1. Derive the recursive equation for the wavefunction, starting from the λ-dependent Schrödinger equation.

$$\Psi(\lambda) = \Phi + R_0(\lambda V_{\mathrm{c}} - E(\lambda))\Psi(\lambda) \tag{1}$$

Assume intermediate normalization and note that $R_0 H_0 = -Q$ follows** from the definition of R_0.

Extra Credit: Define "resolvent" and explain why this follows from your definition.

2. Determine the first- and second-order components of Ψ by differentiating equation 1. You do <u>not</u> need to fully evaluate and simplify your answer,[1] but you should eliminate all terms that vanish and explain why each one evaluates to zero.[2]

[1]That is, your final answer may contain R_0's and V_c's.

[2]You may take $E_c^{(m+1)} = \langle\Phi|V_c|\Psi^{(m)}\rangle$ as given.

3. Evaluate the following contributions to the CI doubles and quadruples coefficients.

$$ {}^{(1)}c_{ab}^{ij} = \langle \Phi_{ij}^{ab} | R_0 V_{\mathrm{c}} | \Phi \rangle \qquad {}^{(2)}c_{abcd}^{ijkl} = \langle \Phi_{ijkl}^{abcd} | R_0 V_{\mathrm{c}} R_0 V_{\mathrm{c}} | \Phi \rangle \tag{2} $$

   Use your answer to show that ${}^{(2)}C_4 = \frac{1}{2}{}^{(1)}C_2^2$.