PHYS545-PARTICLE PHYSICS I
5th Homework-Due December 17, 2009

1. In the class, we have discussed some isospin multiplets: the four Δ particles, the two K doublets, the pion triplet, etc. From the PDG web site, or booklet, find similar isospin doublets. (Note that in an isospin multiplet, the mass deviation is at the order of a few MeV.) What is the hyper charge of each of the multiplet? Is it possible to group that isospin multiplet into $SU(3)$ multiplets? (You should find at least one $SU(3)$ multiplet. The multiplet that you find should not be discussed in the lecture.)

Questions From the Book

2. Show that the reaction $\pi^- + d \to n + n + \pi^0$ can not occur for pions at rest.

3. What restrictions does the decay mode $K^0 \to 2\pi^0$ place on (a) the pion spin, (b) the kaon parity.

4. Show that a scalar meson can not decay into three pseudo scalar mesons in a parity conserving process.

5. (a) Find a relation between the total cross-sections (at a given energy) for the reactions

$$\pi^0 p \to K^0 \Sigma^0$$
$$\pi^- p \to K^+ \Sigma^- \pi^+ p \to K^+ \sigma^+$$

   (b) At a given center-of-momentum energy, what is the ratio of cross-sections for the reactions $p + d \to^3 He + \pi^0$ and $p + d \to^3 H + \pi^+$

6. In which isospin states can (a) $\pi^+ \pi^- \pi^0$ (b) $\pi^0 \pi^0 \pi^0$ exist?