Physics 218. Advanced Quantum Field Theory. Professor Dine

Winter, 2009. Homework Set 1. Due Wed, Jan. 21.

Problem numbers refer to your textbook.

1. Verify eqn. 10 on the handout on Canonical Quantization of the Electromagnetic Field (correcting errors as necessary, esp. making sure conventions agree with Srednicki)

2. Sketch how to modify Srednicki's derivation of the Kallen-Lehman representation in chapter 13 to apply to fermions. Don't write pages and pages; just focus on the main differences, esp. around eqn. 13.8, 13.9 (matrix elements of the fermions, esp. to one particle states). The Lorentz structure is different, but the goal is to write an eqn. like 13.17, where the first term is the ordinary single particle propagator and the second is the contribution of the multiparticle continuum. If necessary, make restrictive assumptions about the spectrum (e.g. that the only single-particle fermionic states have spin 1/2), but try to spell them out explicitly.

3. Modify the derivation we performed in class of the LSZ formula for scalar fields to obtain a formula appropriate for fermions. The modifications required are minor; the main issue is the structure of the matrix elements for the fermions as in the previous problem.

4. Do the exercise on the spin sums in the handout on the Dirac field.

5. Derive the Feynman rules for *Green's functions* in Yukawa theory and QED. From your understanding of LSZ, sketch the derivation of the Feynman rules for the S-matrix in QED.

6. 47.1-47.3

7.