

Questions we are interested in:

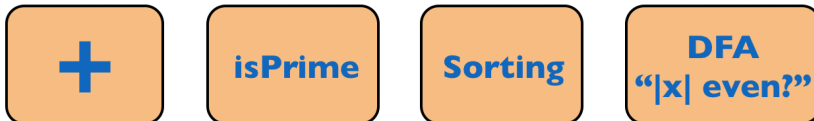
The quest to find the right definition

Turing's thinking



The beauty in Turing's definition:

Universal Machine



Do we really need a separate machine for each task?

Motivation for universal machines comes from humans:

Code is data!

Picture for universal machine:

Turing machines and the universe

Physical Church-Turing Thesis:

Extended Physical Church-Turing Thesis:

Implications:

Which ones are decidable?

$$\begin{aligned}\text{ACCEPTS}_{\text{DFA}} &= \{\langle D, x \rangle : D \text{ is a DFA that accepts the string } x\}, \\ \text{SELF-ACCEPTS}_{\text{DFA}} &= \{\langle D \rangle : D \text{ is a DFA that accepts the string } \langle D \rangle\}, \\ \text{SAT}_{\text{DFA}} &= \{\langle D \rangle : D \text{ is a DFA with } L(D) \neq \emptyset\}, \\ \text{NEQ}_{\text{DFA}} &= \{\langle D_1, D_2 \rangle : D_1 \text{ and } D_2 \text{ are DFAs with } L(D_1) \neq L(D_2)\}.\end{aligned}$$

Reduction: