Assignment 7

Byungjoon Min, Statistical Mechanics
(due date: November 19, 2018)

1 Generalized Quantum Statistics [40 pt]

Consider the hypothetical situation where no more than p particles are allowed to be in a given quantum state. Clearly $p = 1$ corresponds to Fermions and $p \to \infty$ corresponds to Bosons.

1.1 Occupation number [20 pt]

Show that for this hypothetical case the mean occupation number is given by

$$\langle n \rangle = \frac{1}{e^{\beta(\epsilon-\mu)} - 1} - \frac{(p+1)}{e^{\beta(p+1)(\epsilon-\mu)} - 1}. \tag{1}$$

1.2 Bosons and Fermions [20 pt]

Show that this number $\langle n \rangle$ reduces to the Fermi-Dirac ($p = 1$) and Bose-Einstein ($p \to \infty$) distributions in the appropriate limits.