Physics 112 - Intro to Statistical and Thermal Physics - Spring 2023
Spoiler Set 05

Problem 5.1 - Paramagnets and the 1D Ising Model

(c) $T = \frac{2\mu B}{k_B}\left[\ln\left(\frac{N-U/\mu B}{N+U/\mu B}\right)\right]^{-1}$.

(e) Gee, I think we went on our *hyperbolic tangent* for a reason...

(g) Think about a 3-spin system and try explicitly writing down all the microstates. For each microstate write down the equivalent "neighboring pairs" microstate. For example, the microstate $\uparrow\uparrow\downarrow$ becomes the neighboring pairs microstate PA, where P represents spins 1 and 2 being aligned and A represents spins 2 and 3 being anti-aligned. Note that to fully specify our microstate we need one more bit (literally) of information on top of whether each pair is parallel or anti-parallel.

(h) You already did most of the work for this.

Problem 5.2 - Entropy of the Ideal Gas

(c) You should find that $\int_0^\infty x^n e^{-x^2}dx = \frac{1}{2}\Gamma\left(\frac{n+1}{2}\right)$.

(d) Remember that for exponentials $e^{\sum a_i} = \prod e^{a_i}$.

(e) This last bit is basically an extension of your answer in part (d). For dr, don't forget your Taylor expansions (for real this time).

♦