Exercises: Tutorial 04.12.2015

1. Which of the following Clebsch-Gordan coefficients are definitely zero? Why?

$$\langle 1\,0,1\,0|1\,0\rangle, \langle 1\,0,1\,0|2\,0\rangle, \langle 2\,1,1\,0|2\,-1\rangle, \langle 0\,0,1\,0|3\,0\rangle$$

2. Consider the system of two electrons with spin ½ in helium atom. Both electrons are in s-states (angular momentum *l* is zero). Construct the wave-functions for the singlet (S=0) and triple (S=1) states. What you can say about (particle) permutation symmetry of these (spin) wave-functions? What you can say about permutation symmetry of corresponding spatial wave-functions.

3. Two particles with momenta $j_1 = 1$ and $j_2 = 2$ are prepared in the state in which projections of both momenta on the z-axis are *zero*. Prove that in this case the total angular momentum of the system, $\mathbf{J}=\mathbf{j}_1+\mathbf{j}_2$, can not be J=2.

4. Find possible terms for the electron configuration d^8 (eight electrons in d state).