Study 1: Feynman Graph Calculations and Deep Inelastic Scattering

This series of 6 problems will give you practice in calculating using Feynman graphs (1-2) and introduce the concepts used in analyzing deep inelastic scattering (3-6). Please feel encouraged to use any and all reference materials, talk with friends, or whatever, to get the job done – just as you would with a research project. Also, as with a research project, write up your results as if they were going to be presented to the whole wide world, not just your professor. Set out the logic and the results fully, but include only enough algebra to make it clear how it goes. Put it all in TeX, or its moral equivalent. Take pride in what you do! Problems 1-2 are due on Monday, October 21, and 3-6 on Wednesday, October 30.

In answering problems 4-6, use the conventions adopted in class, and found in Cheng+Li Chapter 7, which are standard.

Leptonic Tensor: Neutrino Scattering

Calculate the leptonic tensor that appears in deep inelastic neutrino scattering. Neglect lepton masses.

Parton Model Dynamics

Show how the parton model leads to Bjorken scaling, and parameterize the structure functions (including F_3, in neutrino scatting) in terms of parton distribution functions, assuming that the charged and weakly interacting partons are quarks. At this point, just use generic vector and axial vector couplings.

Spin Zero Straw Man

Do the same thing, for spin zero partons.

Partons With Names and Faces

Now put in the couplings appropriate to the different possible scattering cases – *e. g.* electromagnetic scattering on protons, charged current on neutrons, ... , and establish relationships between measured structure functions and parton distribution functions.