Sorting circuit for Quantum Computing

Supervisor: Dr. Omer Usman Khan
Yousaf Khan 16P-6059
Muhammad Hamza 16P-6068
Izhar Ali 16P-6125

Presentation

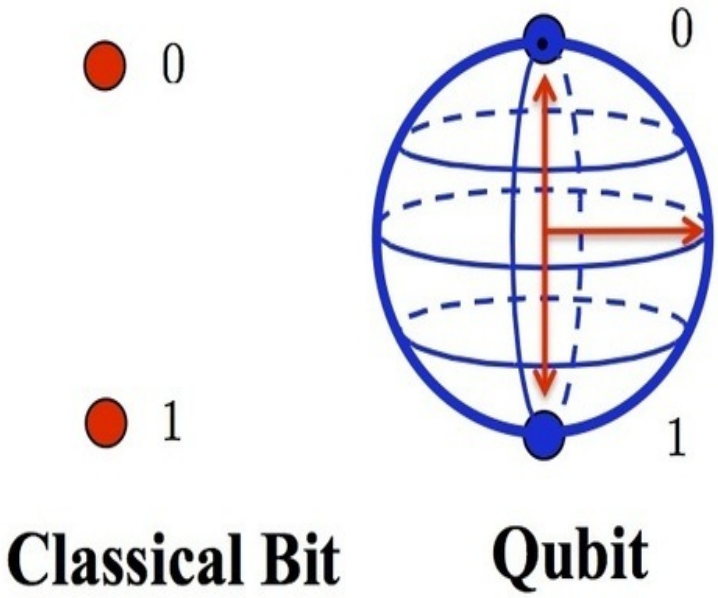
National University Of
Computer And Emerging Sciences

29th October 2020

Table of Contents

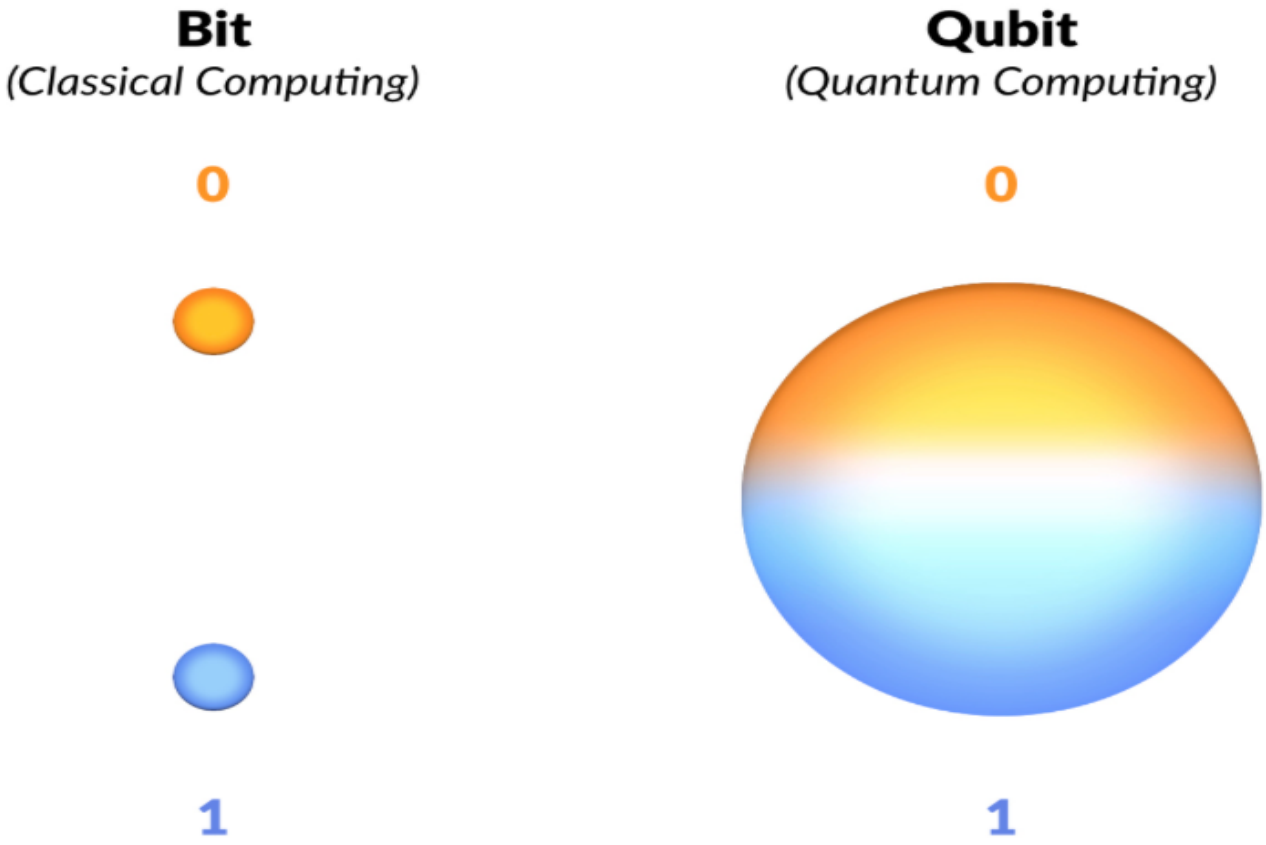
Quantum Bit

- What is Quantum bit?
- What is Qbit made off?
- Temperature
- Super Conductor



Quantum Phenomenon

- Super Position
- Entanglement



Quantum Gates

- Hadamard Gate

- ID Gate

- Swap Gate

- X Gate

- CX Gate

Quantum Operations

- Barrier Operation

- IF Operation

- $|0\rangle$ Opertaion

- Z measurement

Hadamard Gate

The hadamard gate acts on a single qubit. It maps the basis state

$$|0\rangle \ to \ \frac{|0\rangle + |1\rangle}{\sqrt{2}} \quad and \quad |1\rangle \ to \ \frac{|0\rangle - |1\rangle}{\sqrt{2}},$$

which means that a measurement will have equal probilities to become 1 or 0(creats a superposition).

$$H = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

$$H|0\rangle = |+\rangle$$

$$H|1\rangle = |-\rangle$$

X Gate

$$|a\rangle = v_0|0\rangle + v_1|1\rangle \rightarrow \begin{bmatrix} v_0 \\ v_1 \end{bmatrix}$$

$$|0\rangle = \begin{bmatrix} 1 \\ 0 \end{bmatrix}, |1\rangle = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$X = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} = |0\rangle\langle 1| + |1\rangle\langle 0|$$

$$X|0\rangle = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \end{bmatrix} = |1\rangle$$

Swap Gate

The swap gate swaps two qubits with respect to the basis

$$|00\rangle, |01\rangle, |10\rangle, |11\rangle.$$

It is represented by the matrix

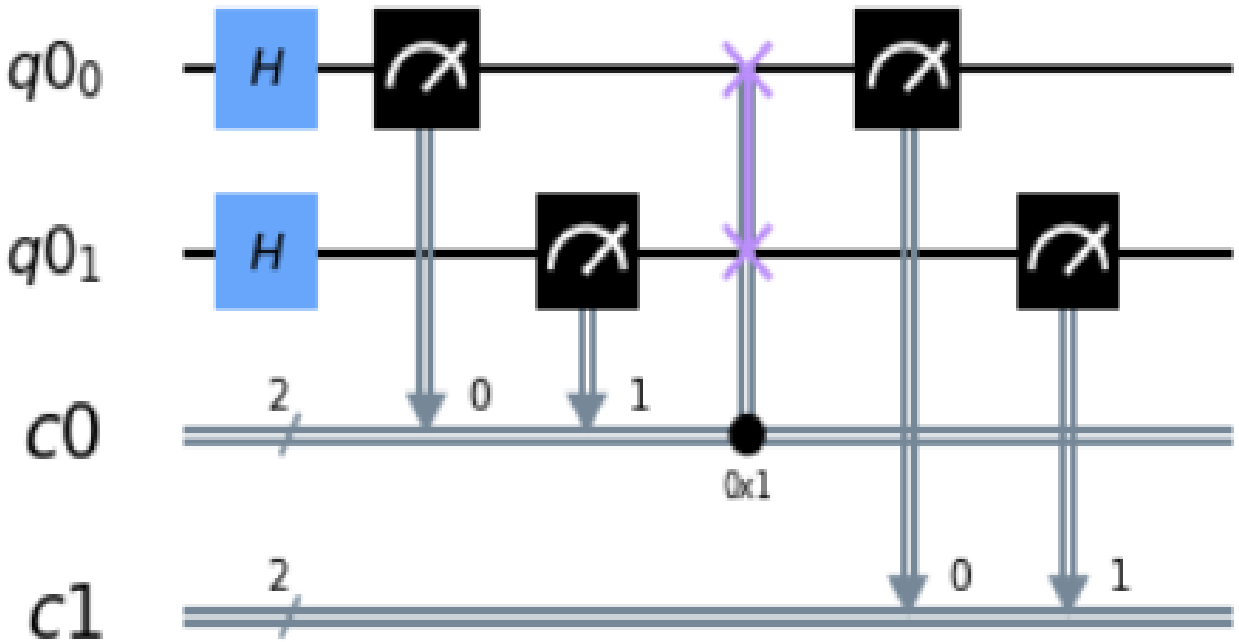
$$SWAP = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Workdone

- Random Bit Generator
- Number Guess
- Two Qubits Swapping

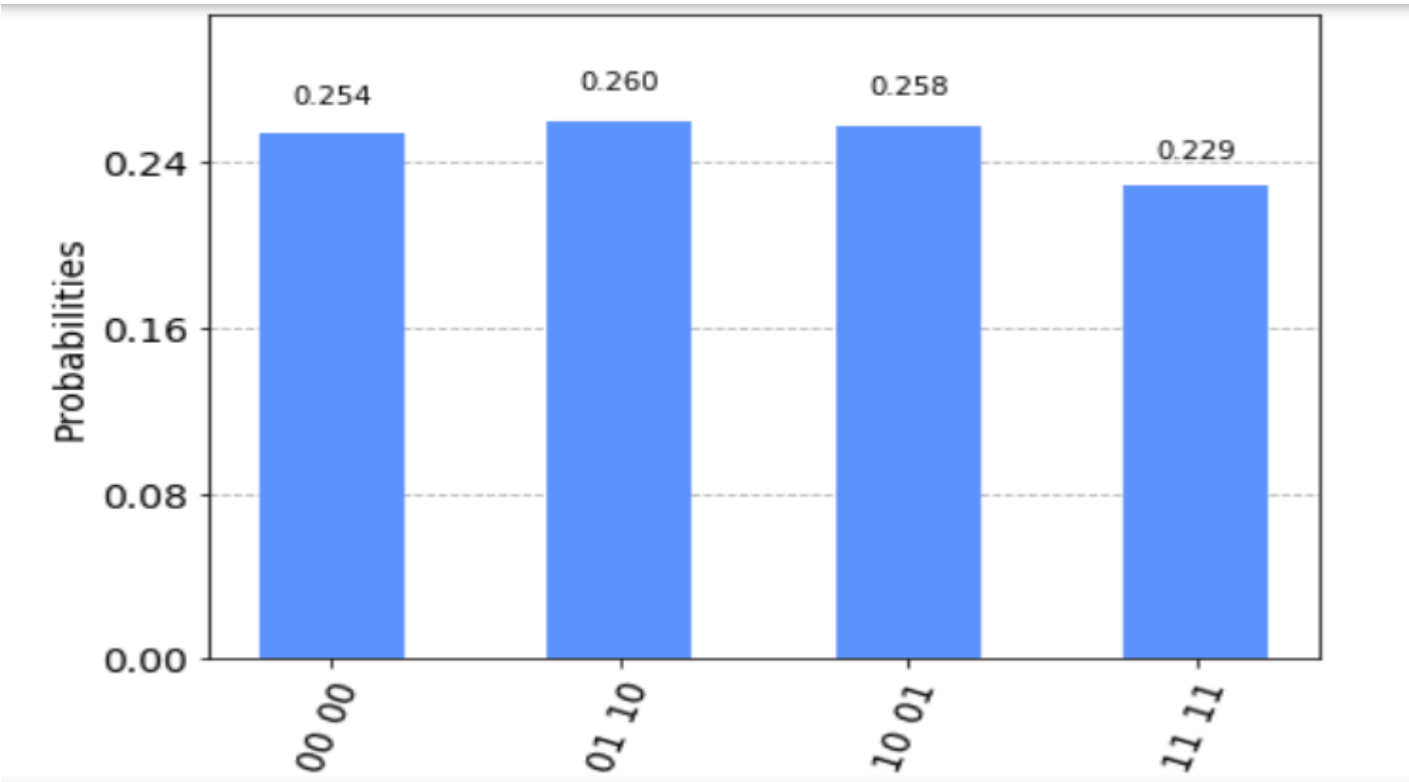
Sorting Quantum Circuit

- Two Qubits Circuit



Sorting Quantum Output

- Output



Choice of Sorting Algorithm

- Bubble Sort
- Merge Sort

Milestone

Milestone	Status
Expenssion of Sorting Circuit	In progress
Study Quantum literature	In progress

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