UNIVERSITY OF CALIFORNIA, SANTA BARBARA
Department of Physics

Physics 221A **Quantum Field Theory** **Winter 2015**

Prof: Joe Polchinski joep@kitp.ucsb.edu

ASSIGNMENT #1
Due: Weds., Jan. 21, in class.

Unfortunately it has not been possible to find a grader, so my plan will be to look over the homeworks to see how well things are understood, and prepare some solution sets, at least for the key problems. Grades will be based primarily on the final exam, and also on handing in reasonably complete homeworks. The important point is that the main way that you learn any subject, and QFT in particular, is to do calculations, so you should do as many as you can, even if they are not graded.

Mostly simple 'verify' type problems:

1. Srednicki 33.2
2. Srednicki 34.1
3. Srednicki 34.2
4. Srednicki 35.4
5. Srednicki 36.5 (parts a,d,e only, I am skipping most of the Majorana notation).
6. Show that γ_5 defined in 36.46 has the properties $\gamma_5^2 = I$ and $\{\gamma_5, \gamma_\mu\} = 0$ (note that the latter is equivalent to $\gamma_5\gamma_\mu = -\gamma_\mu\gamma_5$).
7. Show that the Dirac equation implies that $\partial_\mu(\overline{\Psi}\gamma^\mu\Psi) = 0$ for a Dirac spinor.

Sorry that these are a bit boring, I will try to be more creative next time.

There are some interesting homework problems that are not in the main line of the course and *they are not assigned*, but they illustrate points that are useful to be aware of:

33.1: Separating a two-index tensor into traceless-symmetric, antisymmetric, and scalar parts.

34.3: Two Levi-Civita tensors are equivalent to none. Hint: for 34.44 check the special cases $\mu, \nu, \rho = 1, 2, 3$ and $\mu, \nu, \rho = 0, 1, 2$, and argue that this is enough.

34.4: Why is this true?

36.4: You already did a special case of this last quarter (HW 9, #5), this is just more general.