Given the operators

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix} \text{ and } C = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}.$$

(a) Show that these commute

(b) Show that (1, 0, 0), $1/\sqrt{2}(0,1,1)$, and $1/\sqrt{2}(0,1,-1)$ are eigenvectors of A and determine the corresponding eigenvalues.

(c) Write the operator *C* in terms of this *A* eigenbasis.

(d) Diagonalize *C* and find the new eigenbasis that is common to the CSCO in terms of the old ones.