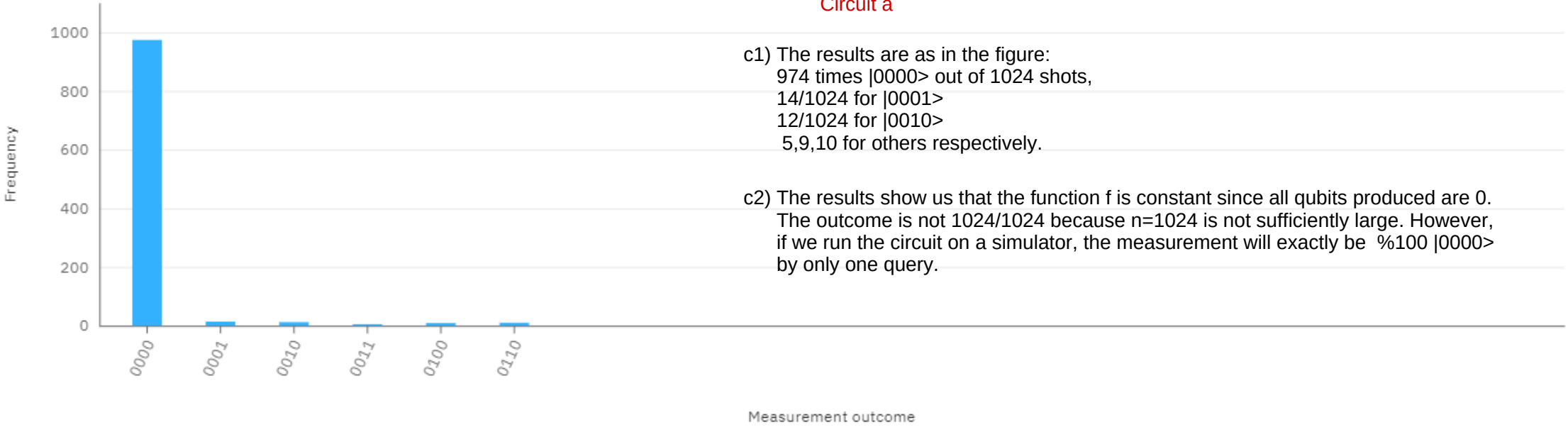
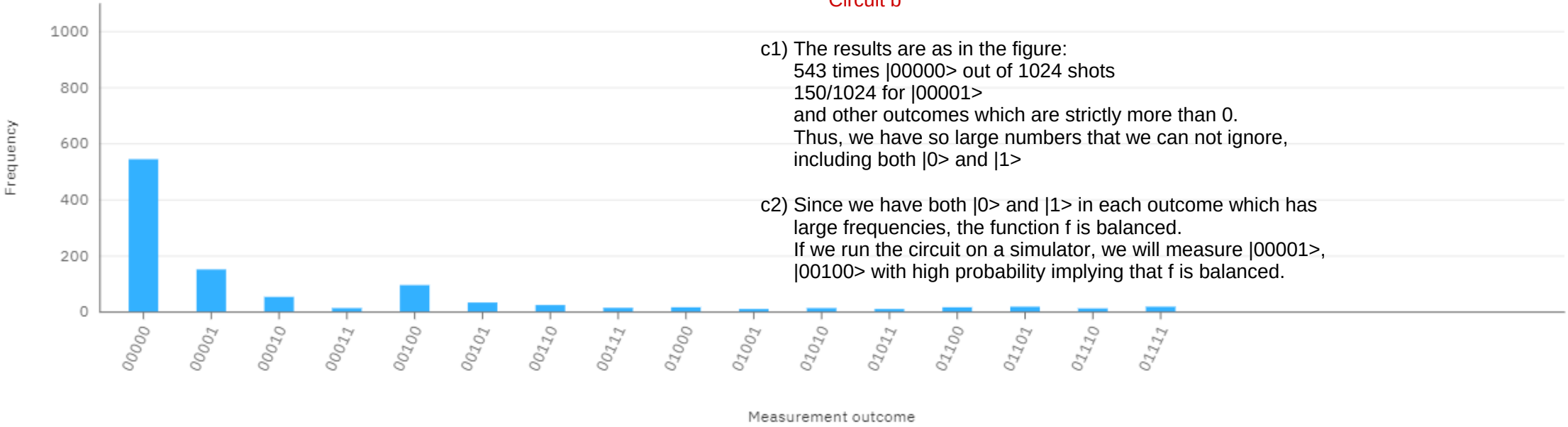
Circuit a



c1) The results are as in the figure:
974 times |0000> out of 1024 shots,
14/1024 for |0001>
12/1024 for |0010>
5,9,10 for others respectively.

c2) The results show us that the function f is constant since all qubits produced are 0. The outcome is not 1024/1024 because n=1024 is not sufficiently large. However, if we run the circuit on a simulator, the measurement will exactly be %100 |0000> by only one query.

Circuit b



c1) The results are as in the figure:
543 times |00000> out of 1024 shots
150/1024 for |00001>
and other outcomes which are strictly more than 0.
Thus, we have so large numbers that we can not ignore,
including both |0> and |1>

c2) Since we have both |0> and |1> in each outcome which has large frequencies, the function f is balanced.
If we run the circuit on a simulator, we will measure |00001>, |00100> with high probability implying that f is balanced.

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

OpenQASM code for 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[3];
id q[4];
id q[0];
ccx q[1],q[2],q[3];
id 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];
```