1. Consider the particles: $\pi^{\pm}$, $K^{\pm}$, $n, \Sigma^{\pm}, \Sigma^{*\pm}, \Delta^{0,\pm,++}, \Sigma^{*\pm}$, Ω, Λ, $\Xi^{\pm}$, $\Xi^{*\pm}$, $D^{\pm}$, $B^{\pm}$ that you have studied in the previous homework. You had found the most probable decays channels. Plot all the lowest order Feynman Diagrams corresponding to those decay channels. (Lowest order Feynman Diagrams are the Feynman Diagrams that contain a minimum number of vertices)

2. Consider a wave function $\psi(x, y, z)$. In your book the differential operator that generates a rotation around the z axis is derived. Carry out the same derivation for a rotation around the x and y axis. Calculate the commutation relation of these differential operators and show that they are the same as the matrices that you have calculated in the first homework.

3. What is the minimum proton energy required for the reaction $p + \gamma \rightarrow p + \pi + 0$ if the photon has energy 2.3×10^{-4} eV? (this photon is a typical photon in the Cosmic Microwave Background(CMB). Protons that have energy higher then the found limit rapidly lose energy through interactions with the photons of the CMB.)

Questions From the Book

4. The solar constant (the rate at which energy is incident on the Earth) is about 2 $cals/cm^{-2}$ each minute. The fusion of hydrogen to helium in the Sun produces 26 MeV energy for every Helium atom formed, plus two neutrinos carrying only a small percentage of energy. Calculate the expected solar neutrino flux at the Earth.

5. The cross-section for the reaction $\pi^- + p \rightarrow \Lambda + K^0$ at 1 GeV incident momentum is about 1 mb (10^{-27} cm^2). Both Λ and K^0 particles decay with a mean lifetime of order 10^{-10} s. From this information, estimate the relative magnitude of the couplings responsible for the production and decay, respectively, of these strange particles.