

Turing Machines

- Turing Machine: Model of Computation
- Turing Machine: Anatomy and Working
- Turing Machine: Formal Definition and Rules of Computation
- Recognizable and Decidable Languages
- Turing Machine: Levels of Abstraction
- Variants of Turing Machine and The Church-Turing Thesis
- Non-Deterministic Turing Machine

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Recognizable and Decidable Languages

Turing Machine: Recognizer and Decider

A TM M **decides** a language $L \subseteq \Sigma^*$ if M accepts all strings in L and rejects all strings not in L

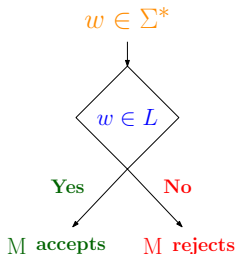
A language L is called decidable or recursive if some TM decides L

A TM M **recognizes** a language $L \subseteq \Sigma^*$ if M accepts all strings in L ~~and rejects all strings not in L~~

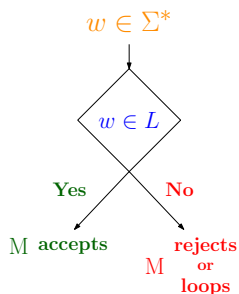
A language L is called recognizable or recursively enumerable if some TM recognizes L

Turing Machine: Recognizer and Decider

If L is language over Σ and
there is a Turing machine M such that



M decides L
 L is (Turing) decidable
 L is recursive



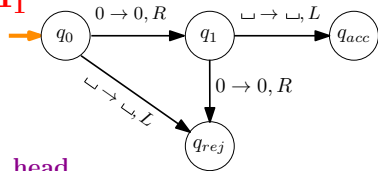
M recognizes L
 L is (Turing) recognizable
 L is recursively enumerable

The class of decidable languages is a subset of recognizable languages

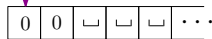
Turing Machine: Recognizer and Decider

$$\Sigma = \{0\}$$

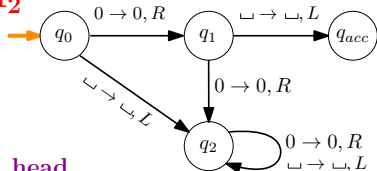
M_1



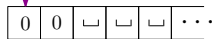
head



M_2



head



The TM M_1 decides the language $\{0\}$

The TM M_2 recognizes the language $\{0\}$