HW assignment 4

Due Thu Feb 19 at the lecture.

Problem 1.

A spin-$\frac{1}{2}$ particle is in an eigenstate of $\hat{S}_y$ with eigenvalue $\frac{\hbar}{2}$ at time $t = 0$. At that time it is placed in a constant magnetic field B in z direction. The spin is allowed to precess for a time T. At that instant, the magnetic field is switched very quickly to the x direction. After another time interval T, a measurement of the y component of the spin is made. What is the probability that the value $-\frac{\hbar}{2}$ will be found?

Problem 2.

Two atoms with $j_1 = 1$ and $j_2 = 2$ are coupled, with an energy described by $\hat{H} = a\hat{\vec{J}}_1 \cdot \vec{\hat{J}}_2$ ($a > 0$). Determine all of the energies and degeneracies for the coupled system. What are the eigenstates corresponding to maximal and minimal energy?