QFT Exercises 10

Due on 22.01.15

Notice: This time again two groups: Giudice and Yaguna!

Topics: Green's function

1. Calculate the Green's function $G^{(3)}(x_1, x_2, x_3)$ and $G^{(4)}(x_1, x_2, x_3, x_4)$ as a function of the $G_c^{(k)}$ (including the one-point Green's functions) and represent the result graphically.

2. Show that the propagator in $(1+1)$-dimensions

$$\Delta_F(x) = \int \frac{d^2k}{(2\pi)^2} \frac{e^{ikx}}{k^2 - m^2 + i\epsilon}$$

is, for space-like x (set $x^0 = 0$), given by:

$$\Delta_F(x) = -\frac{i}{2\pi} K_0(m|x|),$$

where $K_n(y)$ is the modified Bessel function of second kind. What is the behaviour for large x ?

3. Calculate the functional integral

$$\int d\varphi \; \varphi(x_1)\varphi(x_2) \; e^{iS[\varphi]}$$

for the φ^4 theory up to the order g^2 and determine the corresponding Feynman diagrams.