energy in the presence of magnetic field is given by

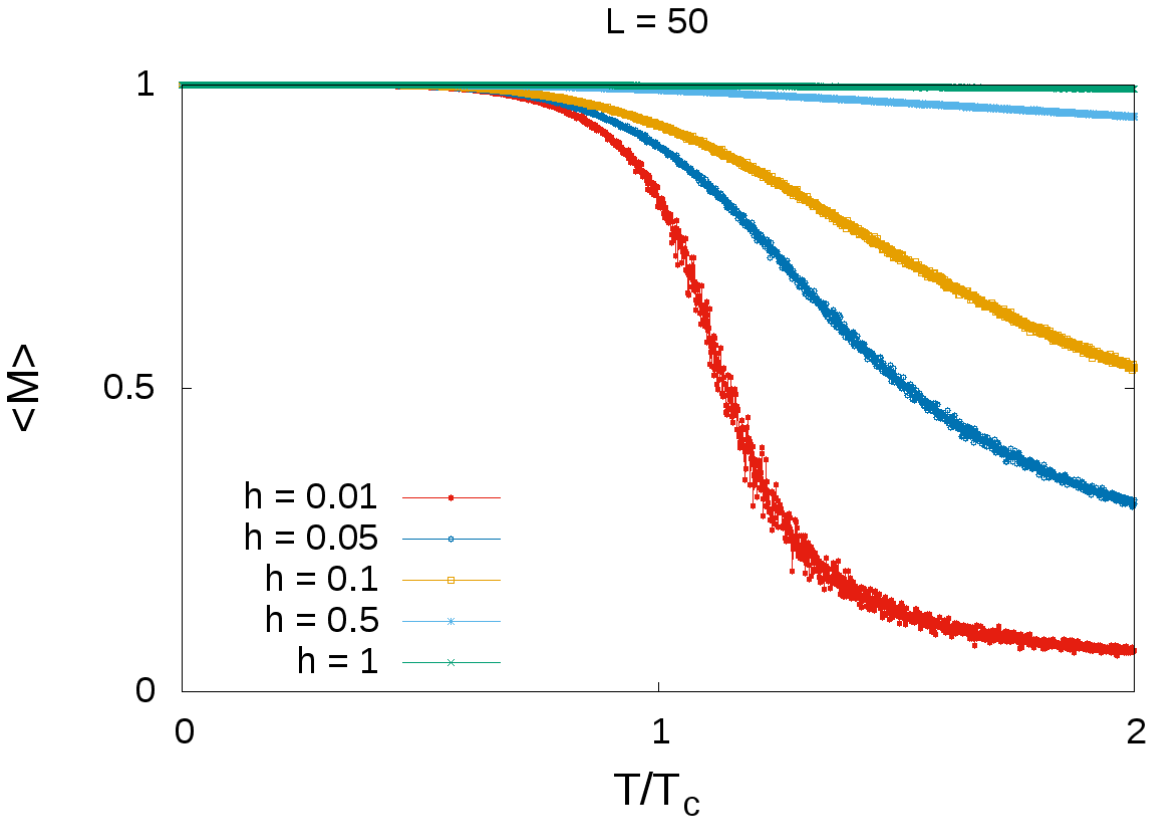
$$\begin{aligned}\Delta H &= E_{suggest} - E \\ &= \frac{J}{kT}(-s_i)\sum_j s_j - h(-s_i) - \left[-\frac{J}{kT}s_i \sum_j s_j - hs_i \right] \\ &= \frac{J}{kT}s_i \sum_j s_j + hs_i + \frac{J}{kT}s_i \sum_j s_j + hs_i \\ &= 2s_i \frac{J}{kT}\sum_j s_j + 2hs_i \end{aligned} \tag{1}$$

Using the exact solution $J/kT_c = (1/2)ln(1+\sqrt{2})$ and setting $T/T_c = x$, we can write

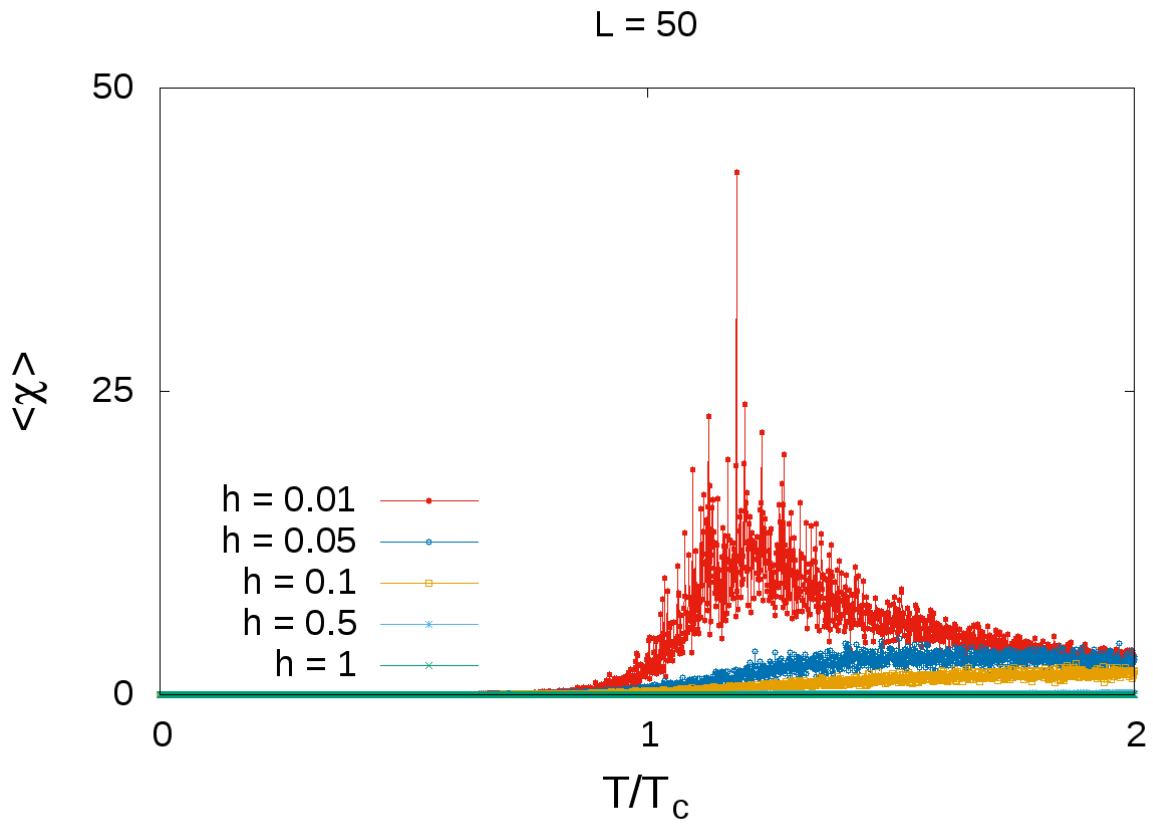
$$\begin{aligned}\frac{J}{kT} &= \frac{J}{kT_c.T/T_c} \\ &= \frac{J}{kT_c x} \\ &= \frac{1}{2x} ln(1+\sqrt{2}) \end{aligned} \tag{2}$$

Note that J/kT has been replaced with $(1/2x)ln(1+\sqrt{2})$ in the code.

1.1 Ensemble average of the magnetization per lattice site



1.2 Ensemble average of the susceptibility per lattice site



Note: I discussed the solution with Rasika.