CS333 - Worksheet 1

1. If you measure the state $|\psi\rangle = \frac{1}{\sqrt{3}}|0\rangle + i\sqrt{\frac{2}{3}}|1\rangle$ in the standard basis, what happens, and with what probability? What about if you measure using the basis $\{|\rightarrow\rangle, |\leftarrow\rangle\}$?

2. If you have two qubits states $|\psi\rangle$ and $|\phi\rangle$ such that $\langle\psi|\phi\rangle = 0$, explain what measurement you should use to perfectly distinguish between these two states?

3. Explain what will happen in the following situations using bra and ket notation, and the language of collapse:

   (a) Alice prepares a right diagonal photon, and Bob measures it using a vertically polarized filter.

   (b) Alice prepares a left diagonal photon, and Bob measures it using a right diagonally polarized filter.