QClass24/25 Quiz3

Due Nov 25 at 3:59am **Points** 20 **Questions** 10
Available until Nov 25 at 3:59am **Time Limit** 60 Minutes
Allowed Attempts 2

Take the Quiz Again

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	18 minutes	12 out of 20

Last Attempt Details:

Time:	18 minutes
Current Score:	12 out of 20
Kept Score:	12 out of 20

1 More Attempt available

Take the Quiz Again

(Will keep the highest of all your scores)

Correct answers are hidden.

Score for this attempt: **12** out of 20
Submitted Nov 24 at 8:45pm
This attempt took 18 minutes.

Question 1

2 / 2 pts

We have two qubits as $q_1 \otimes q_0$ in $|0\rangle \otimes |0\rangle$.

Which one of the following operators leads the composite system to

$\frac{1}{\sqrt{2}}|00\rangle + \frac{1}{\sqrt{2}}|11\rangle$?

- $CNOT(q_1, q_0), H(q_1)$
- $H(q_1), CNOT(q_0, q_1)$
- **$H(q_1), CNOT(q_1, q_0)$**
- $H(q_1), H(q_0)$

Question 2

2 / 2 pts

What is the matrix representation of $CNOT(q_1, q_0)$

- $\begin{pmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$
- **$\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{pmatrix}$**

- $\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$
- $\begin{pmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{pmatrix}$

Incorrect

Question 3

0 / 2 pts

We have two qubits as $q_1 \otimes q_0$ in $\frac{1}{2}|00\rangle - \frac{1}{2}|01\rangle + \frac{1}{2}|10\rangle$.

What are the states of q_1 and q_0 separately?

- $|-\rangle \otimes |-\rangle$
- $|+\rangle \otimes |+\rangle$
- $|+\rangle \otimes |-\rangle$
- $|-\rangle \otimes |+\rangle$

Incorrect

Question 4

0 / 2 pts

We have two qubits as $q_1 \otimes q_0$ in $\frac{1}{\sqrt{2}}|01\rangle - \frac{1}{\sqrt{2}}|10\rangle$

After applying which one of the followings, the system will no longer be entangled?

- $X(q_1),\ Z(q_0)$
- $CNOT(q_0, q_1)$
- $X(q_1), X(q_0)$
- $H(q_2)$

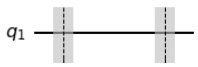
Question 5

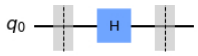
2 / 2 pts

We have a quantum register with two qubits as $q_1 \otimes q_0$

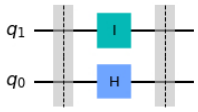
We apply Hadamard operator to q_0

What is its matrix form on the composite system, i.e., the operator applied between two barriers?





Hint: The operator of the composite system is tensoring of all local operators, where the identity operator is applied to the qubit(s) if no specific operator is defined.



- $\begin{pmatrix} 0 & 0 & \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ 0 & 0 & \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{pmatrix}$
- $\begin{pmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} & 0 & 0 \\ \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} & 0 & 0 \end{pmatrix}$
- $\begin{pmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} & 0 & 0 \\ \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} & 0 & 0 \\ 0 & 0 & \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ 0 & 0 & \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{pmatrix}$
- $\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ 0 & 0 & \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{pmatrix}$

Question 6

2 / 2 pts

We have a composite system with three qubits as $q_2 \otimes q_1 \otimes$ in state

$\frac{1}{\sqrt{2}}|101\rangle + \frac{1}{\sqrt{3}}|110\rangle + \frac{1}{\sqrt{6}}|011\rangle$

We measure only the qubit q_2.

What is the probability of observing state $|1\rangle$?

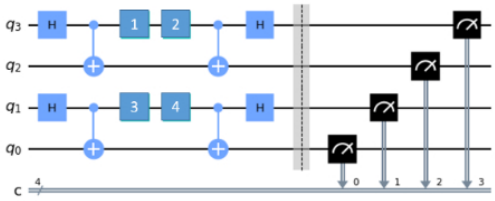
- 1/3
- 0
- 5/6
- 1/2

Incorrect

Question 7

0 / 2 pts

We implement the superdense coding protocol in the following circuit.



If the outcome is '0110', what can the operators for 1,2,3,4 be in the circuit?

- I, Z, X, I
- I, X, Z, I
- I, I, X, Z
- X, Z, X, Z

Incorrect

Question 8

0 / 2 pts

We have a composite system with three qubits $q_2 \otimes q_1 \otimes q_0$ that is in state $\frac{1}{2}|110\rangle + \frac{1}{2}|010\rangle - \frac{1}{\sqrt{2}}|111\rangle$. If we measure the qubit q_2, which one of the following mixtures is obtained?

- state $|10\rangle$ with probability $\frac{1}{4}$
  state $\frac{1}{\sqrt{3}}|10\rangle + \sqrt{\frac{2}{3}}|11\rangle$ with probability $\frac{3}{4}$
- state $|10\rangle$ with probability $\frac{3}{4}$
  state $\frac{1}{\sqrt{3}}|10\rangle - \sqrt{\frac{2}{3}}|11\rangle$ with probability $\frac{1}{4}$
- state $|10\rangle$ with probability $\frac{3}{4}$
  state $\frac{1}{\sqrt{3}}|10\rangle + \sqrt{\frac{2}{3}}|11\rangle$ with probability $\frac{1}{4}$
- state $|10\rangle$ with probability $\frac{1}{4}$
  state $\frac{1}{\sqrt{3}}|10\rangle - \sqrt{\frac{2}{3}}|11\rangle$ with probability $\frac{3}{4}$

Question 9

2 / 2 pts

We have a composite system with two qubits q_1 and q_0. In which one of the following states the system is not entangled?

- $\frac{1}{2}\begin{pmatrix} 1 \\ -1 \\ -1 \end{pmatrix}$

$\begin{pmatrix} \\ -1 \end{pmatrix}$

1 $\frac{1}{2}\begin{pmatrix} -1 \\ 1 \\ -1 \\ -1 \end{pmatrix}$

$\frac{1}{2}\begin{pmatrix} -1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$

$\frac{1}{2}\begin{pmatrix} -1 \\ 1 \\ 1 \\ -1 \end{pmatrix}$

Question 10

2 / 2 pts

We have a composite system with three qubits $q_2 \otimes q_1 \otimes q_0$
What is the final state if $CZ(q_0, q_2)$ applied to state
$\frac{1}{\sqrt{5}}|100\rangle - \sqrt{\frac{2}{5}}|001\rangle - \sqrt{\frac{2}{5}}|111\rangle$

$\frac{1}{\sqrt{5}}|100\rangle - \sqrt{\frac{2}{5}}|001\rangle + \sqrt{\frac{2}{5}}|111\rangle$

$\frac{1}{\sqrt{5}}|100\rangle - \sqrt{\frac{2}{5}}|001\rangle - \sqrt{\frac{2}{5}}|111\rangle$

$\frac{1}{\sqrt{5}}|100\rangle - \sqrt{\frac{2}{5}}|001\rangle - \sqrt{\frac{2}{5}}|111\rangle$

$\frac{1}{\sqrt{5}}|000\rangle - \sqrt{\frac{2}{5}}|101\rangle - \sqrt{\frac{2}{5}}|011\rangle$

Quiz Score: **12** out of 20

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