PHY 5667 : Quantum Field Theory A, Fall 2003

October $30^{th}$, 2003

Assignment # 5

(due Thursday November $13^{th}$, 2003)

**1.** Which of the diagrams in Eq. (4.58) contribute to the invariant matrix element $\mathcal{M}(p_1, p_2 \to p_3, p_4)$ at $\mathcal{O}(\lambda^2)$? Write the explicit expression of $\mathcal{M}(p_1, p_2 \to p_3, p_4)$ at $\mathcal{O}(\lambda^2)$ in momentum space.

**2.** Problem 4.2 of Peskin and Schroeder's book.

**3.** Consider the two fermion scattering:

$$\text{fermion}(p) + \text{fermion}(k) \to \text{fermion}(p') + \text{fermion}(k')$$

in the context of the Yukawa theory. We have derived the lowest order or *tree level* invariant matrix element $\mathcal{M}$ for this scattering process in class. Using that result, complete our discussion by calculating the differential cross section $\left(\frac{d\sigma}{d\Omega}\right)_{CM}$ and the total cross section $\sigma$.

**4.** Problem 5.2 of Peskin and Schroder's book.