Unit 6 - Week 5

Week 5 - Assignment 5

The due date for submitting this assignment has passed. Due on 2017-08-30, 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. (1X9=9 Marks)

1) Consider a function over a set of two integers {0, 1}. Let f(0) = 1 and f(1) = 2. If $\tilde{f}_0$ and $\tilde{f}_1$ are the corresponding discrete Fourier transforms, then *1 point*

- $\tilde{f}_0 = \frac{1}{\sqrt{2}}$
- $\tilde{f}_0 = -\frac{1}{\sqrt{2}}$
- $\tilde{f}_0 = \frac{3}{\sqrt{2}}$
- $\tilde{f}_0 = \frac{\sqrt{3}}{2}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\tilde{f}_0 = \frac{3}{\sqrt{2}}$

2) Quantum Fourier Transform of $\frac{|0\rangle - |1\rangle}{\sqrt{2}}$ is *1 point*

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

No, the answer is incorrect.
Score: 0

Accepted Answers:

$|1\rangle$

3) Quantum Fourier Transform of the Bell state $\frac{|01\rangle + |10\rangle}{\sqrt{2}}$ is *1 point*

- $\frac{1}{2\sqrt{2}}[2|00\rangle - (1-i)|01\rangle - (1+i)|11\rangle]$
- $\frac{1}{2\sqrt{2}}[2|00\rangle - (1-i)|01\rangle + |10\rangle + (1+i)|11\rangle]$
- $\frac{1}{2\sqrt{2}}[2|00\rangle - (1+i)|01\rangle - (1-i)|11\rangle]$
- $\frac{1}{2\sqrt{2}}[|00\rangle - |01\rangle + |10\rangle - |11\rangle]$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{2\sqrt{2}}[2|00\rangle - (1-i)|01\rangle - (1+i)|11\rangle]$

4) If an operator S acting a state $|x\rangle$ gives the state $|x+1, mod\ N\rangle$, then S acting on its QFT, $|\tilde{x}\rangle$, gives *1 point*

- $S|\tilde{x}\rangle = |\tilde{x}+1, mod\ N\rangle$
- $S|\tilde{x}\rangle = |\tilde{x}-1, mod\ N\rangle$
- $S|\tilde{x}\rangle = exp(-2\pi i\tilde{x}/N)|\tilde{x}, mod\ N\rangle$
- $S|\tilde{x}\rangle = exp(-2\pi i\tilde{x}/N)|\tilde{x}+1, mod\ N\rangle$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$S|\tilde{x}\rangle = exp(-2\pi i\tilde{x}/N)|\tilde{x}, mod\ N\rangle$

5) The circuit shown below gives an output given by *1 point*

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

No, the answer is incorrect.
Score: 0

Accepted Answers:
$-|11\rangle$

6) The order of 4 mod 35 is *1 point*

- 2
- 4
- 6
- 8

No, the answer is incorrect.
Score: 0

Accepted Answers:
6

7) The continued fraction representation of 3.1415 is *1 point*

- [3,7]
- [3,7,7]
- [3,7,14,1]
- [3,7,14,1,8,2]

No, the answer is incorrect.
Score: 0

Accepted Answers:
[3,7,14,1,8,2]

8) In factorizing N = 15 to illustrate Shor's algorithm, a coprime integer m = 7 is chosen to obtain its period. Choose a pair of l qubit registers such that $N^2 \leq 2^l \leq 2N^2$. Modular exponentiation is done and the second register contains f(x) corresponding to various values of x . A measurement of the second register now yields f(x) = 7 . We now apply QFT on the first register. A measurement of the first register gives the state $|128\rangle$. The probability of obtaining this outcome is *1 point*

- 0.25
- 0.125
- 0.0625
- 0.0312

No, the answer is incorrect.
Score: 0

Accepted Answers:
0.25

9) In factorizing N = 21 to illustrate Shor's algorithm, a coprime integer m = 11 is chosen to obtain its period. Choose a pair of qubit registers such that $N^2 \leq 2^l \leq 2N^2$. Modular exponentiation is done and the second register contains f(x) corresponding to various values of x. A measurement of the second register now yields f(x) = 16. How many states are there in the first register at this stage? *1 point*

- 84
- 85
- 86
- 512

No, the answer is incorrect.
Score: 0

Accepted Answers:
85

In the following questions, ONE or MORE answer(s) is(are correct. Choose all the appropriate ones. (2X3=6 Marks)

10)Which of the following is (are) properties satisfied by Discrete Integral Transform (DIT)? *2 points*

- The inverse transform always exists.
- The kernel of the transform is unitary
- If f is a function defined on a set of integers S_n = {0, 1, . . . N − 1} , then the kernel K can be represented by an N × N matrix.
- If the kernel K is unitary, then Parseval's theorem : $\sum_{x=0}^{N-1} |f(x)|^2 = \sum_{y=0}^{N-1} |f(y)|^2$ holds

No, the answer is incorrect.
Score: 0

Accepted Answers:

If f is a function defined on a set of integers S_n = {0, 1, . . . N − 1} , then the kernel K can be represented i an N × N matrix.

If the kernel K is unitary, then Parseval's theorem : $\sum_{x=0}^{N-1} |f(x)|^2 = \sum_{y=0}^{N-1} |f(y)|^2$ holds

11) Suppose in a period finding algorithm with n qubit registers, f(x) is a periodic function with a period P. Oracle is used to calculate f(x) and store it in the output register. A QFT is applied on the first register. Then on measuring the first register, the possible values are **2 points**

- 0
- N/2P
- 2N/2P
- 3N/2P

No, the answer is incorrect.
Score: 0

Accepted Answers:
0
2N/2P

12) In using Shor's algorithm to factorize N = 187, which of the following numbers may be used to determine period of m^a? **2 points**

- 3
- 5
- 7
- 11

No, the answer is incorrect.
Score: 0

Accepted Answers:
3
5
7

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