Contents

- · · · · · ·
- • • •

- 1. What is an algorithm?
- 2. The Turing Machine
 - a. Presentation
 - b. Definition
 - c. Examples







Computability Theory

What are algorithms and what can they do?

Euclid's algorithm

Euclid_GCD(a, b):a = 49, b = 84while $(a \neq b)$ a = 49, b = 35if (a > b)a = 49, b = 35a := a - ba = 14, b = 35elsea = 14, b = 21b := b - aa = 14, b = 7return aa = 7, b = 7

.



.

What is the GCD of *x* and *y*?

What is the shortest path in graph *G* between nodes *i* and *j*?

What is the sorted order of list *l*?

A problem is a function from a set of inputs to a set of outputs

 $f: I \to O$

.

Is graph G fully connected?

Is number *n* prime?

Can program p ever trigger a SEGFAULT?

A decision problem is a problem with a boolean output

 $f: I \rightarrow \{FALSE, TRUE\}$





strings strings strings A *problem* is a function from a set of inputs to a set of outputs

$f\colon \Sigma_1^* \to \Sigma_2^*$

A decision problem is a problem with a boolean output

 $f: \Sigma^* \rightarrow \{FALSE, TRUE\}$