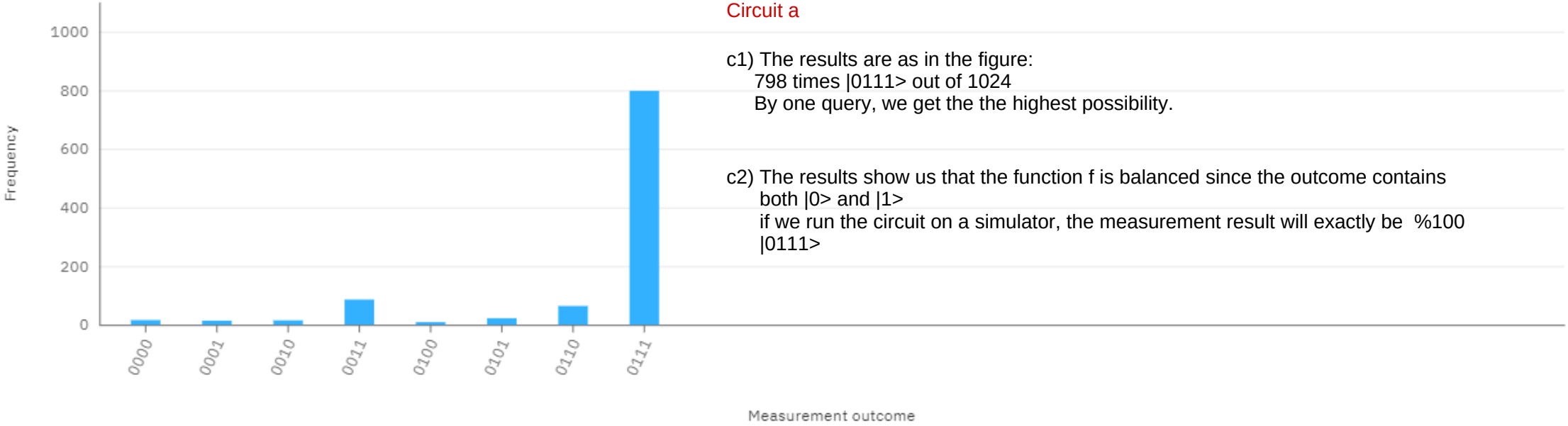


Circuit a

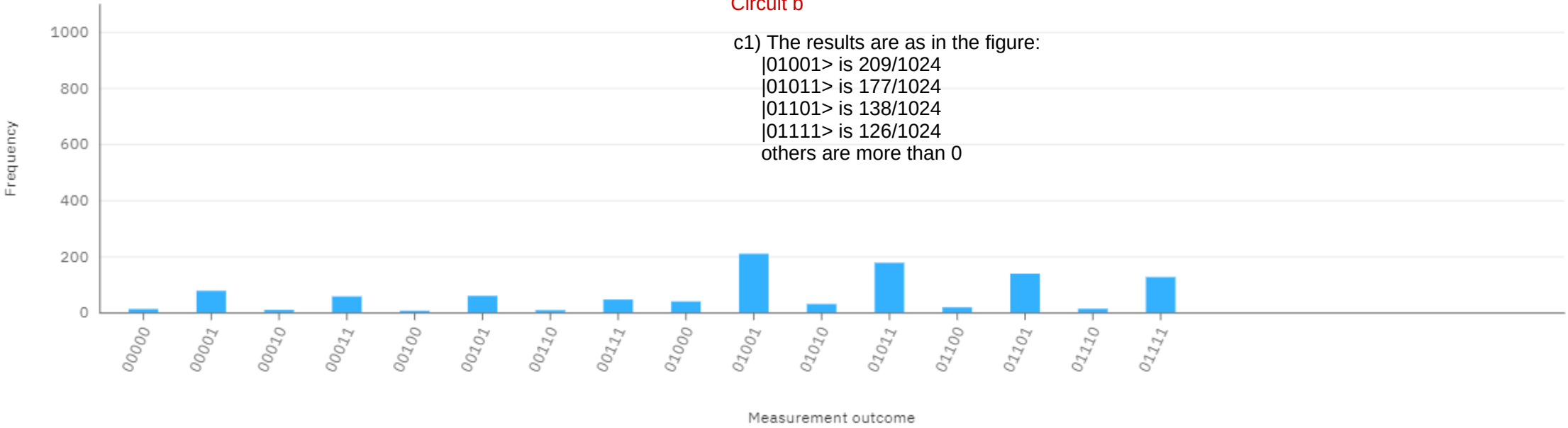
c1) The results are as in the figure:
798 times |0111> out of 1024
By one query, we get the the highest possibility.

c2) The results show us that the function f is balanced since the outcome contains both |0> and |1>
if we run the circuit on a simulator, the measurement result will exactly be %100 |0111>

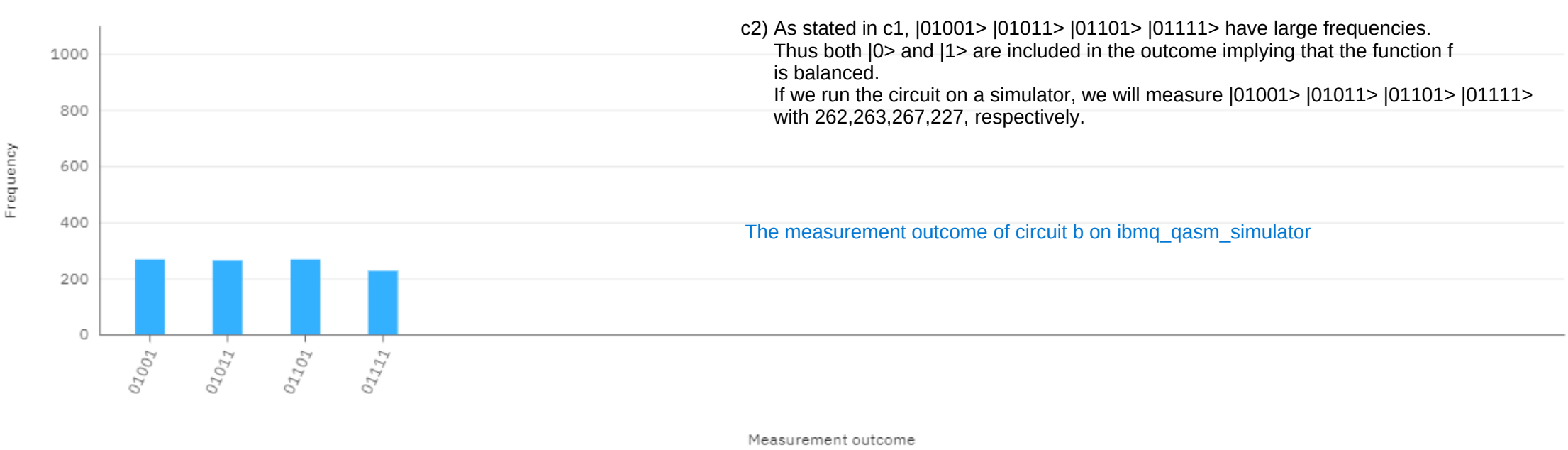

The measurement outcome of circuit a on ibmq_qasm_simulator
Frequency
1000
800
600
400
200
0
0111
Measurement outcome

Circuit b

c1) The results are as in the figure:
|01001> is 209/1024
|01011> is 177/1024
|01101> is 138/1024
|01111> is 126/1024
others are more than 0



c2) As stated in c1, |01001> |01011> |01101> |01111> have large frequencies.
Thus both |0> and |1> are included in the outcome implying that the function f is balanced.
If we run the circuit on a simulator, we will measure |01001> |01011> |01101> |01111> with 262,263,267,227, respectively.



OpenQASM code of circuit a

```
OPENQASM 2.0;
include "qelib1.inc";

qreg q[4];
creg c[4];

id q[0];
id q[1];
id q[2];
x q[3];
h q[0];
h q[1];
h q[2];
h q[3];
barrier q[0];
barrier q[1];
barrier q[2];
barrier q[3];
cx q[0],q[3];
id q[0];
cx q[1],q[3];
id q[0];
id q[1];
cx q[2],q[3];
barrier q[0];
barrier q[1];
barrier q[2];
barrier q[3];
h q[0];
h q[1];
h q[2];
id q[3];
measure q[0] -> c[0];
measure q[1] -> c[1];
measure q[2] -> c[2];
```

OpenQASM code of circuit b

```
OPENQASM 2.0;
include "qelib1.inc";

qreg q[5];
creg c[5];

id q[0];
id q[1];
id q[2];
id q[3];
x q[4];
h q[0];
h q[1];
h q[2];
h q[3];
h q[4];
barrier q[0];
barrier q[1];
barrier q[2];
barrier q[3];
barrier q[4];
```

```
cx q[0],q[4];
id q[0];
id q[1];
id q[2];
cx q[3],q[4];
id q[0];
ccx q[1],q[2],q[4];
barrier q[0];
barrier q[1];
barrier q[2];
barrier q[3];
barrier q[4];
h q[0];
h q[1];
h q[2];
h q[3];
id q[4];
measure q[0] -> c[0];
measure q[1] -> c[1];
measure q[2] -> c[2];
measure q[3] -> c[3];
```