

**Problem 3.23**

1. Your life will be easier if we use the following Hamiltonian operator instead of the one he suggests,

$$\hat{H} = \varepsilon(|1\rangle\langle 1| + i|1\rangle\langle 2| - i|2\rangle\langle 1| + |2\rangle\langle 2|).$$

2. Write this operator as a matrix using the orthonormal basis  $|1\rangle$  and  $|2\rangle$ .
3. Find the eigenvalues and eigenfunctions for  $\hat{H}$