Phys 163; HW#9; Due Tues 11/7

(Only three problems, because they are long! Start early...)

1. a) At time=0, a spin state is measured to be "spin up". If it is in a uniform magnetic field that points in the x-direction, find the evolution of the state as a function of time.

b) Also as a function of time, find the probability that Sy would be measured to have a positive outcome. (Use your answer from part a).

2. Consider an operator Q = B $\begin{pmatrix} 0 & 0 & -2i \\ 0 & 1 & 0 \\ 2i & 0 & 0 \end{pmatrix}$, in a 3D Hilbert space. In this same space the Hamiltonian is H = $E_0\begin{pmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$. E_0 and B are positive and real.

A) Find the eigenvalues and normalized eigenvectors of Q.

B) If at t=0 the unnormalized state is $\psi = A\begin{pmatrix} i \\ 1 \\ 1+i \end{pmatrix}$, find <Q>. (Start by normalizing ψ.)

C) If at t=0 the unnormalized state is $\psi = A\begin{pmatrix} i \\ 1 \\ 1+i \end{pmatrix}$, find the probability that one would measure Q=2B at later time t=T. (Start by normalizing and evolving ψ.)

D) At time t=0, suppose one measures Q and gets a negative number for a result. Calculate the probability that another measurement of Q at time t=T will yield a positive number.

3. Problem 3.37. Careful here: the Hamiltonian is not diagonal!