Quiz- QPE, Order finding, Shor Results for SevdanurGenc

Correct answers are hidden.

Score for this attempt: **14.5** out of 20

Submitted Jun 15 at 8:05pm

This attempt took 4,041 minutes.

Question 1

2 / 2 pts

[D03-02] Let U be the quantum operator such that $U|\psi\rangle = e^{2\pi i \phi}|\psi\rangle$. Let $k > 0$ be an integer. We apply CU^k operator to the state. What is the resulting state.

- (selected) $\frac{1}{\sqrt{2}}(|0\rangle|\psi\rangle + e^{2\pi i k \phi}|1\rangle|\psi\rangle)$
- $\frac{1}{\sqrt{2}}(e^{2\pi i k \phi}|0\rangle|\psi\rangle + |1\rangle|\psi\rangle)$
- $\frac{1}{\sqrt{2}}(e^{2\pi i \phi}|0\rangle|\psi\rangle + e^{2\pi i \phi}|1\rangle|\psi\rangle)$
- $\frac{1}{\sqrt{2}}(|0\rangle|\psi\rangle - e^{2\pi i k \phi}|1\rangle|\psi\rangle)$

Incorrect

Question 2

0 / 2 pts

[D03-06] If $\phi = 3/16$ and the first register contains 3 qubits, which states do you expect to observe more frequently?

- $|011\rangle$
- $|001\rangle$ and $|010\rangle$
- $|011\rangle$ and $|111\rangle$
- (selected) $|011\rangle$ and $|100\rangle$

Question 3

2 / 2 pts

[D03-08] How do you initialize the second register in QPE?

- ○ We apply X and H to each qubit in the second register.
- ○ We leave qubits in the second register in 0 state.
- ◉ It is initialized as the eigenvector of the operator U.
- ○ We apply H to each qubit in the second register.

Question 4

2 / 2 pts

[D03-01] Select the eigenvectors and the corresponding eigenvalues of the Z operator.

- [ ] $|-\rangle$ with eigenvalue 1
- [ ] $|+\rangle$ with eigenvalue -1
- [x] $|0\rangle$ with eigenvalue 1
- [ ] $|0\rangle$ with eigenvalue -1
- [x] $|1\rangle$ with eigenvalue -1

Question 5

2 / 2 pts

[D04-01] Let x=4 and N=81. What is r ? (You can compute in Python)

27

Partial

Question 6

0.5 / 2 pts

[D04-02] Select the true statements.

- [ ] Order finding has no use in practice since we don't know how to prepare the eigenvector.
- [ ] At the end of the order finding algorithm, we measure r in the first register.
- [x] The second register is initialized as |1⟩ in the order finding algorithm.
- [x] We need continued fractions algorithm to extract r out of the estimate for s/r.
- [x] When s and r are not relatively prime, the algorithm needs to be repated.
- [ ] If U_x is the operator which maps $U_x|y\rangle \rightarrow |xy \mod N\rangle$ where $x < N$ are relatively prime, its eigenvalues are of the form $e^{\frac{2\pi i s}{r}}$.
- [ ] Modular exponentiation is the name of the procedure in which the powers of the operator CU are computed.

Question 7

2 / 2 pts

[D04-03] Given the continued fraction expression [1,4,2,1] write one of the convergents. (Do not leave any space e.g. write 3/2 instead of 3 / 2)

16/13

Question 8

2 / 2 pts

[D05-01] Select the true statements.

- [x] The main advantage of Shor's algorithm is the ability to compute r efficiently.

- [ ] It is proven that no classical algorithm solves the factoriazation problem in polynomial time.

- [ ] Shor's algorithm provides quadratic speedup compared to the best known classical algorithm.

- [x] If r is not even, then one should pick a new x and repeat the algorithm.

Question 9

2 / 2 pts

[D05-02] If the quantum state before applying the inverse QFT is the the following state,

$\frac{1}{\sqrt{2^9}}\left(|0\rangle|1\rangle + |1\rangle|3\rangle + |2\rangle|9\rangle + |3\rangle|7\rangle + |4\rangle|1\rangle + |5\rangle|3\rangle + |6\rangle|9\rangle + \ldots + |2\right.$

what is r ?

4

Incorrect

Question 10

0 / 2 pts

[D06-01] If at the end of the Shor's algorithm, the probability of observing state $|k\rangle$ is given by $\left|\frac{1}{\sqrt{85\cdot 512}}\sum_{x=0}^{84} e^{-\frac{2\pi i(6x+2)k}{512}}\right|^2$, write down a state (except 0 and 256) which is likely to be observed with high probability. (Write it as a decimal number, e.g. 34)

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