**Homework 7; due Thursday, Dec.5**

1. Consider quantum mechanics with Yukawa coupling. That is, we have a scalar boson $\phi(t)$ and two fermions $\psi_1(t), \psi_2(t)$, and the Lagragian is

$$\mathcal{L} = \frac{1}{2}(\dot{\phi}^2 - m^2\phi^2 + \psi_1\dot{\psi}_1 + \psi_2\dot{\psi}_2 - \mu\psi_1\psi_2) + g\phi\psi_1\psi_2.$$

Compute the 2-point function $<\phi(t)\phi(0)>$ modulo $g^3$ (in the Euclidean setting).

Hint. The correction to the free theory answer is given by one Feynman diagram. Remember about automorphism grups and the minus sign corresponding to odd loops.

2. In the same theory, compute the two point function $<\psi_1(t)\psi_1(0)>$ modulo $g^3$ (in the Euclidean setting). Does the corresponding diagram have non-trivial automorphisms?

3. Compute explicitly the two point function for a massive scalar valued bosonic field in $d$ dimensional Euclidean space (use Bessel functions when needed).

4. Do the same for a fermion taking values in a spinor space $Y$ with mass $M : Y \to Y^*$ ($M$ is invertible, $M^* = -M$).