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Quantum Computing
Assignment 2
(Working with IBM Composer and qubit normalization)

Instructions: The assignment is self explanatory. Try yourself, as these concepts will be used for later assignments.

Section 1

Working with Quantum Composer in IBM Q Experience Go through various features available in Quantum Composer. Refer to the material available at the following site.
https://quantum-computing.ibm.com/composer/docs/iqx/overview

Section 2

Hands-on Experience on Quantum Composer Note: If you are not aware of quantum gates, no issue, you need to cover this section to understand the concept of working with the quantum composer.

1. Create the first circuit on the composer by referring to material available at:
   https://quantum-computing.ibm.com/composer/docs/iqx/first-circuit.
2. Read out the topics of visualizations available at
   https://quantum-computing.ibm.com/composer/docs/iqx/visualizations.
3. Run the circuit using https://quantum-computing.ibm.com/composer/docs/iqx/run-circuits

Section 3

Learning about Hadamard Gate Create a circuit by adding a Hadamard gate to the composer. Observe the result for a single shot ten times. Observe any pattern.
You can refer to the following link to learn about Hadamard gate:
https://www.youtube.com/watch?v=W0qrTMdzqtgt=220s
Learning: Every time, you get 0 or 1, which is perfectly random.

Section 4

Learning about QASM Learn how to write code in OPENQASM2.0 appear in the right side of the circuit composer.

1. In Section 3, modify the program that appears in OpenQASM2.0 for single qubits and single classical bits.
2. Modify it for four qubits and four classical bits.

Section 5

Apply Hadamard gate to four qubits. Create four quantum bits and apply Hadamard gate on all four qubits. Run it and observe the outcome.

Section 6

Complex Number in Python

1. Refer to the material on converting the complex number into the polar form and vice versa. Visit the site https://math.libretexts.org/ and search for the Polar Form of Complex Numbers.
2. Import cmath in python and use the cmath.polar for converting a complex number to polar form.
3. Use cmath.rect to convert the polar to complex number cartesian form.