

Introduction to the Course

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Course Outcomes

- Given a small section of code you should be able to:
 - Trace through and predict it's output.
 - Describe, in plain English, what it does.
- Write a small python program some, or all, of the fundamentals you will learn in the course.
- Beginner and intermediate spreadsheet operations.
- Beginner level understanding of how the internet works and how to write basic HTML documents.

What is Computer Science?

- CS is concerned with understanding:
 - What is computable
 - How to compute it in one or more of the following in mind:
 - Speed
 - Reliability
 - Security
 - Resource cost

What is Programming?

- Programming \neq Computer Science
 - Rather, programming is a subset of Computer Science
- “Computer Science is no more about computers than astronomy is about telescopes”
 - Edsger W. Dijkstra
 - A bit of an overstatement but still a useful thing to keep in mind.
- **High Level Definition:** A series of instructions that a computer carries out.

Where did this all come from?

Early “Computers”

The Difference Engine

Alan Turing, Alonzo Church, and Turing Machines

- ① **Church-Turing Thesis** - Any effective calculation can be performed by a mechanical computer (e.g., a Turing Machine).
- ② **Turing Machines** - An abstract, mathematical model of a machine that moves up and down a strip of paper, one step at a time, and performs operations based on a set of rules (Figure 1).

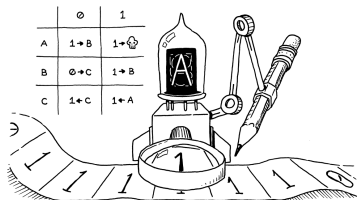


Figure: Artists Representation of a Turing Machine

Von Neumann Architecture

- ❶ **Input Devices:** Something with buttons and knobs.
- ❷ **Central Processing Unit:**
 - ❶ **Control Unit:** Manages other parts.
 - ❷ **Arithmetic/Logic Unit:** Does math on integers.
- ❸ **Memory Unit:** Supplies info to CPU (i.e., Random Access Memory).
- ❹ **External Storage Unit (Not Pictured):** We often need larger storage for data that isn't needed immediately (e.g., Hard Drive).
- ❺ **Output Devices:** Flashing lights, monitor, etc.

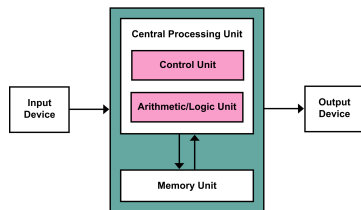


Figure: Von Neumann Architecture

Break time!

5 Minute Break

Computers Run Low-Level Instructions

- Computers don't "Play a video"
- They...
 - ① Move some numbers into memory.
 - ② Do some math, or a comparison, or both
 - ③ Make a decision based on the results
 - ④ Rise a and repeat a few million time before something useful happens
- Programming at this level is:
 - Tedious and error prone.
 - Needs **A LOT** of code to do anything useful.
 - Isn't portable. Each processor is it's own machine and will require a different set of instructions that works with it's parts.

Enter Python (And Other High-Level Languages)

- They are:
 - **Productive** → A few lines do a lot and it's easy to debug.
 - **Safer** → Less likely to write code that is insecure or damaging.
 - **Portable** → Works on all systems that support the Python interpreter.
- Used for everything from machine learning to general scripting.
- We use Python 3.x (not Python 2.x)

How programs are Constructed

- **Algorithms** → A step-by-step process for achieving a result
 - Often Written in pseudo-code
- **Programming** → Express the commands in a form the computer understands.
- **Testing** → Designing inputs that test specific behaviours of the code.
- **Debugging** → Finding errors in the code based on the results of your tests and fixing them.

How Languages are Constructed

- **Syntax** → Rules of how programs should be constructed (think grammar).
- **Semantics** → Rules specifying what a program does.

Data Types in Python

- Two types we'll need to know now:
 - **Strings:** A long list of characters accompanied by surrounding quotes (e.g., "Hello, CS 105!").
 - **Integers:** Whole numbers, both positive and negative.
- You can check the type of a variable or expression with the `type()` function.
- You can convert between them with the `str()` and `int()` functions.
- It's important to keep the type of your variables in mind when programming.
- Keeping types in mind when attempting to deduce what a program is doing is very important.

Poll Question: Python Values have Types

What is the type of x if x is assigned $x = 23$?

Input and Print

- **The Input Function**: A builtin function that gets a string from the user.
 - **input()** → Doesn't give a prompt.
 - **input("A test input: ")** → Will output the message *"A test input:"* to the screen and let the user type their input in after it.
- **The Print Function**: A builtin function that takes a string as a parameter (in between the parentheses) and outputs that string
 - **print("Hello, World!")** → Will output the "Hello, World!".

Poll Question: Input and Print

Assuming there is a variable `value` with the value 7, which of the following statements prints: `count = 7`.

- ❶ `print("count = " value)`
- ❷ `print("count = ", end="value")`
- ❸ `print("count = ", value)`
- ❹ `print("count = $value")`

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