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

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

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

\( |0\rangle \)
\( |1\rangle \)
\( |0\rangle + |1\rangle \)
\( \sqrt{2} \)
\( |0\rangle - |1\rangle \)
\( \sqrt{2} \)

No, the answer is incorrect.
Score: 0

Accepted Answers:
3) Quantum Fourier Transform of the Bell state \[ \frac{|01\rangle + |10\rangle}{\sqrt{2}} \] is

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

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[
\frac{1}{2\sqrt{2}} \left[ |00\rangle - (1 - i)|01\rangle - (1 + i)|11\rangle \right]
\]

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

\[
S|\tilde{x}\rangle = |\tilde{x} + 1, \text{mod}\ N \rangle
\]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[
S|\tilde{x}\rangle = |\tilde{x} + 1, \text{mod}\ N \rangle
\]

5) The circuit shown below gives an output given by

No, the answer is incorrect.
Score: 0
Accepted Answers:

6) The order of 4 mod 35 is

2
4
6
8
7) The continued fraction representation of 3.1415 is

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

No, the answer is incorrect.
Score: 0
Accepted Answers:

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 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

- 0.25
- 0.125
- 0.0625
- 0.0312

No, the answer is incorrect.
Score: 0
Accepted Answers:

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?

- 84
- 85
- 86
- 512

No, the answer is incorrect.
Score: 0
Accepted Answers:

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)?

- The inverse transform always exists.
- The kernel of the transform is unitary
- If f is a function defined on a set of integers \( \mathbb{S}_n = \{0, 1, \ldots, N-1\} \), then the kernel K can be represented by an N x 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
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

- 0
- \( \frac{N}{2P} \)
- 2\( \frac{N}{2P} \)
- 3\( \frac{N}{2P} \)

No, the answer is incorrect.

Score: 0

Accepted Answers:

- 0
- 2\( \frac{N}{2P} \)

12) In using Shor’s algorithm to factorize \( N = 187 \), which of the following numbers may be used to determine period of \( m^x \)?

- 3
- 5
- 7
- 11

No, the answer is incorrect.

Score: 0

Accepted Answers:

- 3
- 5
- 7