8.334: Statistical Mechanics II Due: **5/9/03**

Suggestions for term paper topics

1. Phase transitions in Early Universe (Linde, ...) – plasma, astro

2. Particle drifting in spatially nonuniform magnetic field. Percolation, diffusion, plasma (de)confinement. Focus on stat mech aspects. (RMP review apprx '95) – plasma

3. Spin glass approach to pattern recognition, memory, neural networks. Hopfield model, ... – computer science, biophysics,

4. Learn Monte Carlo technique. Focus on using simulated annealing to solve NP problems. – computer science

5. Learn real space RG for disordered systems. Focus on the effect of disorder on phase transitions. – condensed matter

6. Statistical theory of polymers – biophysics, condensed matter

Somewhat more theoretical topics

7. Exactly solvable models in 2D. Bethe ansatz. E.g., the 6 and/or 8 vertex models (Baxter, ...)

8. Nonlinear sigma model and RG theory of the Quantum Hall effect (Wegner, Efetov, Pruisken, ...)

9. Conformal field theory at a 2D critical point. Exactly solvable models (Ising, Potts, ice, 8-vertex, 6-vertex, ...)

10. Effect of a long-range (e.g. electric dipole, or elastic) interaction on phase transitions. The lower critical dimension (Dyson), the upper critical dimension (Larkin, ...)

11. 1/N expansion

- If any of these topics look interesting, but you are not sure what is it about, or need advice on how to look for literature, please see LL.
- If you are looking for a different topic, a very good source are books from the series edited by Domb and Green, "Phase Transitions and Critical Phenomena," (by Domb and Lebowitz since 1982). Each book contains several review articles on various subjects. Many of these articles, especially in the early volumes, are quite suitable for term paper work.