

## Exercises in Statistical Mechanics

Based on course by Doron Cohen, has to be proofed  
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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 0150]

#### Spectral functions for N spins

Consider an  $N$  spin system:

$$\hat{H} = \sum_{\alpha=1}^N \frac{\varepsilon}{2} \hat{\sigma}_z^{(\alpha)}$$

Calculate  $Z_N(\beta)$  in two different ways:

- (1) The short way - Calculate  $Z_N(\beta)$  by factoring the sum.
- (2) The long way - Write the energy levels  $E_n$  of the system. Mark with  $n = 0$  the ground level, and with  $n = 1, 2, 3, \dots$  the excited levels. Find the degeneracy  $g_n$  of each level. Use these results to express  $Z_N(\beta)$ , and show that the same result is obtained.