Computers used to be bigger and more expensive ... this is part of the Bell Relay Computer

Two big ideas ...

1. Instead of connecting cables, let’s store the program in memory!
   (stored program machine)

2. Let’s write a program that simulates a more convenient computer!
   (Universal Turing Machine)
Add content of memory cell 1532 and 2648, putting result in 2648.

Add

Fetch content of memory cell 1532 and 2648

Store result in memory cell 2648
Programming with Code

\[ x = x + y \]

Same thing, if memory cell 2648 is called ‘x’ and memory cell 1532 is called ‘y’:

Fetch the value in x
Fetch the value in y
Add them
Store the result in x

Virtual (imaginary) Computers

Now it’s simulating a (virtual) computer, which executes Python programs

The hardware computer executes programs expressed in binary machine language

( It has an interpreter too!)

Universal Computing Devices

A computer executes instructions

A program is a collection of instructions

A program can simulate another (more convenient) computer.

Almost any computer can simulate any other (with the right programs).
Why is universality a big deal?

Computer science is not like “automobile science” or “rocket science”
  • Computers change quickly, but computer science fundamentals remain

We can have theory!
  • All based on abstract computers, but applied to real programs on real computers

We can have languages!
  • And they don’t depend on what brand computer I buy

This isn’t rocket science ... it’s way better!