Whence QFT? (239a) Spring 2014
Assignment 2

Posted April 9, 2014 **Due Wed, April 23, 2014**

All problems are optional in the following sense: if you are sure that you know the ideas involved so well that it would be a waste of your time to do the problem, don't do it, or merely sketch the answer. By this point in your education you don't need to rely on me to determine what you know and don't know.

1. **Trotterization practice.**

   Here's an exercise in understanding the quantum-to-classical correspondence.

   Suppose we add a term

   $$\Delta \mathbf{H}_1 = -v_x \sum_j \mathbf{X}_j \mathbf{X}_{j+1}$$

   to the hamiltonian of the transverse-field Ising model.

   (a) Show that this term preserves the $\mathbb{Z}_2$ symmetry generated by $\mathbf{S} = \prod_j \mathbf{X}_j$.

   (b) Construct a corresponding statistical mechanics model. Are the Boltzmann weights positive?

   (c) Answer the previous two questions for

   $$\Delta \mathbf{H}_2 = -v_y \sum_j \mathbf{Y}_j \mathbf{Y}_{j+1} \ .$$

   (d) Answer the previous two questions for

   $$\Delta \mathbf{H}_3 = -g_y \sum_j \mathbf{Y}_j \quad .$$