

# cmpt 308 - Computability & Complexity

[course webpage](#)

[www.cs.sfu.ca/~kabanets/308](http://www.cs.sfu.ca/~kabanets/308)

(no class this Wed, May 8)

Valentine Kabanets

About the Course:

## Foundations of CS

Computer : what is it ?

How powerful is it ?

## Algorithms

- argue computer is powerful <sup>via</sup> efficient algorithms

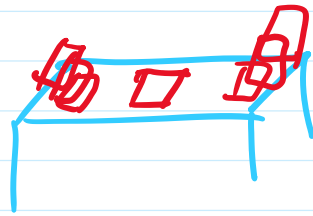
## Comp / Complexity

- computers are not all-powerful
- limitations
  - not computable
  - not computable efficiently

A. Turing 1936

D. Hilbert 1900

Algorithms



Algorithms  
book

Turing machine: model of a human computer

- finite set of states of mind
- each time, read one page
- depending on my state, contents of page, write something new & change my state & move to another sheet.

Power of Computers:

- computer viruses / self-replicating programs

Write a Java prog:  
that will print its own  
source code

that can print its own source code.

- Virus detecting program?  
*Impossible!*

- Can replace mathematicians by computers?

Given a statement about nat. numbers,  $(\forall x \exists y y > x)$   
decide if it's true. *Impossible!*

- Hard vs. easy problems.



Thm: There exist unsolvable problems.

Pf.

Problem:  $f: \{0,1\}^* \rightarrow \{0,1\}^n$

Algorithm: Java program

like natural numbers

{ Java progs } is countable

$f(\epsilon), f(0), f(1), f(00), f(01), \dots$

{ fns } is uncountable!