Chiao Lu; 204848946; 14:00

# Problem 1

After measuring the qubit, the state of that qubit will collapse into whatever was measured. There’s no point doing quantum computing with that qubit.

# Problem 2

We are actually sending classical bits.

# Problem 3

You only need to run the Deutsch-Jozsa circuit ONCE to determine whether is constant or balanced.

The reason is that you have a magic matrix that your circuit will use, and at the end of the circuit if you measure then is constant; otherwise, it’s balanced.

# Problem 4

Solve for and we get

So,

This tells us that we need at least iterations.

# Problem 5

I assume measure 1 here means 11…1

In the case of , we have the secret

So, with probability 1 we will measure 11…1

# Problem 6

# Problem 7

We have

# Problem 8

Applying CNOT (left most bit as control):

Applying :

# Problem 9

Left qubit measured to be 0, so state is now

Do some normalization…

# Problem 10

Probability of measure the left qubit and get 0 is

If this happens, the other qubit is collapsed into a superpositioned state:

Probability of measuring the right qubit and get 1 is

If this happens, the other qubit is collapsed into a superpositioned state:

(will need to normalize probability to sum up to 1)

# Problem 11

We can use matrix multiplication to get to the final state and use the coefficient to determine the probability of measuring 000

# Problem 12

Left circuit:

Right circuit:

Equation is

Just carry out the matrix multiplication to check whether the equation holds.

# Problem 13

For where

We have the circuit

We have probability 1 to measure the first qubit as . This tells us that is balanced, which is expected.

# Problem 14

Simon circuit might produce

and

These two equations means that we are hoping to use a classical computer to solve these equations to get . By producing a sufficient number of equations, we can get enough linearly independent equations . With linearly independent equations for , we can solve for correctly.

The in this problem is 111.

# Problem 15

This tells us that after running the Grover circuit, we have probability to measure . Thus, we found 10 after a single use of .