

## Exercises in Statistical Mechanics

Based on course by Doron Cohen, has to be proofed  
*Department of Physics, Ben-Gurion University, Beer-Sheva 84105, Israel*

This exercises pool is intended for a graduate course in “statistical mechanics”. Some of the problems are original, while other were assembled from various undocumented sources. In particular some problems originate from exams that were written by B. Horovitz (BGU), S. Fishman (Technion), and D. Cohen (BGU).

### ===== [Exercise 2190]

#### Electron gas in a magnetic field, Landau levels

Calculate the partition function for electrons in a 3D box subject to a homogeneous magnetic field in the  $z$  direction. Use the known results for the Landua levels and their degeneracy. Assume the Boltzmann approximation.

Find the magnetization for arbitrary field, and the susceptibility at zero field. Distinguish the orbital (Landau) and spin (Pauli) contributions.

Disregarding the spin, explain why there is no magnetism in the classical limit.

Note: The zero temperature case is treated in a different exercise, and requires to take the Pauli exclusion into account.