Phy 410
Quiz #1, Jan 22, 2010

a) **There are 6 magnets each can point either up or down with equal probability (6 points)**
   i)   **How many possible microstates are there for this system?**
   ii) **What is the probability of seeing the <u>microstate</u> ($\uparrow\uparrow\uparrow\downarrow\downarrow\downarrow$)?**
   iii) **What is the probability of seeing a <u>macrostate</u> (N,s), 2s=spin excess, for N=6, s=1?**

   i) $2^6 = 64$; **ii)** $1/64$;

   ii) $P(N,s) = g(N,s) \bullet \dfrac{1}{2^N} = \dfrac{N!}{(\frac{N}{2}+s)!(\frac{N}{2}-s)!} \bullet \dfrac{1}{2^N} = \dfrac{15}{64}$

b) **Consider a system consisting of 2 quantum harmonic oscillators (N=2). The total energy of the system is 3 (in units of energy quantum hω i.e. n=3). (4 points)**
   i) **How many microstates (N;s_1,s_2) correspond to this macrostate (N,n)?**
   ii) **Write down these microstates.**

   i) $g(N,n) = \dfrac{(N-1+n)!}{(N-1)!n!} = \dfrac{(2-1+3)!}{(2-1)!3!} = 4$

   ii) $s_1 + s_2 = 3$;

   The microstates are:
   $(2;0,3),(2;3,0),(2;2,1);(2;1,2)$