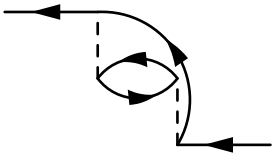
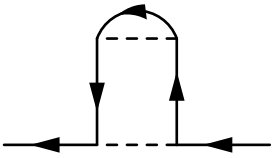
Statistical Physics Homework 3

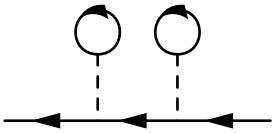
1. Calculate the interacting Green's function with the help of Feynman diagrams up to first order. Use coordinate representation and Matsubara frequencies.

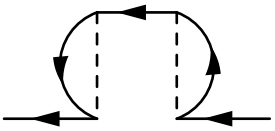
2. When calculating the contribution of a Feynman graph of the Green's function at order n in momentum and frequency representation, we have n momentum and n frequency sums instead of $2n$ space and $2n$ time integrals of coordinate and time representation. Show, that n is also equal to the number of independent loops in the diagram[1].

3. Give the contributions of the following Feynman diagrams both in coordinate and in momentum representations.

a) 

b) 

c) 

d) 

Just express the contribution with the help of the Green's functions and interactions (according to the graph rules) and don't try to perform the integrals!

Submission: at the beginning of the practice class on 26 Oct.

[1]This is a difficult and optional problem. You can get another 100 points for solving this one, but if you skip, you won't be penalized. Hint: try to use mathematical induction.