Week 8 (due November 26)

(Note: chiral perturbation theory is explained in Section 19.7 of Weinberg.)

1. The chiral Lagrangian has $SU(3) \times SU(3)$ invariance. Compute $SU(3) \times SU(3)$ currents in terms of the field Σ and verify that the corresponding charges obey the commutation relations of the Lie algebra of $SU(3) \times SU(3)$.

2. Consider the chiral Lagrangian with gauged $SU(3) \times SU(3)$ symmetry. Compute the commutator of covariant derivatives acting on Σ in terms of the field-strength of the $SU(3) \times SU(3)$ gauge fields ℓ_μ and r_μ.

3. (a) Derive Eq. (19.4.24) in Weinberg. (Hint: use $SU(2) \times SU(2)$ chiral perturbation theory and expand the axial $SU(2)$ current to linear order in the pion field).

(b) Derive Eq. (19.4.25) in Weinberg. (Hint: use Eqs. (19.4.22) and (19.4.24)).