# EXERCISE IV
# (JAN 23 2013, TO BE HANDED IN FEB 06 2013)

INTRODUCTION TO THE RENORMALIZATION GROUP EQUATION (KREIMER, WS 12/13)

- 1.
  Set $Q(g) = \prod_{r\in\mathcal{R}} X^r(g)^{-s_r}$ and
  $$X^r(g) = 1 - sign(s_r) \sum_{k\geq 1} \sum_{i=0}^{t_k^r} g^k B_+^{k,i;r}(X^r(g)Q^k(g)),$$
  where $B_+^{k,i;r}$ is a Hochschild closed 1-cocycle by assumption.
  Show:
  $$\Delta X^r(g)_{|_k} = \sum_{j=0}^{k} (X^r(g)Q^{k-j}(g))_{|_j} \otimes X^r(g)_{|_{k-j}},$$
  and
  $$\Delta(X^r(g)Q^l(g))_{|_k} = \sum_{j=0}^{k} (X^r(g)Q^{k+l-j}(g))_{|_j} \otimes (X^r(g)Q^l(g))_{|_{k-j}}.$$
  Here, a subscript $_{|_n}$ denotes a term of order $n$ in $g$. Hint: use arXiv:0810.2249 (Yeats).

- 2.
  Read *Decomposing Feynman Rules* (Brown, Kreimer), hep-th/1212.3923.