HW#3; Due Mon. 2/20

1. Problem 4.18. The approach here is the same one we used for the Simple Harmonic Oscillator; no need to prove that L_+ and L_- are Hermtian conjugates. Also, note this equations works for spin as well as orbital angular momentum: we will need it a lot this semester!

2. Start with the spin state in Problem 4.27.

A) Solve parts A and B of Problem 4.27; use the matrix-multiplication technique to find the expectation values.

B) Now use the Born rule to find the *probability* of each possible measurement outcome of Sx, Sy, and Sz. (You'll need to know the eigenvectors of each operator.) Show that your answers here are consistent with your answer to part A. (Construct the expectation values using the probabilities, and show they're the same.)

3. Problem 4.30. You'll have to take the dot product of the spin-operator-vector with [4.154], and then add the three matrices together to find S_r.

4. Consider a particle with spin 3/2. Following the basic approach of section 4.4.1:

A) Find the 4x4 matrix representing Sz.
B) Find the 4x4 matrices representing S+ and S- (hint: they are Hermitian conjugates of each other.)
C) Find the 4x4 matrices representing Sx and Sy. (Hint: use your answer to part B)

D) Without explicitly solving for the eigenvalues of Sx and Sy, think about it, and deduce what they have to be! (Hint: nature doesn't know which way is the x-direction.)