

CS 880: Quantum Algorithm
Homework NUM: 1

Solution

Question 1

Because C-NOT gate requires check whether the control qubit is in state $|1\rangle$ or not, so it will make the superposition of the control qubit collapse.

Therefore, it has the same effect as measure the 5 qubits as the for z as the measurement in y .

Question 2

It changes because of measurement collapse the distribution into a single state.

Therefore, the potential interference between the two qubits is destroyed, but instead become a linear combination as probability model.

$$|00\rangle = \begin{pmatrix} 1 \\ 0 \\ 0 \\ 0 \end{pmatrix}$$

$$|01\rangle = \begin{pmatrix} 0 \\ 1 \\ 0 \\ 0 \end{pmatrix}$$

$$|10\rangle = \begin{pmatrix} 0 \\ 0 \\ 1 \\ 0 \end{pmatrix}$$

$$|11\rangle = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 1 \end{pmatrix}$$

$$\text{CNOT} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{pmatrix}$$

$$|0\rangle \implies |00\rangle$$