1. Derive the recursive equation for the wavefunction, starting from the $\lambda$-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 $\Psi$ 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 $V_\mathrm{c}$'s.

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

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

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

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