QWorld Global QBronze Wokrshop | Homework Day 5

Total points 20/20

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Questions

✓ Which one is true about Grover's Search? 3/3

- ○ You need to know what is inside the oracle to flip the sign of the marked element.
- ◉ None of the above. ✓
- ○ In Grover's search, if you run the algorithm for more iterations you get a better result.
- ○ Grover's search provides exponential speedup.
- ○ All of the above.

✓ Let's say we have 4 elements in the database. If after the first query phase the resulting state is 1/2(|00)-|01)+|10)+|11)), which one is the marked element? 2/2

- ◉ |01) ✓
- ○ |11)
- ○ |10)
- ○ |00)

✓ How do we flip the sign of the marked element without knowing which element is marked? 2/2

- ○ We can not, we should know the marked element beforehand
- ○ We multiply all amplitudes by -1.
- ◉ We use a procedure called phase kickback ✓

✓ When represented visually, what does inversion phase correspond to? 2/2

- ◉ Reflection over the equal superposition state ✓
- ○ Reflection over y-axis
- ○ Reflection over x-axis
- ○ Reflection over 45 degrees

Grover

You are given a circuit named mycircuit and a quantum register named qreg. There are 64 elements in the search space.

You are given the following code piece:

```
for i in range(a):
    mycircuit.b(qreg[i])
```

✓ How many qubits do you need to represent 64 elements? (Not counting any extra qubits, only to represent elements) 2/2

- ○ 32
- ○ 16
- ○ 8
- ◉ 6 ✓

✓ What should be a and b to create an equal superposition representing the elements in the search space? (Assuming that qubits starting from 0 represent the search space) Write your answer as a,b without leaving space e.g. 10,x 4/4

6,h ✓

✓ Which operator(s) do you apply to set the ancilla qubit in state |-⟩? 2/2

- ○ H
- ○ X
- ◉ First X, then H ✓
- ○ Z

✓ How would you apply a NOT operator to qreg[4] if qreg[0], qreg[1], qreg[2], and qreg[3] are all in state 1? 3/3

- ○ Apply 4 sequential CNOTs where qreg[0], qreg[1], qreg[2] and qreg[3] are the control qubits and qreg[4] is the target qubit
- ○ Apply 2 CCNOTs where qreg[0] and qreg[1] are the controls in the first one, qreg[2] and qreg[3] are the controls in the second one and qreg[4] is the target qubit of both CCNOTs
- ◉ Use two ancilla qubits and apply 2 CCNOTs where qreg[0] and qreg[1] are the controls in the first one, qreg[2] and qreg[3] are the controls in the second one and ancilla qubits are the target qubits of the CCNOTs and apply one more CCNOT where ancilla qubits are the controls and qreg[4] is the target ✓
- ○ This is not possible