

Qiskit Lab Manual

QAMP Fall 21 - Checkpoint 2

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Lab 1 Completed

Lab on Single Qubit Gates has now been published on the Qiskit (Quantum Computing Labs) web page and is available for the users to consume.

The lab enables the learners to understand the effects of single qubit gates like Pauli gates and Phase gate (S) on the eigenvectors of X, Y and Z.

The lab also provides a visual depiction of the circuit along with the plot on Bloch sphere, Qsphere and the input and output/state probability as statevector.

Qiskit Overview

Browse all content Miss the old version of the textbook? Access it [here](#)

Quantum Computing Labs Reading time: ~20 min

Lab 1 Quantum Circuits

Lab 2 Single Qubit Gates

Part 1 - Effect of Single-Qubit Gates on state $|0\rangle$

Goal

Part 2 - Effect of Single-Qubit Gates on state $|1\rangle$

Goal

Part 3 - Effect of Single-Qubit Gates on state $|+\rangle$

Prerequisite

Ch.1.3 Representing Qubit States

Ch.1.4 Single Qubit Gates

Other relevant materials

[Grokking the Bloch Sphere](#)

```
import numpy as np
```

Quantum Computing Labs

Lab 1 Quantum Circuits

Lab 2 Single Qubit Gates

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Part 2 - Effect of Single-Qubit Gates on state $|1\rangle$

Goal

Part 3 - Effect of Single-Qubit Gates on state $|+\rangle$

Goal

Part 4 - Effect of Single-Qubit Gates on state $|-\rangle$

Goal

Part 5 - Effect of Single-Qubit Gates on state $|i\rangle$

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Effect on Qubit on application of Gate	Statevector	QSphere Plot	Statevector (Post Measurement)
Input State = $(1 + 0j \ 0 + 0j)$			
Before measurement, - qubit state = $(0 + 0j \ 1 + 0j)$ - qubit has probability 1 of being in state '1'			

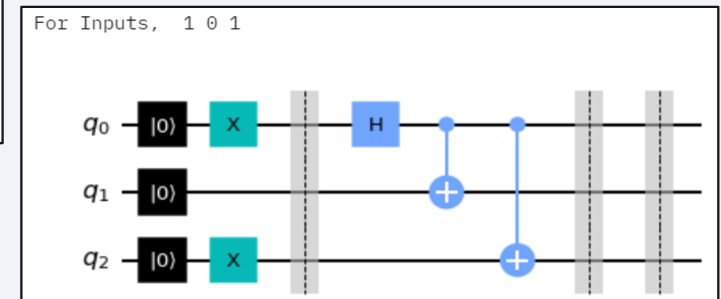
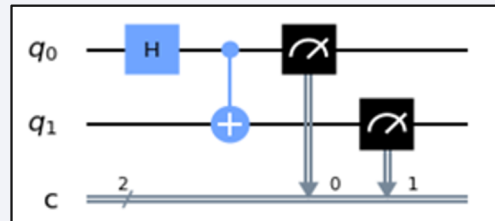
Lab 2 and 3 Progress



We have started working on Labs 2 and 3 that will focus on the Bell Circuits and GHZ Circuit.

These lab manuals are aimed at students/beginners starting on Qiskit to smoothly transition from fundamentals to advanced concepts on the Qiskit (Quantum Computing Labs).

These lab manuals are targeted to be completed by the Checkpoint 3 and published on the Quantum Computing Labs webpage.



Q-SPHERE REPRESENTATION FOR ALL THE STATES IN A 3 QUBIT GHZ CIRCUIT

```
In [1]: import numpy as np
from qiskit import QuantumCircuit, QuantumRegister, ClassicalRegister
from qiskit import IBMQ, Aer, transpile, assemble
from qiskit.visualization import plot_histogram, plot_bloch_multivector, plot_state_qsphere

In [2]: import warnings
warnings.filterwarnings('ignore')

In [3]: sim = Aer.get_backend('aer_simulator')

In [6]: def ghzCircuit(inp1,inp2,inp3):

    qc = QuantumCircuit(3)
    qc.reset(range(3))

    if inp1 == '1':
        qc.x(0)
    if inp2 == '1':
        qc.x(1)
    if inp3 == '1':
        qc.x(2)

    qc.barrier()

    qc.h(0)
    qc.cx(0,1)
    qc.cx(0,2)

    qc.barrier()

    qc.save_statevector()
    qobj = assemble(qc)
    state = sim.run(qobj).result().get_statevector()
```