Quantum Mechanics, Physics 531
Homework Assignment 4, due March 31, 2008

Problem 1. Problem 4.28.

Problem 2. Problem 4.49.

Problem 3. Find the eigen energies of two interacting spins 1/2 in a magnetic field B, described by the Hamiltonian

$$\hat{H} = -J\hat{\boldsymbol{s}}_1\hat{\boldsymbol{s}}_2 + g\mu_{\mathrm{B}}B(\hat{s}_{1,z} + \hat{s}_{2,z}).$$

To evaluate the product $\hat{\boldsymbol{s}}_1\hat{\boldsymbol{s}}_2$, use the following relation $(\hat{\boldsymbol{s}}_1 + \hat{\boldsymbol{s}}_2)^2 = \hat{\boldsymbol{S}}^2$, where the total angular momentum for two spins 1/2 is either $S = 0$ or $S = 1$. Draw the dependence of eigen energies on the strength of the magnetic field B.

Problem 4. Problem 3.35. In part (c), prove that the choice of coefficients c_n satisfies the equation $\hat{a}_-|\alpha\rangle = \alpha|\alpha\rangle$.