2. Postulates on quantum computing

Vaughan Sohn

October 6, 2024

Contents

Turing machine

Definition of Turing machine

Components of a Turing machine

Definition of Turing machine

Operation of a Turing Machine

Universial Turing machine

Church-Turing thesis

Definition 1

A partial function $f : A^* \to A$ is computable if there exists a Turing machine M such that $\delta_M = f$. In this case, we say that f is computed by M.

Church-Turing thesis

The class of functions computable by a Turing machine corresponds exactly to the class of functions which we would naturally regard as being computable by an algorithm.

Halting problem

Halting problem

Dose turing machine M halt for given input x?
$\rightarrow$ *We can't compute halting problem by any turing machine!*

$*$ Proof: (귀류법) Halting 문제를 풀 수 있는 TM HALT가 존재한다고 가정하자.

Circuit model

Definition of Circuit model

Universiality of Circuit model

Theorem 2

Circuit model can solve every type of boolean function.

$$f : \{0,1\}^n \to \{0,1\}^m$$

Two computation model

Association between two computation models

Definition 3 (uniform circuit family)

-

Can circuit model solve halting problem?

References

- M. A. Nielson and I. L. Chuang, Quantum Computation and Quantum Information
- Lecture notes for QU511: Quantum Computing (Fall 2024)