

3/13/07 Homework 4. Due on or before March 23, 9:00 am (under my office door if needed)

1. For  $\lambda\phi^4$ , we have  $m_B^2 = Z_m m_R^2$  (check your lecture notes for the notation). Define  $Z_m \equiv 1 + \sum_k c_k(\lambda)\epsilon^{-k}$ . To two loops, i.e. to order  $\hat{\lambda}^2$ , where  $\hat{\lambda} \equiv \lambda/16\pi^2$ , one computes

$$Z_m = 1 + \epsilon^{-1}(\hat{\lambda} - \frac{5}{12}\hat{\lambda}^2) + \epsilon^{-2}2\hat{\lambda}^2$$

Verify that the coefficient  $c_2$  of the  $1/\epsilon^2$  term is completely determined by  $c_1$  and the condition that  $\gamma_m$  have a smooth  $\epsilon \rightarrow 0$  limit. Verify that the  $c_1$  and  $c_2$  given above satisfy this relation (using the expression given in class for  $\beta(\lambda, \epsilon)$  to one loop).

2. Srednicki, 28.3.
3. Srednicki, 51.1
4. Srednicki 51.3.
5. Srednicki 52.1.