

This assignment involves quite a bit of calculation, so don't leave it too late. Late assignments will be accepted only until 5PM on Friday Dec. 6, so that the solutions can be posted in advance of the final exam.

Do all problems. They are of equal value.

1. Griffiths 9.2
2. Griffiths 9.5 + 9.29
3. Griffiths 9.23+9.24 (but in 9.24 don't include the top quark as he suggests. You can take the necessary completeness relation from problem 9.1. You don't need to derive it.)
4. Griffiths 9.28 [(only for the up and down type quarks. We'll do the others in class.)
5. Griffiths 9.31
6. Some extensions of the Standard Model predict the existence of additional higher-mass gauge bosons similar to the  $W^\pm$  and  $Z^0$  (called the  $W'$  and  $Z'$  respectively). If a  $Z'$ , having exactly the same couplings as the Standard Model  $Z^0$ , exists at a mass of  $250\text{GeV}/c^2$ , estimate the relative magnitude of the contribution from the  $Z'$  to the total cross-section for the process  $e^+e^- \rightarrow \text{hadrons}$  at  $E_{CM} = M(Z^0)$ . [You don't need to do long amplitude calculations for this; give it some thought before calculating].