# Notebook

October 17, 2023

## 1 Laboratory notes

### 1.1 Some lecture notes

One online tool very useful to emulate quantum circuits is the IBM Quantum Learning platform.

It is also available a library which deals with quantum mechanics: QuTiP

### 1.2 Prerequisistes

Here we will implement our first quantum circuit using the python library `Qiskit`. In order to run the code, remember to install the dependencies:

```
pip install qiskit qiskit[visualization] qiskit-aer
```

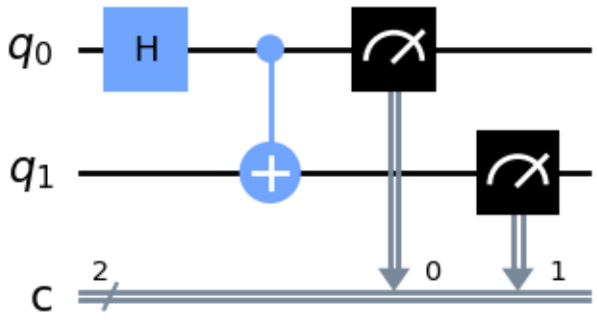
Let's import the function we will use:

[1]:
```
from qiskit import QuantumCircuit, transpile
from qiskit.providers.aer import QasmSimulator
from qiskit.visualization import plot_histogram
```

[2]:
```
simulator = QasmSimulator()
# declare a circuit with 2 qubits and 2 classical bits
circuit = QuantumCircuit(2, 2)
```

[3]:
```
# apply a Hadamard gate to the qubit 0
circuit.h(0)
# apply a C-X gate on quibit 1 using qubit 0 as control
circuit.cx(0, 1)
# measure both qubits, storing values into classical bits
circuit.measure([0, 1], [0, 1])
circuit.draw(output='mpl')
```

[3]:



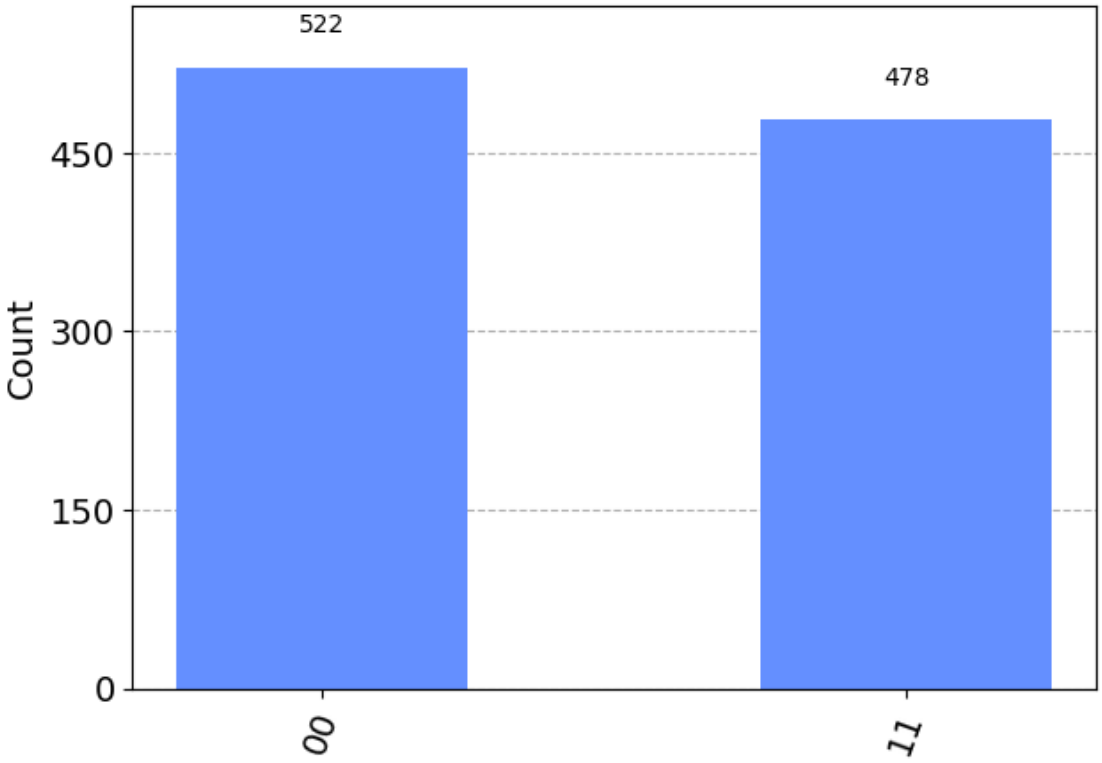

[4]:
```
# transpile (i.e. "compile") the circuit to run on the simulator
compiled_circuit = transpile(circuit, simulator)
# run the circuit on the simulator and get the results
job = simulator.run(compiled_circuit, shots=1000)
result = job.result()
```

[5]:
```
counts = result.get_counts(compiled_circuit)
print("\nTotal count for 00 and 11 are:", counts)

plot_histogram(counts)
```

```
Total count for 00 and 11 are: {'11': 478, '00': 522}
```

[5]:


522
478
450
300
150
0
Count
00
11