Unit 3 - Week-2

Week 2 - Assignment 2

The due date for submitting this assignment has passed. Due on 2017-08-09, 23:59 IST.
As per our records you have not submitted this assignment.

In the following questions, ONLY ONE answer is correct. Choose the most appropriate one. (1X10=10 Marks)

1) Action of Z operator on an arbitrary point on the Bloch sphere is to rotate the Bloch sphere vector of the point about *1 point*

- z axis by $\pi/2$
- z axis by π
- x axis by $\pi/2$
- x axis by π

No, the answer is incorrect.
Score: 0

Accepted Answers:
z axis by π

2) A two qubit state is given by $\psi = 0.6|00\rangle + 0.8|11\rangle$. If a NOT gate is applied on the second qubit and the resulting state is measured, the probability of getting the state $|10\rangle$ is *1 point*

- 0.8
- 0.64
- 0.6
- 0.36

No, the answer is incorrect.
Score: 0

Accepted Answers:
0.64

3) A T-gate is equivalent to *1 point*

- $\pi/8$ gate
- $\pi/4$ gate
- XZ gate
- YZ gate

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\pi/8$ gate

4) Hadamard gate is equivalent to **1 point**

- $\frac{1}{\sqrt{2}}(X+iY)$
- $\frac{1}{\sqrt{2}}(X-iY)$
- $\frac{1}{\sqrt{2}}(X+Z)$
- $\frac{1}{\sqrt{2}}(X-Z)$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{\sqrt{2}}(X+Z)$

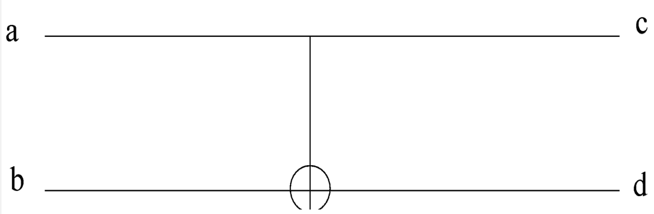
5) Which of the following operator relations is NOT correct? **1 point**

- $X^2 = I$
- $XYX = -Y$
- $ZXZ = -X$
- $XZX = Z$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$XZX = Z$

6) In the following circuit, if $|a\rangle = \frac{|0\rangle + |1\rangle}{\sqrt{2}}$, then $|cd\rangle$ is equal to **1 point**



- $\frac{|0b\rangle + |1b\rangle}{\sqrt{2}}$
- $\frac{|0\bar{b}\rangle + |1\bar{b}\rangle}{\sqrt{2}}$
- $\frac{|0\bar{b}\rangle + |1b\rangle}{\sqrt{2}}$
-

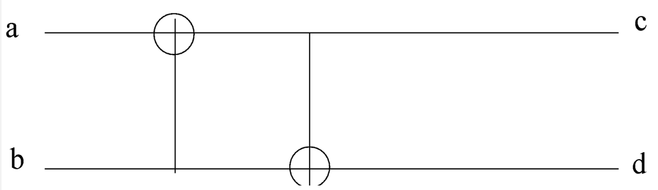
$\frac{|0b\rangle + |1\bar{b}\rangle}{\sqrt{2}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$\frac{|0b\rangle + |1\bar{b}\rangle}{\sqrt{2}}$

7) What is matrix representation of the following circuit? *1 point*



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

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

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

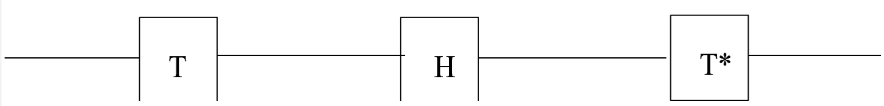
- $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix}$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$

8) The output of the circuit given below, in which T^* is the adjoint of T for the input state is $|\psi\rangle = cos\theta|0\rangle + sin\theta|1\rangle$is *1 point*



$\frac{1}{\sqrt{2}}[(cos\theta + e^{i\pi/4}sin\theta)|0\rangle + (sin\theta + e^{-i\pi/4}cos\theta)|1\rangle]$

- $\frac{1}{\sqrt{2}}[(cos\theta + sin\theta)|0\rangle]$
- $\frac{1}{\sqrt{2}}[(cos\theta + e^{i\pi/4}sin\theta)|0\rangle]$
- $\frac{1}{\sqrt{2}}[(cos\theta + e^{i\pi/4}sin\theta)|0\rangle + (-sin\theta + e^{-i\pi/4}cos\theta)|1\rangle]$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{\sqrt{2}}[(cos\theta + e^{i\pi/4}sin\theta)|0\rangle + (-sin\theta + e^{-i\pi/4}cos\theta)|1\rangle]$

9) No cloning theorem tells us that ***1 point***

- It is impossible to create an identical copy of an arbitrary quantum state
- If a unitary operator can be found which duplicates one quantum state, the same operator cannot duplicate a state orthogonal to it
- Teleportation protocol violates no-cloning theorem
- Entangling of one state with the state of another system violates no-cloning theorem

No, the answer is incorrect.
Score: 0

Accepted Answers:
It is impossible to create an identical copy of an arbitrary quantum state

10) The matrix representation of a controlled NOT gate is ***1 point***

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

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

In the following questions, ONE or MORE answer(s) is(are correct. Choose all the appropriate ones. (2X5=10 Marks)

11) Which of the following statements about dense coding is (are) correct? *2 points*

- [ ] Dense coding is used to convey more number of classical bits by appropriately coding smaller number of quantum bits
- [ ] Dense coding is used to convey more number of quantum bits by appropriately coding smaller number of classical bits
- [ ] In dense coding the receiving end gets a set of states distinguishable in an orthonormal basis
- [ ] Dense coding does not involve physical transfer of qubit(s) from the sender to th receiver

No, the answer is incorrect.
Score: 0

Accepted Answers:
Dense coding is used to convey more number of classical bits by appropriately coding smaller number of quantum bits
In dense coding the receiving end gets a set of states distinguishable in an orthonormal bas

12) In a quantum teleportation protocol, Alice has an arbitrary quantum state $|\psi\rangle = \alpha|0\rangle + \beta|1\rangle$ with her, which she wants to send to Bob. Alice and Bob also share a Bell state $\frac{1}{\sqrt{2}}[|00\rangle|11\rangle]$. Which of the following statements is (are) true for the transportation protocol *2 points*

- [ ] The state $|\psi\rangle$ is physically transferred from Alice to Bob
- [ ] Alice needs to send two bits of classical information to Bob after the local operations performed by he
- [ ] One of the local operations at Alice's end requires measurement in Bell basis
- [ ] After the local operation at Alice's end, Bob's qubit is dis-entangled from Alice's qubit

No, the answer is incorrect.
Score: 0

Accepted Answers:
Alice needs to send two bits of classical information to Bob after the local operations performed by he
One of the local operations at Alice's end requires measurement in Bell basis
After the local operation at Alice's end, Bob's qubit is dis-entangled from Alice's qubit

13) Which of the following statements is (are) true for the CNOT gate? *2 points*

- [ ] CNOT can be used to generate entangled state from a pair of separable states
- [ ] CNOT is hermitian
- [ ] CNOT gate is its own inverse
- [ ] CNOT is unitary

No, the answer is incorrect.
Score: 0

Accepted Answers:
CNOT can be used to generate entangled state from a pair of separable states
CNOT is hermitian
CNOT is unitary

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

- [ ] If a measurement of the second qubit is made, the probability of getting the state $|0\rangle$ is 13/14
- [ ] 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 state $|0\rangle$ would be 4/5
- [ ] If a measurement of the first qubit finds it in the state $|0\rangle$, the second and the third qubits would have collapsed to a Bell state
- [ ] If a measurement of the first qubit finds it in the state $|1\rangle$, the second and the third qubits would have become dis-entangled

No, the answer is incorrect.
Score: 0

Accepted Answers:
If a measurement of the second qubit is made, the probability of getting the state $|0\rangle$ is 13/14
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 state $|0\rangle$ would be 4/5
If a measurement of the first qubit finds it in the state $|1\rangle$, the second and the third qubits would have become dis-entangled

15) Which of the following statements is (are) true? **2 points**

- [ ] Toffoli gate is equivalent to a CCNOT gate
- [ ] Toffoli gate is a reversible logic gate
- [ ] Fredkin gate is equivalent to a SWAP gate
- [ ] Fredkin gate is a reversible logic gate

No, the answer is incorrect.
Score: 0

Accepted Answers:
Toffoli gate is equivalent to a CCNOT gate
Toffoli gate is a reversible logic gate
Fredkin gate is a reversible logic gate

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