

Solve the following two exercises:

**Exercise 1.**

Discuss the problem of large logs in QFT and how it can be addressed using the Renormalization Group.

**Exercise 2.**

Consider the following four-dimensional Lagrangian theory:

$$\mathcal{L} = \frac{1}{2}(\partial\phi)^2 - \frac{1}{2}m_\phi^2\phi^2 + \bar{\psi}i\not{\partial}\psi + y\phi\bar{\psi}\psi - \frac{\lambda}{4!}\phi^4. \quad (1)$$

- (a) Compute the anomalous dimension  $\gamma_\phi$  of the real scalar field  $\phi$  at one-loop level in perturbation theory.
- (b) Compute the anomalous dimension  $\gamma_\psi$  of the Dirac fermion field  $\psi$  at one-loop level in perturbation theory.
- (c) Is a fermion mass term generated at the quantum level? Motivate your answer