Assignment

1. For any state $|\psi\rangle$ and unitary operator U, prove that $\| U|\psi\rangle \|_2 = \| |\psi\rangle \|_2$

2. For two operators A, B : $[A, B] = AB - BA$. Find a matrix representation for $[X, Z]$ in the standard basis $\{|0\rangle, |1\rangle\}$

3. Show that Pauli matrices are all Hermitian, Unitary, and the eigenvalues are ± 1. A matrix U is Hermitian if $U^\dagger = U$.

4. Show that $HXH = Z$ and $HZH = X$.

5. Determine the set of measurement operators corresponding to a measurement of X observable.

6. Show that $|\phi\rangle = \frac{1}{\sqrt{2}} (|00\rangle + |11\rangle) = \frac{1}{\sqrt{2}} (|++\rangle + |--\rangle)$ is an entangled state.

7. Draw a circuit to prepare the state $|\Phi\rangle = \frac{1}{\sqrt{2}} (|00\rangle + |11\rangle)$ in the lab.