Phys. 622: Problem Set IX

- 1. JJS 3.25
- 2. JJS 3.26

3. Consider a spin 1/2 particle. Show that in the space of states of a given orbital angular momentum l, the operators

$$\frac{l+1+\vec{l}\cdot\vec{\sigma}}{2l+1}; \quad \frac{l-\vec{l}\cdot\vec{\sigma}}{2l+1} \tag{1}$$

are the projectors onto the states of total angular momentum j = l+1/2 and j = l - 1/2, respectively, where \vec{l} is the orbital angular momentum operator (modulo \hbar which you can ignore). Using the above projection operators, work out the C.G. coefficients for the total angular momentum states. [Hint: the projected states satisfy $\vec{j}^2 \psi_{jm} = j(j+1)\psi_{jm}$. A projection operator P is an operator satisfying $P^2 = P$, and $P\psi$ yields ψ_{jm} .]

- 4. JJS 3.27
- 5. JJS 3.28
- 6. JJS 3.29