

# 8.851 Homework 4

Iain Stewart, March 5, 2003

## Problem 1) HQET for Antiquarks

Do problem 1 in section 2 of the book.

## Problem 2) Heavy-to-Light Form Factors in HQET

Consider heavy-to-light semileptonic decays,  $B$  to a vector meson.

a) Do the first part of problem 3 in section 2 of the book. (Do not bother with the last part which asks you to discuss the decays to  $\rho$  mesons.) Argue that

$$\langle V(p', \epsilon) | \bar{q} \Gamma Q_v | P^{(Q)}(v) \rangle = \text{tr} \left( M_V \Gamma H_v^{(Q)} \right), \quad (1)$$

where  $M_V$  depends on  $p'$ ,  $\epsilon^*$ , and  $v$ . Then show that the most general  $M_V$  gives no reduction in the number of vector and axial-vector form factors (which is why this problem considers flavor symmetry relations but not spin symmetry relations).

b) (For bonus only) Use your results from a) to solve problem 4 in section 2 which shows that there are spin symmetry relations for the tensor current.