IIT Madras
Department of Physics
Name : Chaganti Kamaraja Siddhartha
ID : EP20B012

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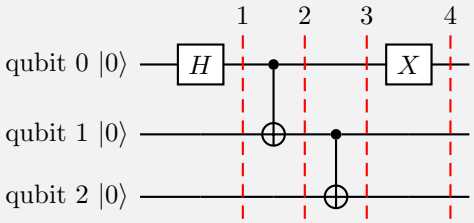
Assignment 1

ID5841: Quantum Computing Lab

Answer to Question 3 (a)



Initial State,

$$|\psi_0\rangle = |000\rangle \tag{1}$$

Applying Hadamard gate to qubit 0,

$$|\psi_1\rangle = \frac{1}{\sqrt{2}}(|000\rangle + |001\rangle) \tag{2}$$

CNOT gate with qubit 0 as control and qubit 1 as target,

$$|\psi_2\rangle = \frac{1}{\sqrt{2}}(|000\rangle + |011\rangle) \tag{3}$$

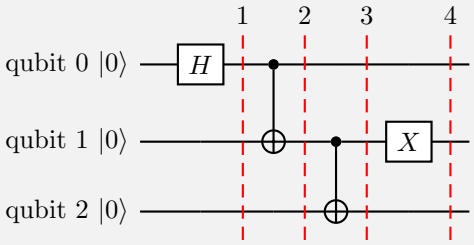
CNOT gate with qubit 1 as control and qubit 2 as target,

$$|\psi_3\rangle = \frac{1}{\sqrt{2}}(|000\rangle + |111\rangle) \tag{4}$$

Applying X gate on qubit 0,

$$|\psi_4\rangle = \frac{1}{\sqrt{2}}(|001\rangle + |110\rangle) \tag{5}$$

Answer to Question 3 (b)



Initial State,

$$|\psi_0\rangle = |000\rangle \tag{6}$$

Applying Hadamard gate to qubit 0,

$$|\psi_1\rangle = \frac{1}{\sqrt{2}}(|000\rangle + |001\rangle) \tag{7}$$

CNOT gate with qubit 0 as control and qubit 1 as target,

$$|\psi_2\rangle = \frac{1}{\sqrt{2}}(|000\rangle + |011\rangle) \tag{8}$$

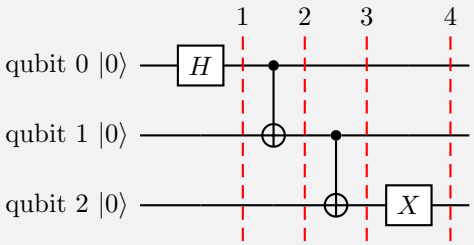
CNOT gate with qubit 1 as control and qubit 2 as target,

$$|\psi_3\rangle = \frac{1}{\sqrt{2}}(|000\rangle + |111\rangle) \tag{9}$$

Applying X gate on qubit 1,

$$|\psi_4\rangle = \frac{1}{\sqrt{2}}(|010\rangle + |101\rangle) \tag{10}$$

Answer to Question 3 (c)



Initial State,

$$|\psi_0\rangle = |000\rangle \tag{11}$$

Applying Hadamard gate to qubit 0,

$$|\psi_1\rangle = \frac{1}{\sqrt{2}}(|000\rangle + |001\rangle) \tag{12}$$

CNOT gate with qubit 0 as control and qubit 1 as target,

$$|\psi_2\rangle = \frac{1}{\sqrt{2}}(|000\rangle + |011\rangle) \tag{13}$$

CNOT gate with qubit 1 as control and qubit 2 as target,

$$|\psi_3\rangle = \frac{1}{\sqrt{2}}(|000\rangle + |111\rangle) \tag{14}$$

Applying X gate on qubit 2,

$$|\psi_4\rangle = \frac{1}{\sqrt{2}}(|100\rangle + |011\rangle) \tag{15}$$