Physics 7910: HW # 02.
(Dated: January 17, 2013)

1. Problem 4.5 of Blundell.
2. Problem 4.7 of Blundell.
3. Problem 5.5 of Blundell.
4. Three $s = 1/2$ spins are placed in the corners of equilateral triangle and interact antiferromagnetically with each other. Hamiltonian of the system is given by

$$H_\Delta = J(S_1 \cdot S_2 + S_1 \cdot S_3 + S_2 \cdot S_2),$$

with $J > 0$.

Find eigenvalues and eigenstates of this system. Characterize eigenstates by the total spin $S_{\text{tot}}$ and its projection $S^z_{\text{tot}}$. Check degeneracies of the states carefully and comment if $(S_{\text{tot}}, S^z_{\text{tot}})$ classification is sufficient in this case.

*Note:* despite simple appearance this problem is somewhat tricky.