Physics 852 **Problem Set 1** **Spring 2023**

NOTE: All problem numbers from Sakurai correspond to the 3^{rd} Edition.

1. Sakurai 4.4

   [As a reminder, the $\mathcal{Y}_l^{j,m}$ are just the coupling of the spherical harmonics, $Y_l^{m\pm 1/2}(\theta,\phi)$, and the spin-1/2 two-components, $\chi_\pm$, into states with definite j and m, as defined in Equation (3.384).]

2. Sakurai 4.5

   Hint: You may assume that $C_{n'l'j'n'}$ are calculated in first-order perturbation theory (which doesn't come until Chapter 5! And will be covered in a week or so!) The relevant expression is

   $$C_{n'l'j'n'} = \frac{\langle n'l'j'm'|V|nljm\rangle}{E_{nlj} - E_{n'l'j'}}\,,$$

   where E_{nlj}, etc., are the unperturbed energy levels (i.e., the energy levels of the atom ignoring the parity violating interaction.)

3. Sakurai 4.7

4. Sakurai 4.11