Lab07

1. We have seen that one of the Bell states is $\beta_{00} = \frac{1}{\sqrt{2}}|00\rangle + \frac{1}{\sqrt{2}}|11\rangle$, where the input is 00. Analytically (similar to lecture), show the three other Bell states.

Hint: In the first one, the input is 01, i.e., you show what β_{01} is. In the second one, the input is 10, i.e., you show what β_{10} is. In the third one, the input is 11, i.e., you show what β_{11} is.

$H|0\rangle = \frac{1}{\sqrt{2}}(|0\rangle + |1\rangle)$

$H|1\rangle = \frac{1}{\sqrt{2}}(|0\rangle - |1\rangle)$

a) $\beta_{01} => |01\rangle$

$=> apply\ Hadamard\ gate => \frac{1}{\sqrt{2}}(|0\rangle + |1\rangle)|1\rangle => \frac{1}{\sqrt{2}}(|01\rangle + |11\rangle)$

$=> CNot\ is\ executed => \frac{1}{\sqrt{2}}(|01\rangle + |10\rangle)$

$=> \beta_{01} = \frac{1}{\sqrt{2}}|01\rangle + \frac{1}{\sqrt{2}}|10\rangle$

b) $\beta_{10} => |10\rangle$

$=> apply\ Hadamard\ gate => \frac{1}{\sqrt{2}}(|0\rangle - |1\rangle)|0\rangle => \frac{1}{\sqrt{2}}(|00\rangle - |10\rangle)$

$=> CNot\ is\ executed => \frac{1}{\sqrt{2}}(|00\rangle - |11\rangle)$

$=> \beta_{10} = \frac{1}{\sqrt{2}}|00\rangle - \frac{1}{\sqrt{2}}|11\rangle$

c) $\beta_{11} => |11\rangle$

$=> apply\ Hadamard\ gate => \frac{1}{\sqrt{2}}(|0\rangle - |1\rangle)|1\rangle => \frac{1}{\sqrt{2}}(|01\rangle - |11\rangle)$

$=> CNot\ is\ executed => \frac{1}{\sqrt{2}}(|01\rangle - |10\rangle)$

$=> \beta_{11} = \frac{1}{\sqrt{2}}|01\rangle - \frac{1}{\sqrt{2}}|10\rangle$

2. We have seen how to program one of the Bell states, $\beta_{00} = \frac{1}{\sqrt{2}}|00\rangle + \frac{1}{\sqrt{2}}|11\rangle$, in Strange. Program the other three Bell states from the previous question, i.e., β_{01}, β_{10}, and β_{11}. Show the bar chart for each case, running 10000 times.

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