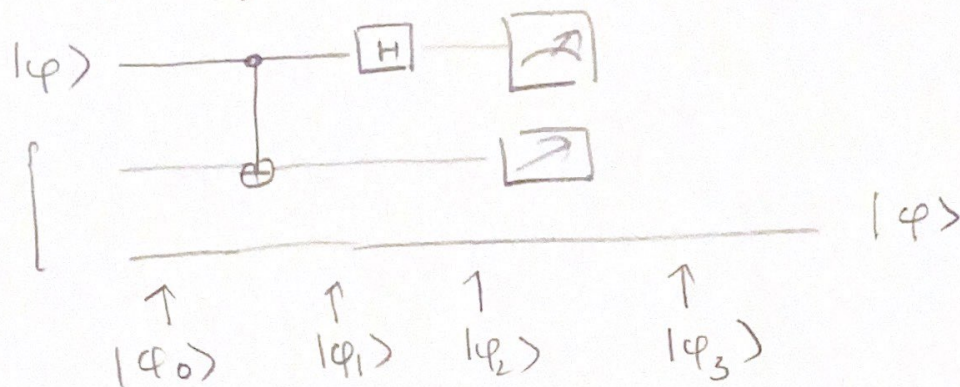


Quiz 4: Quantum Teleportation

1) Alice wants to send Bob state $|\varphi\rangle = \alpha|0\rangle + \beta|1\rangle$

She uses the following Quantum Circuit.



At $|\varphi_1\rangle$, she applies CNOT $\rightarrow |\varphi_1\rangle = \frac{1}{\sqrt{2}} \left[\alpha|0\rangle(|00\rangle + |11\rangle) + \beta|1\rangle(|10\rangle + |01\rangle) \right]$

then Applying H on $|\varphi_1\rangle$, giving

$$|\varphi_2\rangle = \frac{1}{\sqrt{2}} \left[\begin{array}{l} |00\rangle (\alpha|0\rangle + \beta|1\rangle) + |10\rangle (\alpha|1\rangle + \beta|0\rangle) + \\ |11\rangle (\alpha|0\rangle - \beta|1\rangle) + |01\rangle (\alpha|1\rangle - \beta|0\rangle) \end{array} \right]$$

Now first 2 qbits is belong to Alice, while \downarrow belong to Bob.

thus if Alice measures these qbits yielding 00, the the state Bob received is $|\varphi\rangle$

2) The duration when $|\varphi\rangle$ vanished is when the transformation $|\varphi_1\rangle \mapsto |\varphi_2\rangle$