single-qubit-gates

July 9, 2021

[5]:

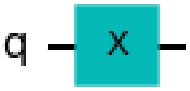
```
import numpy as np
# Importing standard Qiskit libraries
from qiskit import QuantumCircuit, transpile, Aer, IBMQ, assemble
from qiskit.tools.jupyter import *
from qiskit.visualization import *
from ibm_quantum_widgets import *
from math import pi, sqrt

# Loading your IBM Quantum account(s)
provider = IBMQ.load_account()
sim = Aer.get_backend('aer_simulator')
```

```
ibmqfactory.load_account:WARNING:2021-07-09 12:42:26,306: Credentials are
already in use. The existing account in the session will be replaced.
```

[6]:

```
# Let's do an X-gate on a |0> qubit
qc = QuantumCircuit(1)
qc.x(0)
qc.draw()
```

[6]:



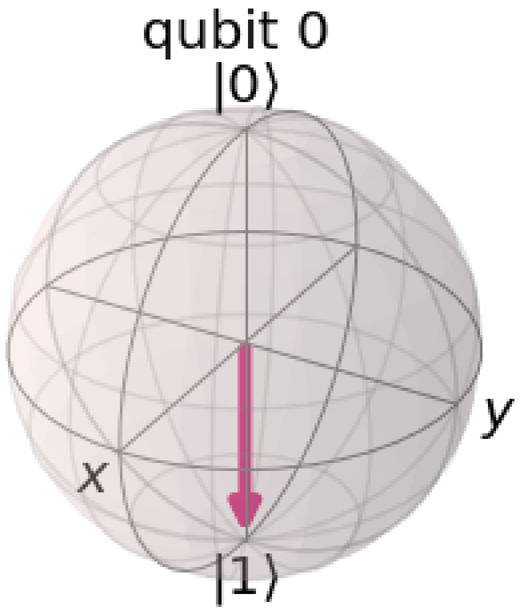
[7]:

```
# Let's see the result
qc.save_statevector()
qobj = assemble(qc)
state = sim.run(qobj).result().get_statevector()
plot_bloch_multivector(state)
```

```
/opt/conda/lib/python3.8/site-packages/qiskit/visualization/bloch.py:69:
MatplotlibDeprecationWarning:
The M attribute was deprecated in Matplotlib 3.4 and will be removed two minor
```

```
releases later. Use self.axes.M instead.
  x_s, y_s, _ = proj3d.proj_transform(xs3d, ys3d, zs3d, renderer.M)
```

[7]:



[8]:

```
# Run the code in this cell to see the widget
from qiskit_textbook.widgets import gate_demo
gate_demo(gates='pauli')
```

```
/opt/conda/lib/python3.8/site-packages/qiskit/visualization/bloch.py:69:
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```

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HBox(children=(Button(description='X', layout=Layout(height='3em', width='3em'), style=ButtonSt
```

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Image(value=b'\x89PNG\r\n\x1a\n\x00\x00\x00\rIHDR\x00\x00\x01 \x00\x00\x01 \x08\x06\x00\x00\x00
```
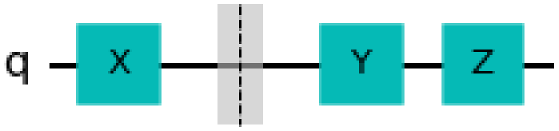

[9]:

```
qc.y(0) # Do Y-gate on qubit 0
qc.z(0) # Do Z-gate on qubit 0
qc.draw()
```

[9]:



[10]:
```
# Run the code in this cell to see the widget
from qiskit_textbook.widgets import gate_demo
gate_demo(gates='pauli+h')
```

```
/opt/conda/lib/python3.8/site-packages/qiskit/visualization/bloch.py:69:
MatplotlibDeprecationWarning:
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```
HBox(children=(Button(description='X', layout=Layout(height='3em', width='3em'), style=ButtonS
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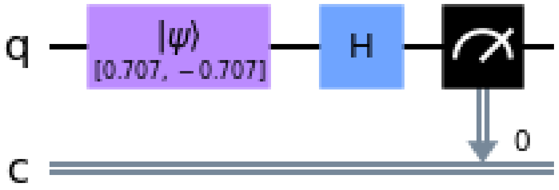
```
Image(value=b'\x89PNG\r\n\x1a\n\x00\x00\x00\rIHDR\x00\x00\x01 \x00\x00\x01 \x08\x06\x00\x00\x00
```

[11]:
```
# Create the X-measurement function:
def x_measurement(qc, qubit, cbit):
    """Measure 'qubit' in the X-basis, and store the result in 'cbit'"""
    qc.h(qubit)
    qc.measure(qubit, cbit)
    return qc

initial_state = [1/sqrt(2), -1/sqrt(2)]
# Initialize our qubit and measure it
qc = QuantumCircuit(1,1)
qc.initialize(initial_state, 0)
x_measurement(qc, 0, 0)  # measure qubit 0 to classical bit 0
qc.draw()
```

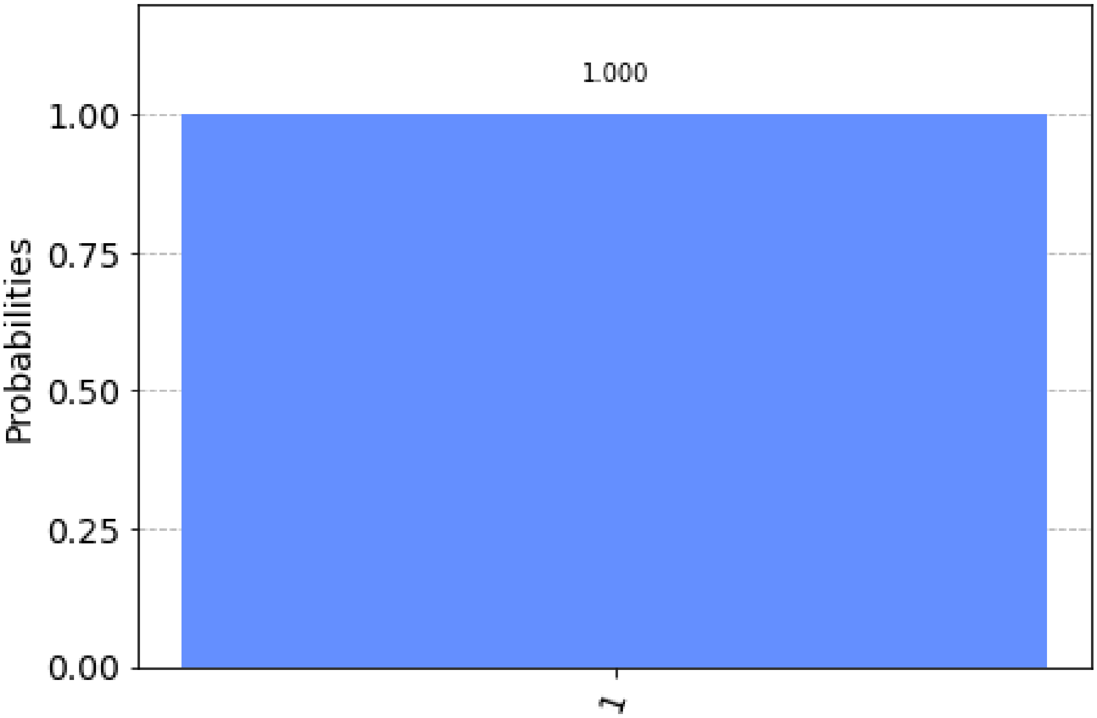
[11]:



[12]:

```
qobj = assemble(qc)  # Assemble circuit into a Qobj that can be run
counts = sim.run(qobj).result().get_counts()  # Do the simulation, returning␣
 ↪the state vector
plot_histogram(counts)  # Display the output on measurement of state vector
```

[12]:



[13]:

```
# Run the code in this cell to see the widget
from qiskit_textbook.widgets import gate_demo
gate_demo(gates='pauli+h+p')
```

```
/opt/conda/lib/python3.8/site-packages/qiskit/visualization/bloch.py:69:
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VBox(children=(HBox(children=(Button(description='X', layout=Layout(height='3em', width='3em')
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```
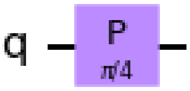

[14]:

```
qc = QuantumCircuit(1)
qc.p(pi/4, 0)
qc.draw()
```

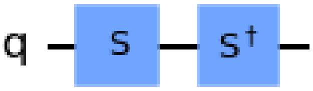
[14]:



[15]:

```
qc = QuantumCircuit(1)
qc.s(0)   # Apply S-gate to qubit 0
qc.sdg(0) # Apply Sdg-gate to qubit 0
qc.draw()
```

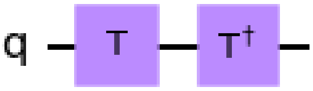
[15]:



[16]:

```
qc = QuantumCircuit(1)
qc.t(0)   # Apply T-gate to qubit 0
qc.tdg(0) # Apply Tdg-gate to qubit 0
qc.draw()
```

[16]:



[17]:

```
# Run the code in this cell to see the widget
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gate_demo()
```

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```
VBox(children=(HBox(children=(Button(description='I', layout=Layout(height='3em', width='3em')
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Image(value=b'\x89PNG\r\n\x1a\n\x00\x00\x00\rIHDR\x00\x00\x01 \x00\x00\x01 \x08\x06\x00\x00\x0
```

[ ]:

```
#Executed by Bhadale IT in IBM Quantum Lab ( https://www.bhadaleit.com)
```