CMPT 440 – Spring 2019: Quantum Finite Automata

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Definition

The formal definition of quantum computing is the "aim to use mechanical phenomena that have no classical counterpart for computational purposes". The central research tasks include building devices with a specified behavior, and designing algorithms to use the behavior.

Quantum Finite Automata are obtained by letting the matrices M_σ have complex entries.

Theoretical Background

A real time quantum finite automaton (rtQFA) with a state set Q, and alphabet Σ is described as:

$$M = \{Q, \Sigma, U_\sigma | \sigma \in \Sigma, q_1, Q_a\} \tag{1}$$

An Example

M_σ is unitary since the sum of the squares of the norms in each column adds up to 1 and the for product of any two columns is 0.

If all matrices only have 0 or 1 entries and the matrices are unitary, then the automaton is deterministic and reversible.

$$M_\sigma = \left\{ \begin{array}{cc} \text{-1} & 0 \\ 0 & \text{i} \end{array} \right\}$$

M_σ is unitary since the sum of the squares of the norms in each column adds up to 1 and the dot product of any two columns is 0.

References

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