Homework #3
Due Feb 9

Read Griffiths chapters 5.8-5.10

1. (a) Griffiths 5.22
   (b) Why is the predicted mass for the η' so far from the true value?
2. Griffiths 5.23
   Note that what is called the F in the text is now known as the D_s^+. For part b) all these particles have now been observed, so check your values against the PDG.
3. Griffiths 5.28
4. Griffiths 5.30
5. Consider the Ω^- baryon.
   (a) Draw the Feynman diagrams for the two most probable Ω^- decay modes.
   (b) Suppose I have a sample of Ω^-, whose spin in aligned in a given direction (call it $\hat{z}$) in the Ω^- rest frame. For the decay $\Omega^- \rightarrow \Lambda K^-$ what is the angular distribution for the decay products, in the rest frame. Assume that the spin of the Ω^- is $s = 3/2$ and along the quantization axis $s_z = 3/2$
   (c) Repeat b) for $s_z = 1/2, -1/2, -3/2$
   (d) If you look at the the PDG's entry for the Ω^- you'll notice that its spin has not actually been measured. Often when a particle like the Ω^- is produced, it is unpolarized, and its spin density matrix may be diagonal. Recall that this means that the particle is in a *mixed* state, with the spin either $-j, -j+1 ... j-1, j$, and not in a coherent superposition. If all of the spin states of the Ω^- have the same probability, what is the angular distribution of the decay products for $\Omega^- \rightarrow \Lambda K^-$? How is that relevant to measurements of the Ω^- spin?

   Hint: Use addition of angular momentum and remember that spherical harmonics describe orbital angular momentum.