

## Week 1 (due Oct. 7)

Please put the HW into the TA's mailbox on the 4th floor of Downs/Lauritsen by Wednesday night.

Reading: Schwartz 25.1-25.4 and 26.1-26.2.

1. (a) Consider QCD in the  $\xi$ -gauge. Compute the charge  $Q$  corresponding to the BRST symmetry (in the  $\xi$ -gauge). Don't forget that BRST transformations act also on quark fields.

(b) Show that  $Q$  is a fermionic operator satisfying  $\{Q, Q\} = 0$ , where the braces denote the anti-commutator. (Hint: use canonical (anti)-commutation relations derived from the action).

2. Consider a quark-quark pair, where each quark is massive and is in the fundamental  $N$ -dimensional representation of  $SU(N)$ . Compute the force between them resulting from the single gluon exchange when the quark pair is in the symmetric and anti-symmetric tensor representations of  $SU(N)$ .