Measurement: Part 1

As you learned in previous weeks, quantum measurements correspond to a probability. When you perform a measurement, you are projecting the state of the qubit onto either $|0\rangle$ or $|1\rangle$ with a probability that is the magnitude squared of their respective coefficients (their probability amplitudes). To understand how QASM deals with measurements, let's go back to the first example,

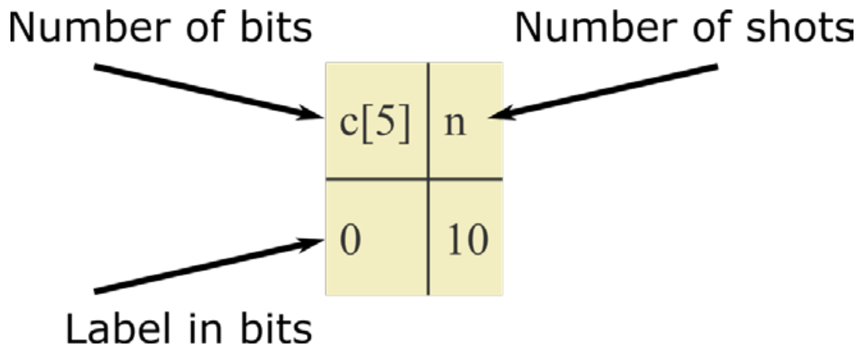
```
include "qelib1.inc";
qreg q[5];
creg c[5];

// This is a comment
measure q[0] -> c[0];
```

In this example, the first qubit q[0] is measured and the result of the measurement is stored in classical bit c[0]. The analytical probabilities of projecting q[0] onto states $|0\rangle$ and $|1\rangle$ are given by

$p(q[0],|0\rangle)=|\langle 0|0\rangle|2=1$ and $p(q[0],|1\rangle)=|\langle 0|1\rangle|2=0$.

The IBM QE platform allows you to either simulate QASM code or run it on a real quantum computer, producing numerical results which can be presented as a table. The following figure shows the tabular result of simulating the previous code with 10 shots. In this example, the qubit was projected 10 times onto state $|0\rangle$. Note that because the qubit is only projected on to one state in this example, the only label is 0.



The results are different when the code is run on a real (imperfect) quantum computer. The figure below shows the result of executing the code 8192 times. In this case, there are two different labels, because qubit q[0] was not only projected to state |0⟩, but was also sometimes projected to state |1⟩. Specifically, it was projected on to |0⟩ 8182 times and onto |1⟩ 10 times.

c[5]	n
0	8182
1	10