Problem Set 5
Phy 341 - Spring 2004
Assigned: Saturday Apr. 3

Problem 1: Gamma Matrix Identities

a) In class I derived trace identities for the gamma matrices. Also useful are the formula of Peskin 5.8 and 5.9. (These equations are also listed in the appendix in Eq. A.29). Derive these formula using the anticommutation relations for the gamma matrices.

b) Suppose we are considering a field theory of spin-$\frac{1}{2}$ particles in 2 space-time dimensions. Find 2×2 matrices that satisfy

$$\{\gamma_\mu, \gamma_\nu\} = 2g_{\mu\nu} \qquad \mu, \nu = 0, 1\,.$$

Evaluate γ_5 explicitly.

c) For 2−D gamma matrices, evaluate the following traces:

$$\mathrm{Tr}[\gamma_\mu \gamma_\nu]$$
$$\mathrm{Tr}[\gamma_\mu \gamma_\nu \gamma_\alpha \gamma_\beta]$$
$$\mathrm{Tr}[\gamma_\mu \gamma_\nu \gamma_5]\,.$$

Problem 2: Mott's Formula

Derive Mott's formula, which is given in Peskin, 5.1. (You do not need to derive it two different ways as is asked in Peskin, 5.1. Just do whatever is easiest for you.)

Problem 3: Bhabba Scattering

Peskin, Problem 5.2

Problem 4: Decays of Positronium Bound States

Read pp. 148-153 and then do Peskin, 5.4, **part a only**