Quantum Field Theory	**Exercises No. 4**	04.05.2016

[Tutor: Marc Sangel, Tutorial: Wednesday 11. May 2016, 16:00-17:30 in V2-200]

Exercise 4.1:

Write down the connected part of the 4-point function $G^{(4)}_{T,\mathsf{c}}(x_1, x_2, x_3, x_4)$.

Exercise 4.2:

(a) Consider the definition

$$(2\pi)^4\delta^{(4)}(p_1+...+p_n)\tilde{G}^{(n)}_{T,\mathsf{c}}(p_1,...,p_n) \equiv \int \mathrm{d}^4x_1...\mathrm{d}^4x_n\, G^{(n)}_{T,\mathsf{c}}(x_1,...,x_n)e^{i(p_1\cdot x_1+...+p_n\cdot x_n)} \;.$$

To which property of $G^{(n)}_{T,\mathsf{c}}$ corresponds the presence of the delta-function in front of $\tilde{G}^{(n)}_{T,\mathsf{c}}$?

(b) In general the Green fuction $G^{(n)}_T$ contains also disconnected parts, i.e. $G^{(n)}_T = ... + G^{(m_1)}_T G^{(m_2)}_T$, with $m_1 + m_2 = n$.
How do these parts behave inside the Fourier tranform $\tilde{G}^{(n)}_T$?

Exercise 4.3:

(a) Verify explicitly that the following holds:

$$:\hat{\phi}_I(x_1)\hat{\phi}_I(x_2): \,=\, :\hat{\phi}_I(x_2)\hat{\phi}_I(x_1):$$

(b) Show that within normal ordering one can exchange any two field operators:

$$:...\hat{\phi}_I(x_i)...\hat{\phi}_I(x_j)...: \,=\, :...\hat{\phi}_I(x_j)...\hat{\phi}_I(x_i)...:$$