PHYS566: Problem Set 2

Problem 1: Consider the ice model such that *a=b=c=1*. Assume a lattice of linear dimension *N* with periodic boundary conditions. Using the line representation work out the solution for *n=0*, *n=1*, and *n=2*, where *n* denotes the number of vertical lines entering the horizontal line representing the transfer matrix from below, or exiting from it to above. Use the ansatz wavefunction $g(x_1, x_2) = A_{12} z_1^{x_1} z_2^{x_2} + A_{21} z_2^{x_1} z_1^{x_2}$.

Problem 2: Consider the anisotropic spin-1/2 Heisenberg model (*XXZ* model) in one dimension with periodic boundary conditions. The Hamiltonian is given by

$$\hat{H} = \sum_{i=1}^{N} S_x^i S_x^{i+1} + S_y^i S_y^{i+1} + J S_z^i S_z^{i+1}.$$

Using the fact that this Hamiltonian conserves the *z*-component of the total spin, find the solutions for *m=0*, *m=1*, and *m=2*, where *m* denotes the number of up-spins in a configuration in which all other components are down-spins.