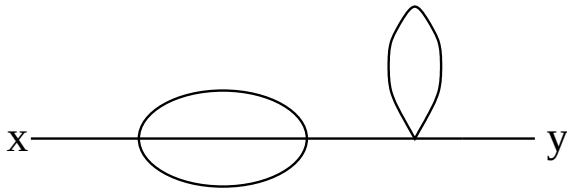
PHY 5667 : Quantum Field Theory A, Fall 2002

October 17^{th}, 2002

Assignment # 4

(due Thursday October 31^{st}, 2002)

1. The following Feynman diagram:



represents a contribution to $\langle\Omega|T\{\phi(x)\phi(y)\}|\Omega\rangle$. Explain from which term of the perturbative expansion of $\langle\Omega|T\{\phi(x)\phi(y)\}|\Omega\rangle$ does it come from and write the corresponding analytical contribution both in position-space and in momentum-space.

2. Summarize the logical steps that, starting from Eq. (4.31) of your book allows you to write Eq. (4.58). You do not have to go over all the details, just explain why at $\mathcal{O}(\lambda^2)$ the four point correlation function $\langle\Omega|T\{\phi(x_1)\phi(x_2)\phi(x_3)\phi(x_4)\}|\Omega\rangle$ corresponds to the series of diagrams written in Eq. (4.58) and show how can you find them.

3. 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.

4. Problem 4.2 of Peskin and Schroeder's book.