Problem Set 1 (Due Aug 29)

1. **Renormalization of QED**
   (a) Problem 62.2 Srednicki
2. **Path integrals** Read Sections 9.1 to 9.6 Peskin.
3. **Path integrals**
   (a) Problem 62.1 Srednicki
4. **Renormalization**
   (a) Write down a general renormalizable lagrangian for a Dirac fermion interacting with real scalar field and an Abelian gauge field. Assume that under parity $\phi(t, r) \to \phi(t, -r)$
   (b) Separate the lagrangian into finite pieces and counter-terms
   (c) Draw diagrams corresponding to the one loop renormalization of one-point, two-point, and three point functions for the fermion and upto four point functions for the scalar
   (d) In $\bar{\text{M}}$S calculate the counterterms
   (e) Calculate the beta function for the quadratic coupling constant (λ) of the scalar field
   (f) Calculate the beta function for the electric charge