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NPTEL

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Courses » Quantum Information and Computing

Announcements **Course** Ask a Question Progress

Unit 5 - Week 4

Week 4 - Assignment 4

The due date for submitting this assignment has passed. **Due on 2017-08-23, 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. (1X12=12 Marks)

1) In the Deutsch algorithm, the input to the oracle is $|x\rangle = \frac{|0\rangle + |1\rangle}{\sqrt{2}}$ and $|y\rangle = |1\rangle$, and the function is such that f(0)=0, f(1)=1. After being subjected to the oracle, the first qubit is passed through a Hadamard gate. The state of the qubits at this stage (before any measurement is made) is *1 point*

- $|00\rangle$
- $|01\rangle$
- $|00\rangle + |01\rangle - |10\rangle + |11\rangle$
- $|00\rangle + |01\rangle + |10\rangle + |11\rangle$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$|00\rangle + |01\rangle - |10\rangle + |11\rangle$

2) In the Deutsch algorithm, the input to the oracle is $x = \frac{|0\rangle + |1\rangle}{\sqrt{2}}$ and $y = |0\rangle$, and the function is such that f(0)=0, f(1)=1. After being subjected to the oracle, the first qubit is passed through a Hadamard gate. The state of the qubits at this stage (before any measurement is made) is *1 point*

- $|00\rangle + |01\rangle$
- $|01\rangle + |11\rangle$
- $|10\rangle + |11\rangle$
- $|00\rangle + |11\rangle$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$|00\rangle + |11\rangle$

3) How many queries are required to determine whether a function $f : \{0,1\}^n \rightarrow \{0,1\}$ is balanced or is constant in a deterministic classical *1 point*

algorithm?

- n
- $\frac{n}{2} - 1$
- $2^{n-1} + 1$
- 2^{n-1}

No, the answer is incorrect.
Score: 0

Accepted Answers:
$2^{n-1} + 1$

4) The following circuit shows Deutsch-Jozsa algorithm: ***1 point***
Take n=2, i.e. a two qubit input in the first register. If f(00)=1 and f(01)=f(10)=f(11)=0, then the state $|\psi_3\rangle$ is

- $|00\rangle - |01\rangle + |10\rangle + |11\rangle$
- $|00\rangle - |01\rangle - |10\rangle - |11\rangle$
- $|00\rangle + |01\rangle - |10\rangle + |11\rangle$
- $|00\rangle + |01\rangle + |10\rangle - |11\rangle$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$|00\rangle - |01\rangle - |10\rangle - |11\rangle$

5) In Deutsch-Jozsa algorithm using a two qubit input, the oracle calculates a balanced function ***1 point***
f(00)=f(01)=0 and f(10)=f(11)=1. After execution of the algorithm, the first register is measured. The output is:

- $|10\rangle$
- $|01\rangle$
- $|00\rangle$
- $|11\rangle$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$|10\rangle$

6) A 2 to 1 function f(x) is such that f(x) = f(y) iff x ⊕ ξ= y. If f(100) = f(010) then it follows that ***1 point***

- f(001) = f(111)
- f(001) = f(101)
- f(001) = f(000)
- f(001) = f(110)

No, the answer is incorrect.
Score: 0

Accepted Answers:
f(001) = f(111)

7) Grover's operator $2|s\rangle\langle s| - I$, acting on an arbitrary state $|\psi\rangle$ **1 point**

- Flips the sign of the component of |ψ⟩ parallel to |s⟩
- Flips the sign of the component of |ψ⟩ perpendicular to |s⟩
- Flips the sign of the component of |ψ⟩ parallel to the marked state |w⟩
- Flips the sign of |ψ⟩

No, the answer is incorrect.
Score: 0

Accepted Answers:
Flips the sign of the component of |ψ⟩ perpendicular to |s⟩

8) How many iterations are required by Grover's algorithm to find one marked item out of 100 in an unstructured database? **1 po**

- 10
- 9
- 8
- 7

No, the answer is incorrect.
Score: 0

Accepted Answers:
8

9) Consider Grover algorithm for N=16 out of which one item is to be searched. The probability of success after two iterations of the algorithm is **1 point**

- 0.067
- 0.481
- 0.958
- 0.997

No, the answer is incorrect.
Score: 0

Accepted Answers:
0.481

10) For Deutsch-Jozsa algorithm with 2 qubit inputs how many functions are constant functions? **1 point**

- 1
- 2
- 6
- 8

No, the answer is incorrect.
Score: 0

Accepted Answers:
2

11) Supposing you write a program for classical deterministic algorithm for Deutsch-Jozsa problem to determine whether a given function is constant or is balanced. What is the minimum number of function evaluation after which such a program may terminate? **1 point**

- 2
- 3
- n/2
- 2^{n-1}

No, the answer is incorrect.
Score: 0

Accepted Answers:

2

12) In Bernstein- Vazirani problem with n qubit inputs $x \in \{0,1\}^n$ and a classical program which calculates $f(x) = a \cdot x$, where $a \cdot x = a_{n-1}x_{n-1} + a_{n-2}x_{n-2} + \ldots + a_0 x_0$ (mod 2), how many queries do we need to determine the unknown string? **1 point**

- n
- $\frac{n}{2} + 1$
- $2^{n-1} + 1$
- 2^n

No, the answer is incorrect.
Score: 0

Accepted Answers:
n

In the following questions, ONE or MORE answer(s) is(are correct. Choose all the appropriate ones. (2X4=8 Marks)

13) If, in the Deutsch algorithm, the input to the oracle is |x⟩=(|0⟩+|1⟩)/√2 and |y⟩=|0⟩, then **2 points**

- If the function is constant, we would get |0⟩ on measuring the first qubit
- If the function is constant, we would get |1⟩ on measuring the first qubit
- If the function is balanced, on measuring the first qubit, we would get |0⟩ 50% of time and |1⟩ 50% of time
- If on measuring the first qubit, we get |1⟩, the function must be balanced

No, the answer is incorrect.
Score: 0

Accepted Answers:
If the function is constant, we would get |0⟩ on measuring the first qubit
If the function is balanced, on measuring the first qubit, we would get |0⟩ 50% of time and |1⟩ 50% of time
If on measuring the first qubit, we get |1⟩, the function must be balanced

14) In Deutsch-Jozsa algorithm taking $x = 2^{n-1}x_{n-1} + 2^{n-2}x_{n-2} + \cdots + 2^0 x_0$, which of the following are examples of a constant function? **2 points**

- $\left[\frac{x}{2^n}\right]$, where [ ] represents the greatest integer function
- sin(πx)
- cos(πx)
- |cos(πx)|

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\left[\frac{x}{2^n}\right]$, where [ ] represents the greatest integer function
sin(πx)
|cos(πx)|

15) Grover's rotation R_G operator is **2 points**

- Unitary
- Hermitian
- Orthogonal
- Symmetric

No, the answer is incorrect.
Score: 0

Accepted Answers:
Unitary
Orthogonal

16) For a database of 16 items, if a measurement of the state is made after 'n' iterations of Grover's algorithm, find the probability 'p', that it will fail to identify the marked state corresponding to 'n' ***2 points***

- [ ] n=1, p=375/256
- [ ] n=2, p=375/4096
- [ ] n=2, p=735/4096
- [ ] n=1, p=135/256

No, the answer is incorrect.
Score: 0

Accepted Answers:
n=2, p=375/4096
n=1, p=135/256

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