1. (a) Derive Eqs. (3.7) and (3.8) in the notes. (b) Plot Eq. (3.8) as a function of $N/M$. (c) Show that in the dilute limit ($N \to 0$), Eq. (3.8) is identical to the ideal gas result. (d) Show that in the opposite limit where $N \to M$, Eq. (3.8) also gives a result very similar to the ideal gas. Explain the physical reason behind this result. (e) Derive a formula for the pressure $P$ of the lattice gas. (f) Derive the equation of state for the lattice gas.