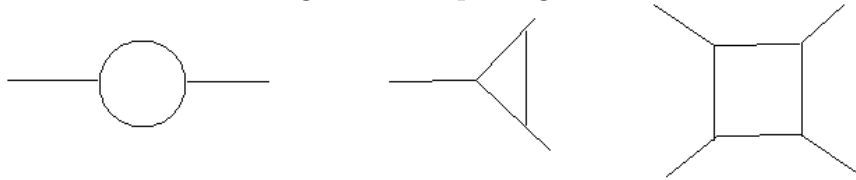


Problem Set 7 (due Apr 21, 2014)

1. **Feynman's parameters for loop integrals** Write the expressions for the following Feynman diagrams (representing scattering processes in ϕ^3 theory) and rewrite using Feynman's parameters into a form involving $\int d^4p/(2\pi)^4 1/(p^2 + D)^n$

Figure 1: Loop integrals



2. **Dimensional regularization** Calculate the following Euclidean integrals in two ways: (a) with a cutoff Λ on the Euclidean momenta, (b) dimensional regularization. Hints: Introduce appropriate powers of μ so as to not change the dimensions of the integral. Expand in powers of Λ (ϵ) after obtaining the result and drop the terms with negative powers of Λ (positive powers of ϵ). Compare the logarithmic part of the answer obtained using the two methods. Assume $D > 0$

$$\begin{aligned}
 & \int \frac{d^4 p_E}{(2\pi)^4} \frac{1}{(p_E^2 + m^2)} \\
 & \int \frac{d^4 p_E}{(2\pi)^4} \frac{1}{(p_E^2 + D)^2} \\
 & \int \frac{d^6 p_E}{(2\pi)^6} \frac{1}{(p_E^2 + D)^3} \\
 & \int \frac{d^6 p_E}{(2\pi)^6} \frac{p_E^2}{(p_E^2 + D)^2}
 \end{aligned} \tag{1}$$

3. Read Chapters 13, 14, 15, and 16 from Srednicki