CSEP 590tv In Class Problems, June 29, 2005

Dave Bacon

1. What is the bra ($\langle\psi|$) corresponding to the ket $|\psi\rangle = \frac{1}{2}e^{\frac{i\pi}{3}}|0\rangle + \frac{\sqrt{3}}{2}|1\rangle$?

Let $|\phi\rangle = \frac{1}{\sqrt{2}}|0\rangle + \frac{1}{\sqrt{2}}|1\rangle$. Calculate $\langle\phi|\psi\rangle$. What is $\langle\psi|\phi\rangle$?

2. What is the output of the following quantum circuit?

$$\frac{1}{\sqrt{3}}|0\rangle + \sqrt{\frac{2}{3}}|1\rangle \quad \text{—}\boxed{H}\text{—}$$

Recall that

$$H = \begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{bmatrix}$$

If we measure the state output from this circuit in the computational basis, with what probability do we get the outcomes $|0\rangle$ and $|1\rangle$?

$$\frac{1}{\sqrt{3}}|0\rangle + \sqrt{\frac{2}{3}}|1\rangle \quad \text{—}\boxed{H}\text{—}\boxed{\text{⌒}}$$