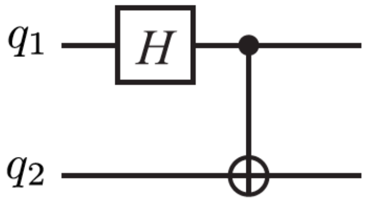
PH 441 Quiz-I
Total Marks 10

Just Put ✔ against the correct option or options. Questions 4 and 5 may have more than one correct option! Full marks will be given, only if all the options are pointed out correctly.

Question 1: Consider the following quantum circuit



Here q_1 denotes the first qubit and q_2 refers to the second qubit. The output for the input $|10\rangle$ is:

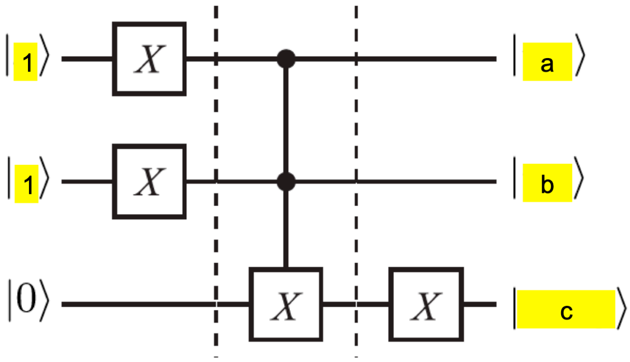
(A) $\frac{1}{\sqrt{2}}(|01\rangle + |10\rangle)$

(B) $\frac{1}{\sqrt{2}}(|01\rangle - |10\rangle)$

(C) $\frac{1}{\sqrt{2}}(|00\rangle - |11\rangle)$

(D) $\frac{1}{\sqrt{2}}(|00\rangle + |11\rangle)$

Question 2: Consider the following quantum circuit



The outputs $|a\rangle$, $|b\rangle$ and $|c\rangle$ respectively are:

(A) $|1\rangle$, $|1\rangle$ and $|1\rangle$
(B) $|0\rangle$, $|1\rangle$ and $|1\rangle$
(C) $|0\rangle$, $|0\rangle$ and $|1\rangle$
(D) $|0\rangle$, $|0\rangle$ and $|0\rangle$

Question 3:

A two qubit state is given by $|\psi\rangle = \frac{3}{5}|00\rangle + \frac{4}{5}|11\rangle$. If a NOT gate is applied on the second qubit and the resulting state is measured, the probability of getting the state is:

(A) 0.8
(B) 0.64
(C) 0.6
(D) 0.36

Question 4:

Which of the following relations are true?
(A) $HXH = Z$
(B) $HZH = X$
(C) $ZXZ = -X$
(D) $XZX = Z$

Question 5:

A 3 qubit state is given by $|\phi\rangle = \frac{1}{\sqrt{14}}[2|001\rangle + |010\rangle + 3|100\rangle]$. Which of the following statements is (are) true?

(A) If a measurement of the second qubit is made, the probability of getting the state $|0\rangle$ is $\frac{13}{14}$.
(B) If the measurement of the first qubit finds it in the state $|0\rangle$, the second and third qubits would have collapsed to a Bell state.
(C) If the measurement of the first qubit finds it in the state $|1\rangle$, the second and third qubits would have become entangled.
(D) If the first qubit is measured first and it is found to be in the state $|0\rangle$ and then the second qubit is measured, the probability of the second qubit being in the state $|0\rangle$ would be $\frac{4}{5}$.