

## Exercise 21: Vector field propagator

Calculate the momentum-space propagator of a vector field

$$\mathcal{L} = -\frac{1}{4}F_{\mu\nu}F^{\mu\nu} - \frac{1}{2}m^2 A_\mu A^\mu, \quad (1)$$

using the path integral approach.

## Exercise 22: Vector field propagator

Verify that

$$\delta_i = d - \partial_i - \sum_f n_{if} \left( s_f + \frac{d}{2} - 1 \right) \quad (2)$$

is the dimension of the coupling constant of the interaction  $i$ .

## Exercise 23: Total derivatives in perturbation theory

Show that interactions that are total derivatives do not have any effect in perturbation theory.

## Exercise 24: All renormalizable theories

Find all the renormalizable terms in a theory with scalars, spinors and massive vectors in  $d = 4$ . What changes if we consider massless vectors with an effective  $s_f = 0$ ?