

Lab Session #2 - QDCS

Sept 26, 2025

1 Measure

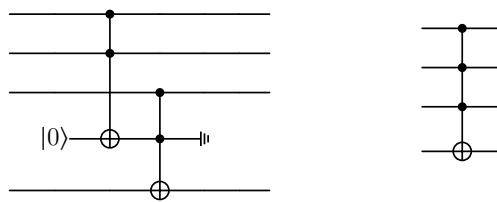
Consider the state

$$\frac{1}{\sqrt{2}}(|00\rangle + |11\rangle)$$

What is the state of the system when the first qubit is measured? What happens when one then measures the second qubit

2 Composing Toffoli Gates

Consider the circuits



The first one is allocating an auxiliary wire in state $|0\rangle$ and then “discarding” it: the wire is measured and forgotten.

(1) Give their action on a basis vector of the general form

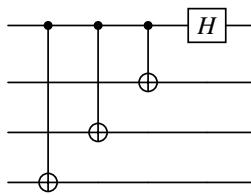
$$|x\rangle \otimes |y\rangle \otimes |z\rangle \otimes |t\rangle .$$

(2) Feed them with the state

$$\frac{1}{\sqrt{2}}(|0000\rangle + |1111\rangle).$$

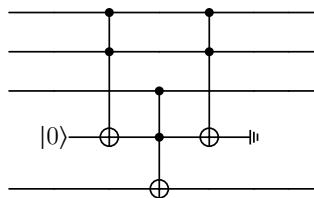
What are they both computing?

(3) To see how these are not the same thing, post-compose them with the circuit



and measure the 4 qubits: what is the result in both cases ?

(4) Consider now the circuit



What has changed?