

CS314 Spring 2023
Homework 7
Due Monday, May 1, 11:59pm

Problem 1 – Reversible Functions

Are the following functions reversible? Justify your answer

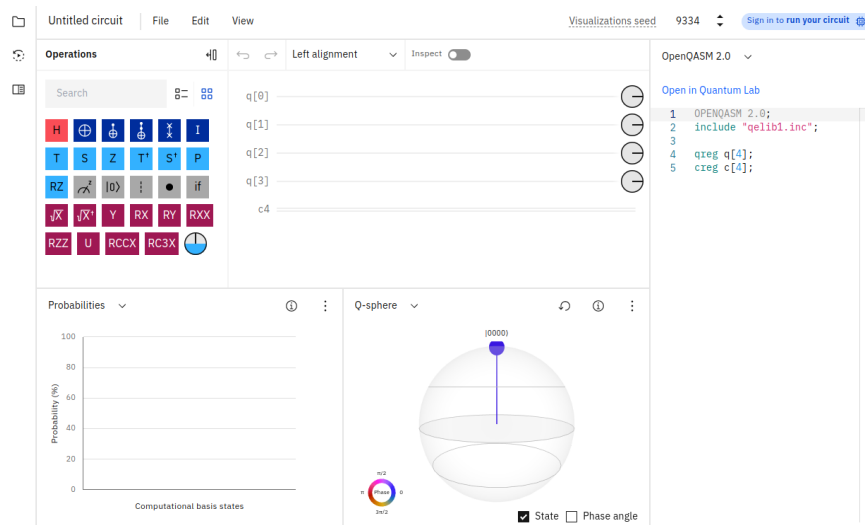
1. $f(x) = x$
2. $f(x) = 2 * x + 1$
3. $f(x) = x \bmod 5$
4. $f(x) = x^2$
5. $f(x, y) = x + y$

Problem 2 – Hadamard Gate

Show that the Hadamard Gate is reversible.

Problem 3 – Deutsch-Jozsa Algorithm

For this problem, please use the **IBM Circuit Composer** given in the following link <https://quantum-computing.ibm.com/composer/>. You can compose your own quantum circuit (which is required) and view the probabilities and Q-sphere visualizations. A screenshot is shown below.



Note: You can get information about the gates themselves by right-clicking on them before dragging the gates to the circuit. Once you've dragged a gate to the circuit, you can right-click on that gate to

edit. (For example, switching the direction of the CNOT gate, etc.) More information can be found here: <https://quantum-computing.ibm.com/composer/docs/idx>.

Documentation for the Deutsch-Jozsa Algorithm, including some examples, is given in the following link: <https://quantum-computing.ibm.com/composer/docs/idx/guide/deutsch-jozsa-algorithm>.

Please give screenshots of your constructed circuit for the Deutsch-Jozsa Algorithm with the number of bits $n = 4$ for the constant function.