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Quantum Computing
Assignment 4
(Working with QASM and Start working with Qiskit)

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

Section 1

Fredkin (CSWAP) Gate Write down a QASM Program to show that Fredkin gate act as AND Gate (Do not use the Drag and Drop option).

Section 2

CSWAP as NOT Write down a QASM Program to show that Fredkin gate act as NOT Gate (Do not use the Drag and Drop option).

Section 3

CSWAP has its own inverse Section 1 and Section 2 indicate that CSWAP is a universal gate. Now Write down a QASM Program to verify that CSWAP has its own inverse.

Section 4

Verify the Identities using QASM

1. $X^2 = Y^2 = Z^2 = I$
2. $X = HZH$
3. $Z = HXH$
4. $S = T^2$
5. $-1Y = XYX$

Section 5

Move towards Qiskit You can start working by selecting Quantum Lab instead of Composer. Complete Section 1.3 from Qiskit Textbook https://qiskit.org/textbook/ch-states/representing-qubit-states.html

1. Create a state vector that will give a 1/3 probability of measuring $|0\rangle$.
2. Create a different state vector that will give the same measurement probabilities.
3. Verify that the probability of measuring $|1\rangle$ for these two states is 2/3.