1. **McIntyre 10.24** (degenerate perturbation theory; explicit matrix form)

2. How large a perturbation does an electric field produce? (a) Calculate the energy (in eV) of the photon emitted when an electron in a hydrogen atom makes a transition from the $n = 2$ to $n = 1$ level in the absence of any perturbations to the Coulomb potential. (b) Now apply an electric field of magnitude 0.5 GV/m (large enough to break down a thin film of glass!) to the H gas. How does the spectrum change? Express any energy differences as a fraction of the energy of the $n = 2$ to $n = 1$ transition.

3. **McIntyre 11.2** (*i.e* verify Eqn. 11.23. Note that $J$ is generic angular momentum operator – could be $S, I, F$ etc.)

4. **McIntyre 11.7** (S dot I in terms of ladder operators)