HW Quiz 10

1. Construct the completely symmetric wavefunction $\psi(x_A, x_B, x_C, x_D)$ for four bosons if two are in the state ψ_1 and two are in the state ψ_8.

$$\psi = \frac{1}{\sqrt{6}}\Big(\psi_1(x_A)\psi_1(x_B)\psi_8(x_C)\psi_8(x_D) + \psi_1(x_A)\psi_1(x_C)\psi_8(x_B)\psi_8(x_D)$$
$$+\psi_1(x_A)\psi_1(x_D)\psi_8(x_B)\psi_8(x_C) + \psi_1(x_B)\psi_1(x_C)\psi_8(x_A)\psi_8(x_D)$$
$$+\psi_1(x_B)\psi_1(x_D)\psi_8(x_A)\psi_8(x_C) + \psi_1(x_C)\psi_1(x_D)\psi_8(x_A)\psi_8(x_B)\Big)$$

2. Suppose you have two distinguishable particles in thermal equilibrium in a one dimensional harmonic oscillator potential with total energy $E_{tot} = 5\hbar\omega$.

   a) What are the possible occupation number configurations?

   b) Which configuration is the least probable?

$E_{tot} = (n_1 + n_2 + 1)\hbar\omega = 5\hbar\omega \Rightarrow n_1 + n_2 = 4 \Rightarrow$

n_1	n_2	$(N_0, N_1, N_2, N_3, N_4)$
0	4	$(1,0,0,0,1)$
4	0	
2	2	$(0,0,2,0,0)$
1	3	$(0,1,0,1,0)$
3	1	

Least possible configuration is $(0,0,2,0,0)$ since it can only be realized in one way.