## Theoretical Physics 6a (QFT): SS 2025 Exercise sheet 8

## 02.06.2025

(0 points) How much time did it take you to solve this exercise sheet?

## Exercise 1. (100 points): Scalar QED

(a)(50 points) Consider the charged Klein-Gordon Field:

$$\mathcal{L} = (D_{\mu}\phi)^{\dagger}(D^{\mu}\phi) - m^{2}\phi^{\dagger}\phi$$
$$D_{\mu}\phi = (\partial_{\mu} + ieA_{\mu})\phi$$
$$(D_{\mu}\phi)^{\dagger} = (\partial_{\mu} - ieA_{\mu})\phi^{\dagger}$$

- Check that this Lagrangian is invariant under U(1) local gauge transformation of the form  $\phi(x) \to \phi'(x) = e^{i\alpha(x)}\phi(x)$ ;
- Write down the interaction Lagrangian and identify the terms. Sketch each one as a different diagram;
- Deduce the Feynman rules for this theory.

(b)(50 points) Calculate the amplitude for the Compton scattering in scalar QED.