

Exercise #06

due date: oral exam.

You can **alternatively** choose:

- exercises a) **and** b)
- point c) **or** d)

a) Prove that the exact solution of the infinitely connected Ising model is given by the mean field theory. Following the lines in this notes evaluate the partition function using the steepest descent method.

b) After reading chapter II of [R.J. Baxter - Exactly solved models in statistical mechanics-Academic Press (1982)].

- Solve the Ising one-dimensional model with the transfer matrix method and prove that there is no phase transition at non zero temperature. Evaluate the entropy and the specific heat.
- Discuss the zero temperature limit.

c) Following the instruction here below

<http://www.aquila.infn.it/ciuchi/didattica/DOTT/OpenSystems/index.html>

try to compile and run the program Oscillators (a fortran compiler is needed).

Once compiled successfully try exercises #1 #2 #3.

d) Derive the Landau theory for the superconducting transition after watching the following recorded lecture:

- Lecture 1

You can also follow a set of notes:

- The BCS model
- A resume of the solution of BCS model by mean-field approach.
- Technical details of Bogoliubov transformation
- Detailed solution of BCS model by mean-field approach.

For reading you can see the book of Linda E. Reichl "A Modern Course in Statistical Physics" chapt. 4 and chapt. 6.11

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