Sorting circuit for Quantum Computing

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Presentation

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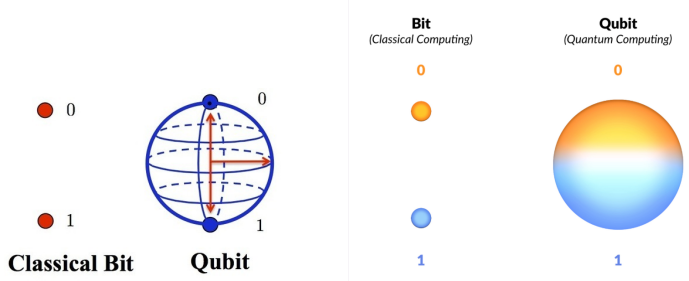
Table of Contents

Quantum Computer

Sorting Circuit for Quantum Computer(QC) is basically a circuit designed to sort elements in Quantum Computers(QC). This is a new experince in the field of computer science because Quantum Computer(QC) are very rare. Only 5 companies Google, IBM, D-Wave Systems, Microsoft and Intel are producing these systems.Google has achived Quantum supremacy last year by building Quantum Computer(QC) consisting on 73 Qbits. Quantum Computers(QC) can be faster than Classical Computers in near future.



(a) (b)

Figur: (a) Qbit (b) Superposition

Tools

- IBMQ

- Qiskit

Problem Statement

Sorting Circuits are almost non-existent for Quantum Computer(QC) However, they are curial to a number of Algorithms, in Computer Science. Our work is to implement such a circuit which runs on both simulator as well as actual Quantum machines.

Objectives

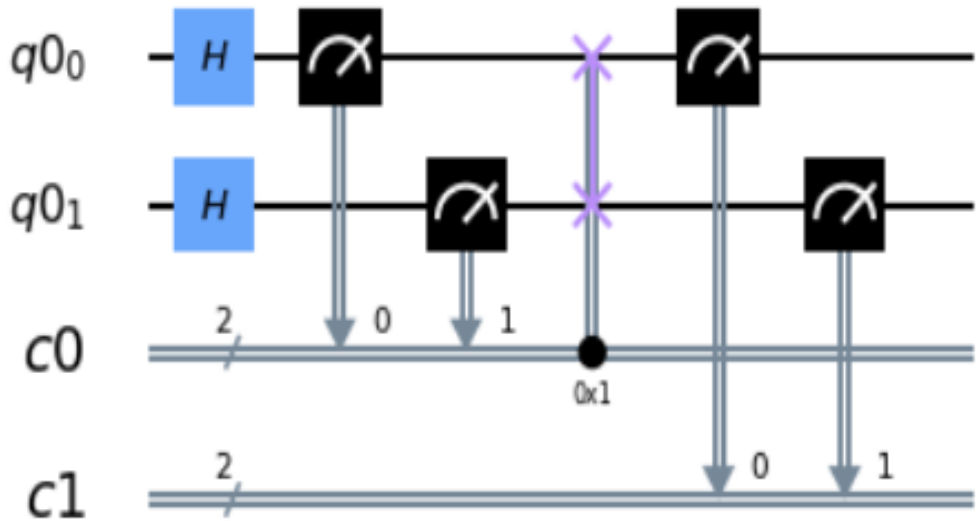
- Swapping Circuit
- Comparator Circuit
- Sorting Circuit

Swapping Circuit

- Hadamard Gate

- Swap Gate

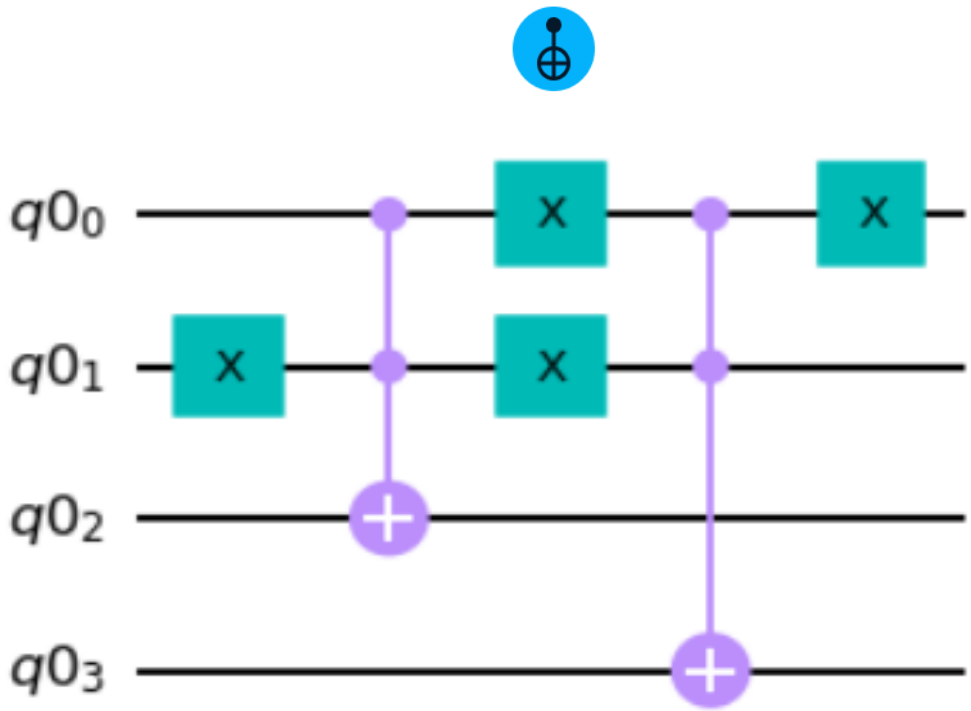
- Z measurement



1-bit Comparator

- X Gate

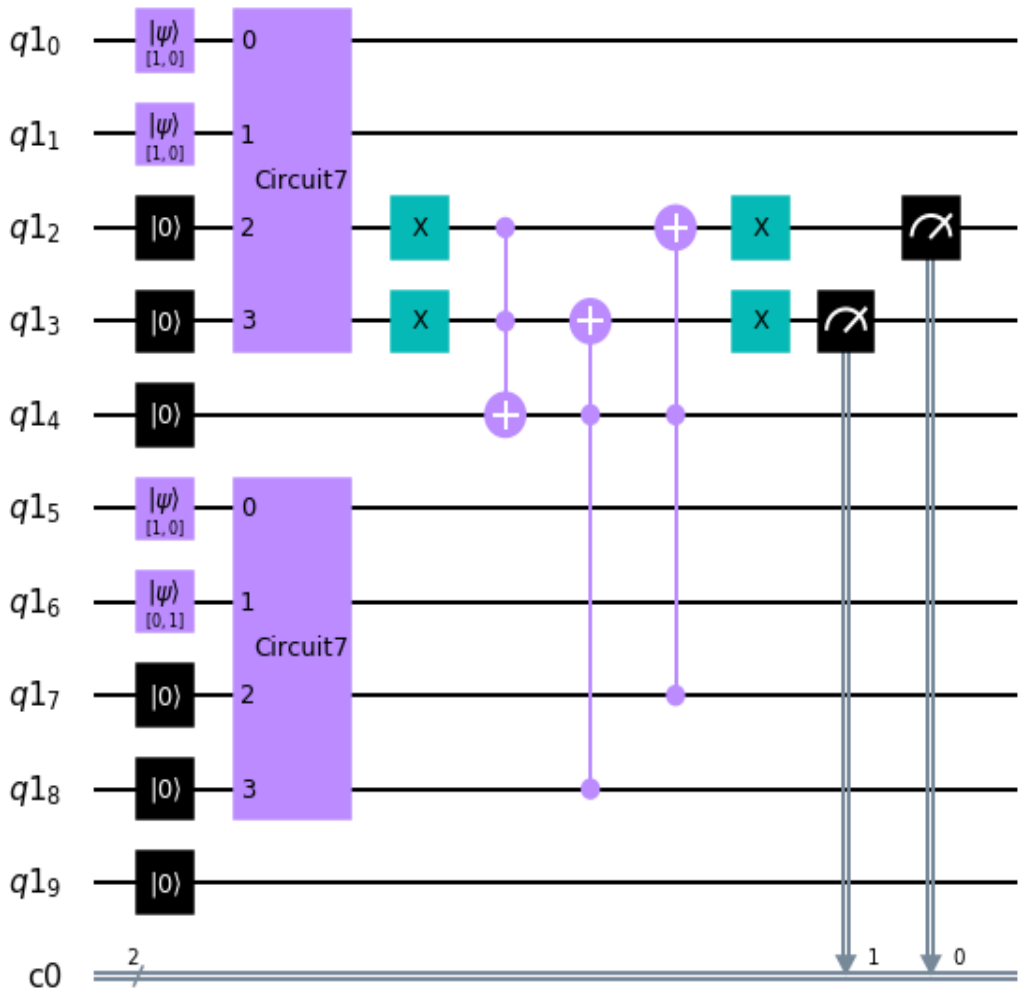
- CX Gate



1-Bit Comparator

Input 1 \ Input 2	0	1
0	0	2
1	1	0

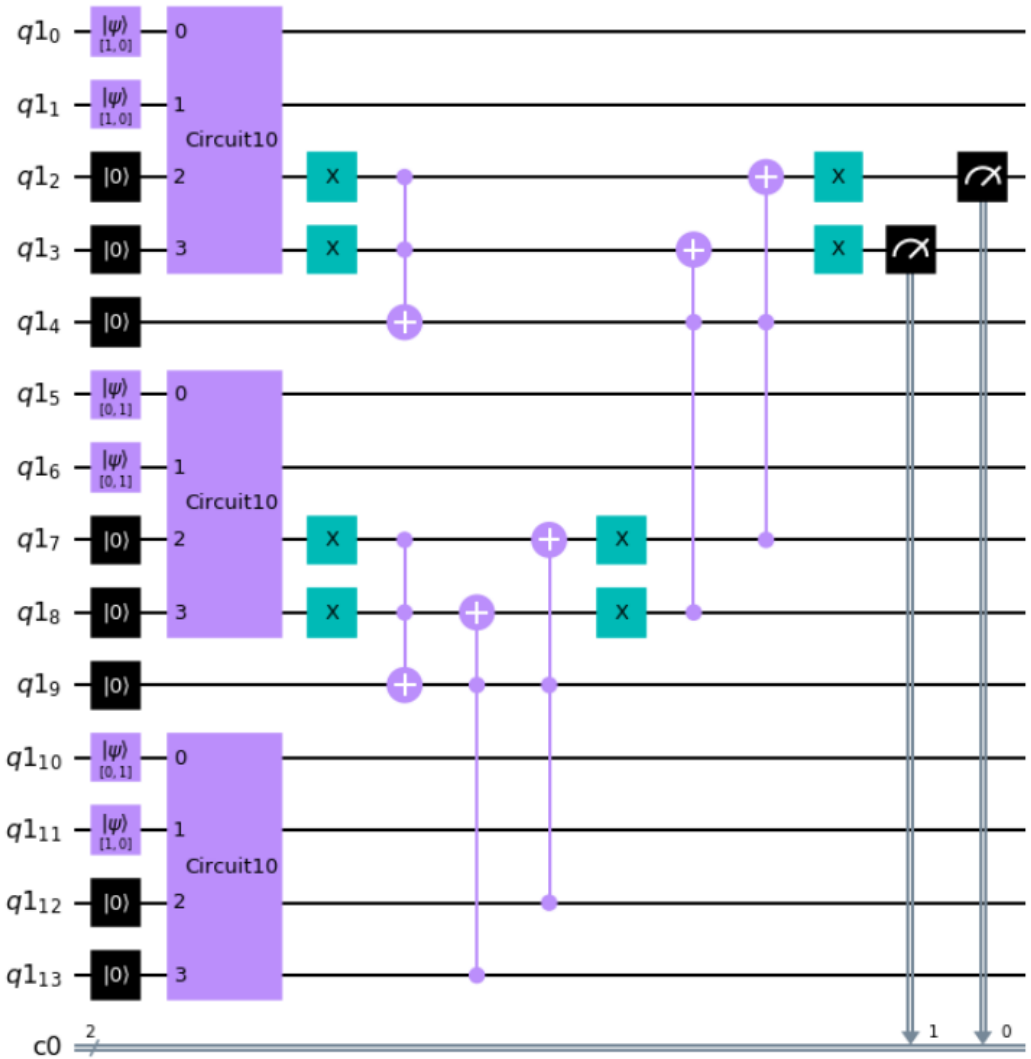
2-bit Comparator



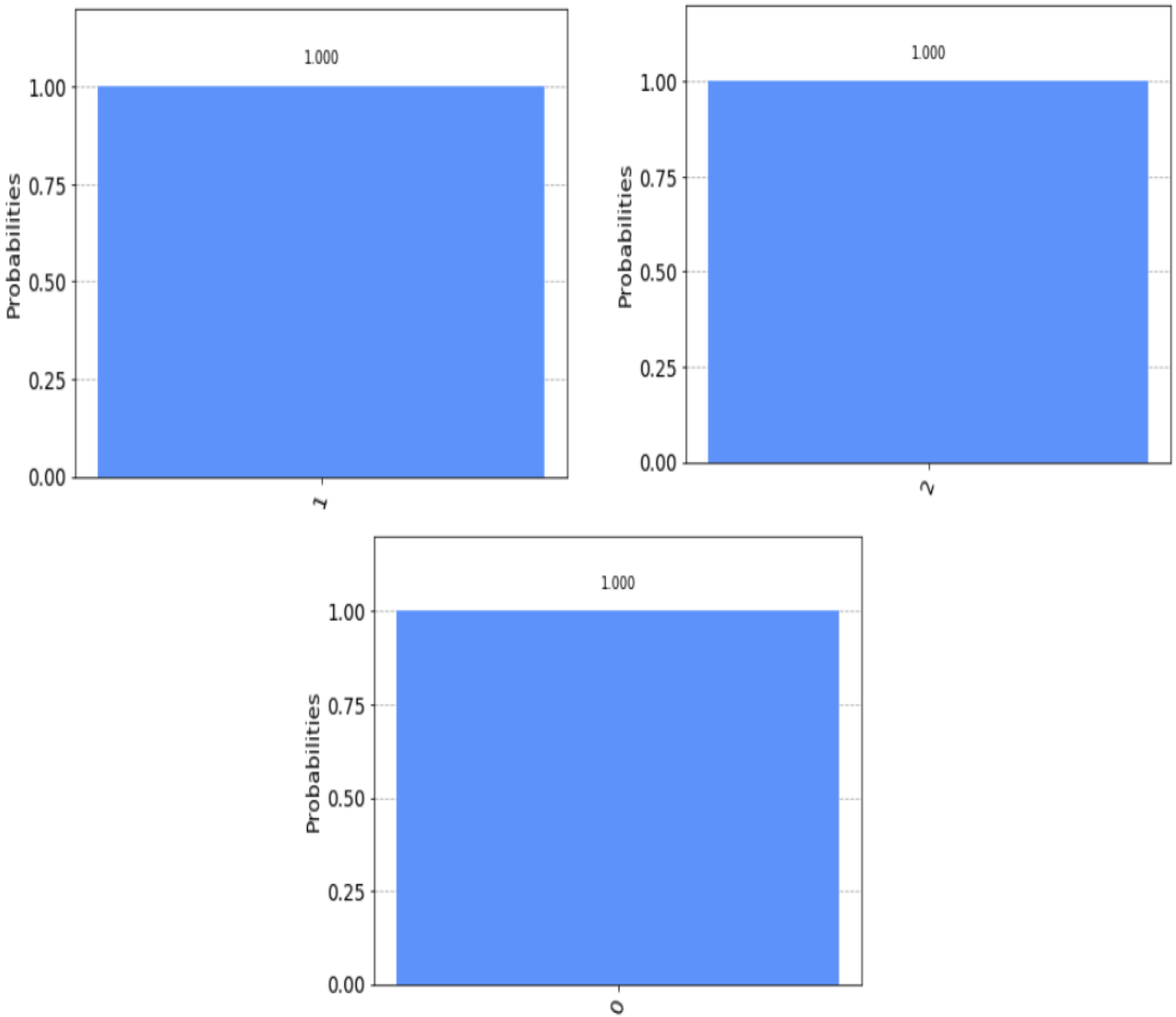
2-Bit Comparator

Input 1 \ Input 2	0	1	2	3
0	0	2	2	2
1	1	0	2	2
2	1	1	0	2
3	1	1	1	0

3-bit Comparator



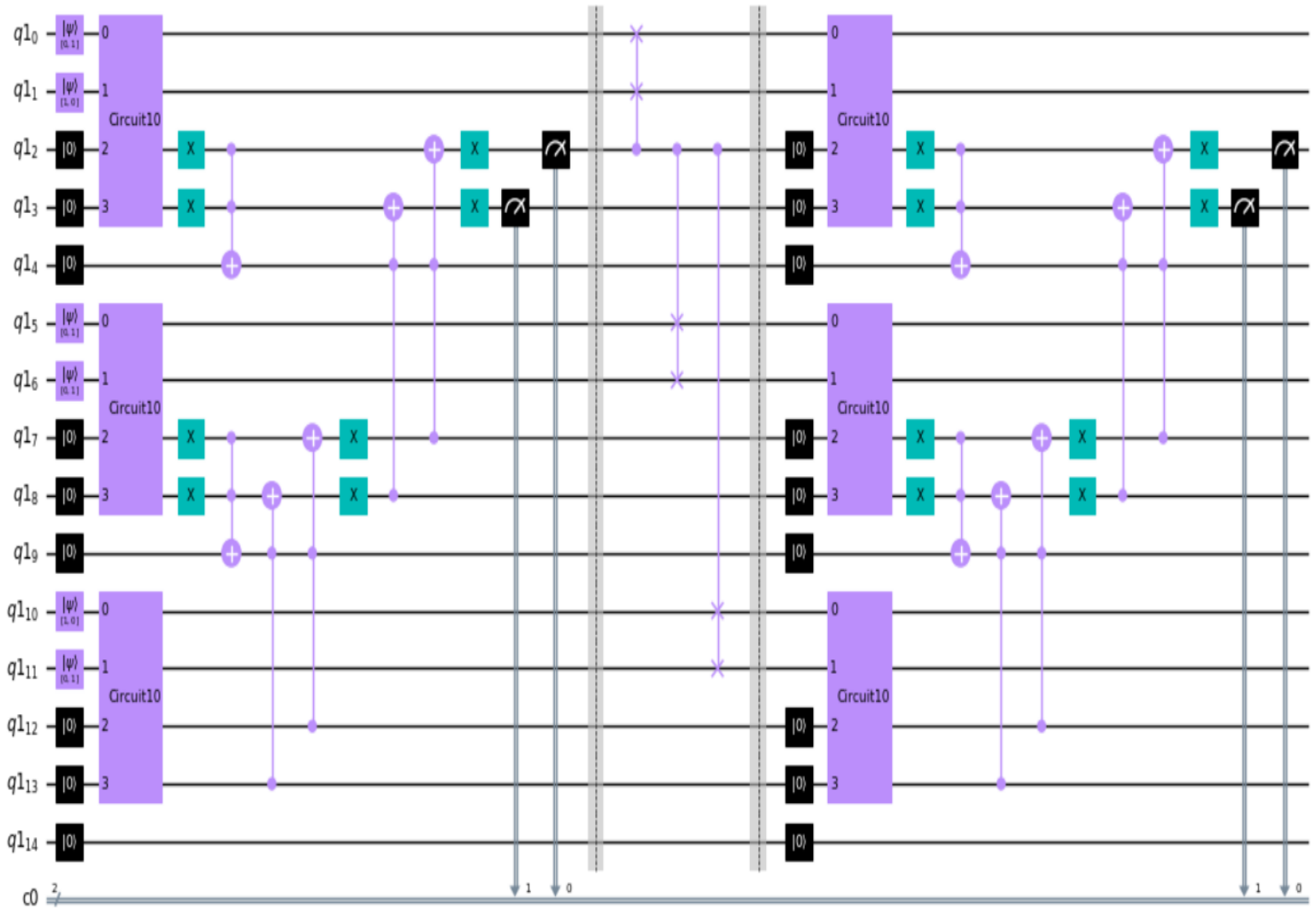
Result


1.000
1.00
0.75
0.50
0.25
0.00
Probabilities
1
1.000
1.00
0.75
0.50
0.25
0.00
Probabilities
2
1.000
1.00
0.75
0.50
0.25
0.00
Probabilities
0

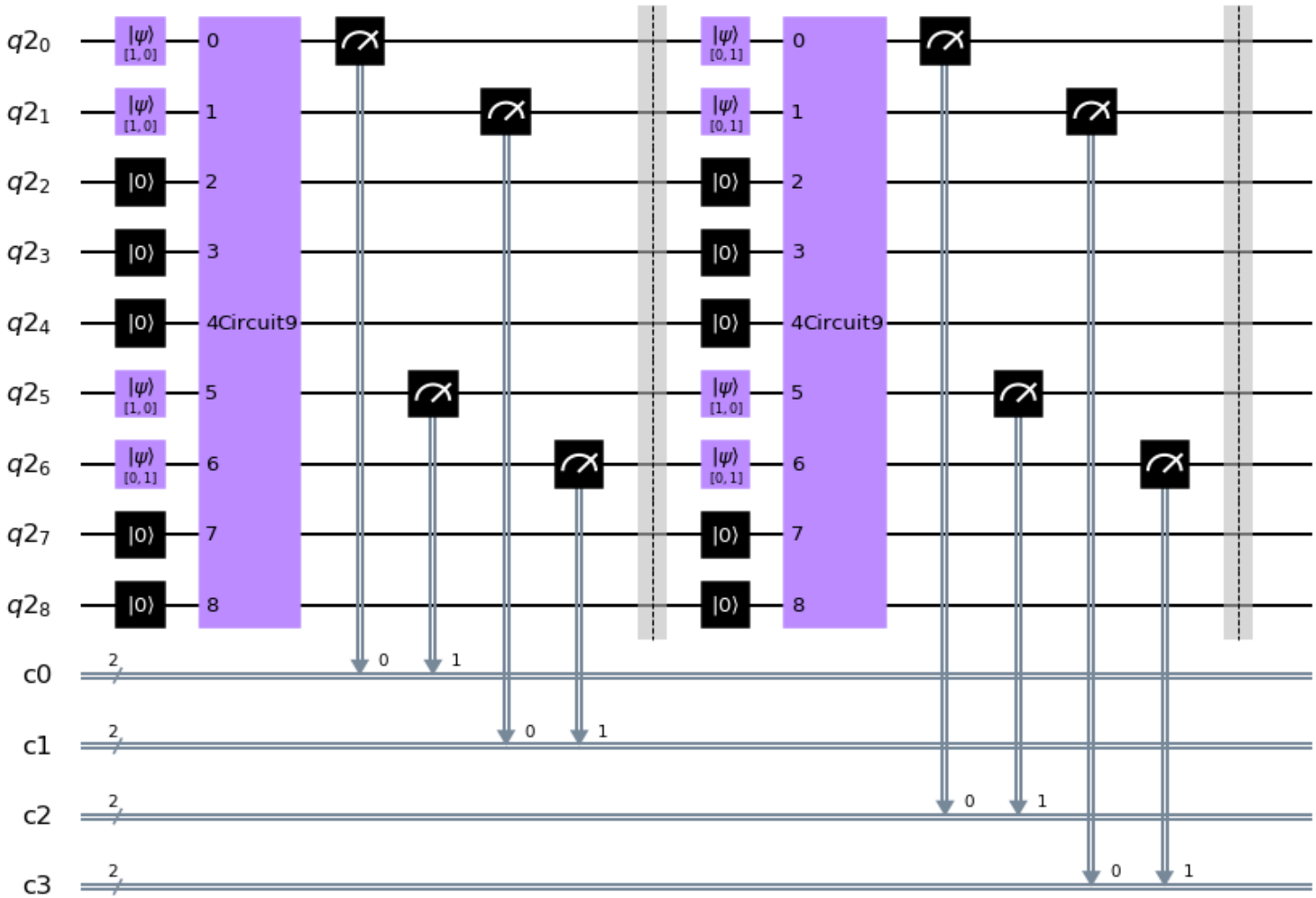
3-Bit Comparator

Input 1 \ Input 2	0	1	2	3	4	5	6	7
0	0	2	2	2	2	2	2	2
1	1	0	2	2	2	2	2	2
2	1	1	0	2	2	2	2	2
3	1	1	1	0	2	2	2	2
4	1	1	1	1	0	2	2	2
5	1	1	1	1	1	0	2	2
6	1	1	1	1	1	1	0	2
7	1	1	1	1	1	1	1	0

Sorting Circuit



Sorting Circuit



Result


```
{'11 01 10 00': 1}
```

Literature Review

Sorting N Elements Using Quantum Entanglement sets

D. S. Oliveira and R. V. Ramos, "Quantum bit string comparator: circuits and applications,"Quantum Computers and Computing, vol. 7, pp. 17-26, 2007

J. Maziero, H. Guzman, L. Céleri, M. Sarandy, and R. Serra, "Quantum and classical thermal correlations in the XY spin-1/2 chain,"Physical Review A, vol. 82, p. 012106, 2010.

Literature Review

Quantum Sort Algorithm bassed On Entanglement Qubits

A. Odeh, K. Elleithy, M. Almasri, and A. Alajlan, "Sorting N Element Using Quantum Entanglement Sets"in innovative Computing Technology (INTECH), 2013 Third International Conference on 2013, pp.213-216

R. P. Feynammn, A. R. Hibbs, and D. Styer, Quantum mechanics and path integrals, Aaver Publications. 2010

Books

Introduction to Quantum Computing

 Phillip Kaye, Raymond Laflamme and Michele Mosca

Quantum Computer Science

 N. David Mermin

Quantum Computing for Computer Science

 Noson S. Yanofsky and Micro A. Mannucci

The End