Exercices about the Ising Model.

1. Explore the critical behaviour of the magnetization m of the Ising model i.e. $T \to T_c$, defining $t \equiv \frac{T-T_c}{T_c}$, remember that $k_B T_c = qJ$, in the MFT result given in class, using the Taylor expansion: $\tanh(x) = x - \frac{x^3}{3} + \mathcal{O}(x^5)$.

2. Compute the isothermal (magnetic) susceptibility $\chi_T(T,h) \equiv \left(\frac{\partial m}{\partial h}\right)_T$ in the MFT approach and explore its behaviour close to T_c. You can use the Taylor expansion of $\cosh(x)$.

3. Compute the MFT solution of the Ising model with single-ion anisotropy given by this Hamiltonian:

$$\mathcal{H} = -J \sum_{\langle ij \rangle} s_i s_j - D \sum_i (s_i)^2 - h \sum_i s_i$$