NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES

SORTING CIRCUIT FOR QUANTUM COMPUTERS

INTRODUCTION

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.

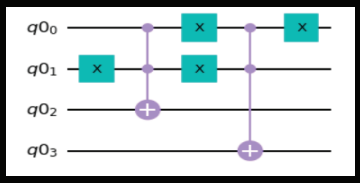
QUANTUM GATES

HADAMARD GATE | X GATE | CX GATE | SWAP GATE | ID GATE

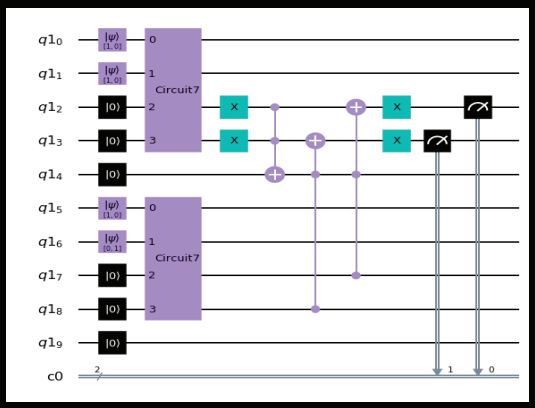
QUANTUM OPERATIONS

RESET OPERATION | BARRIER OPERATION | Z-MEASURMENT OPERATION | IF OPERATION

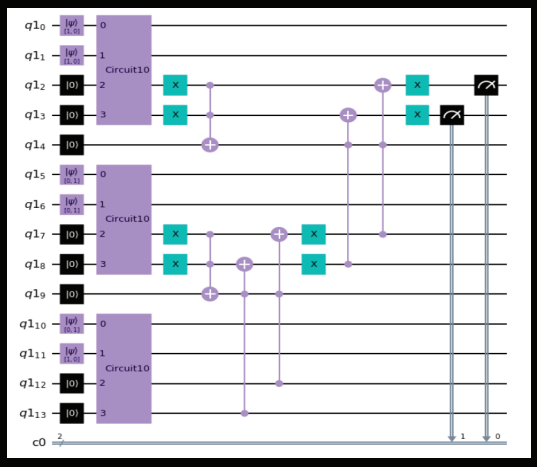
QUANTUM CIRCUITS



1 BIT COMPARATOR



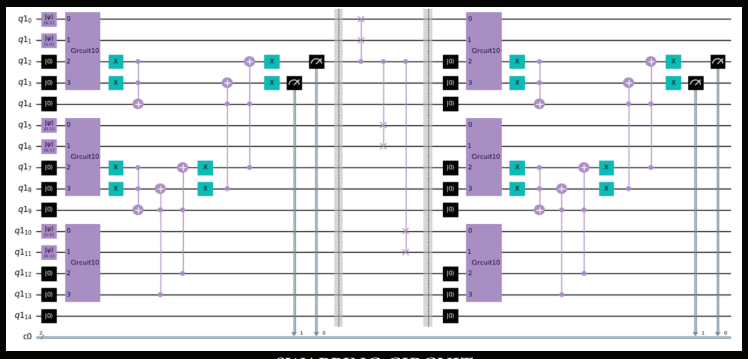
2 BIT COMPARATOR



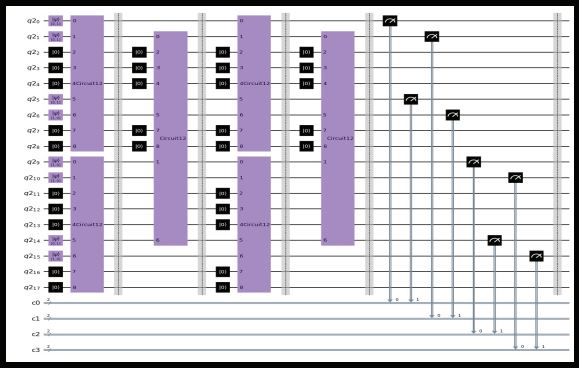
3 BIT COMPARATOR

EXPLANATION

We designed 1-bit comparator using X and and CX gates to compare two qubits. It will return us 0,1,2. 0 in case if both inputs are equal, 1 if input-1 is greater than input-2 and, 2 if input-2 is greater. Then we expanded it to 2 and 3 qubits.



SWAPPING CIRCUIT



SORTING CIRCUIT

SORTED ARRAY

CONCLUSION

From the result of comparator we start swapping the qubits in such order that it returns at the end sorted list of numbers(0,1,2,3).

P.S. Read the list from right to left because Quantum Computers are complicated.

SUPERVISOR
DR. OMAR USMAN

GROUP MEMBERS

MUHAMMAD HAMZA 16P-6068
M. YOUSAF KHAN 16P-6059
SYED IZHAR ALI 16P-6125

TOOLS

IBMQ
QISKIT
PYTHON