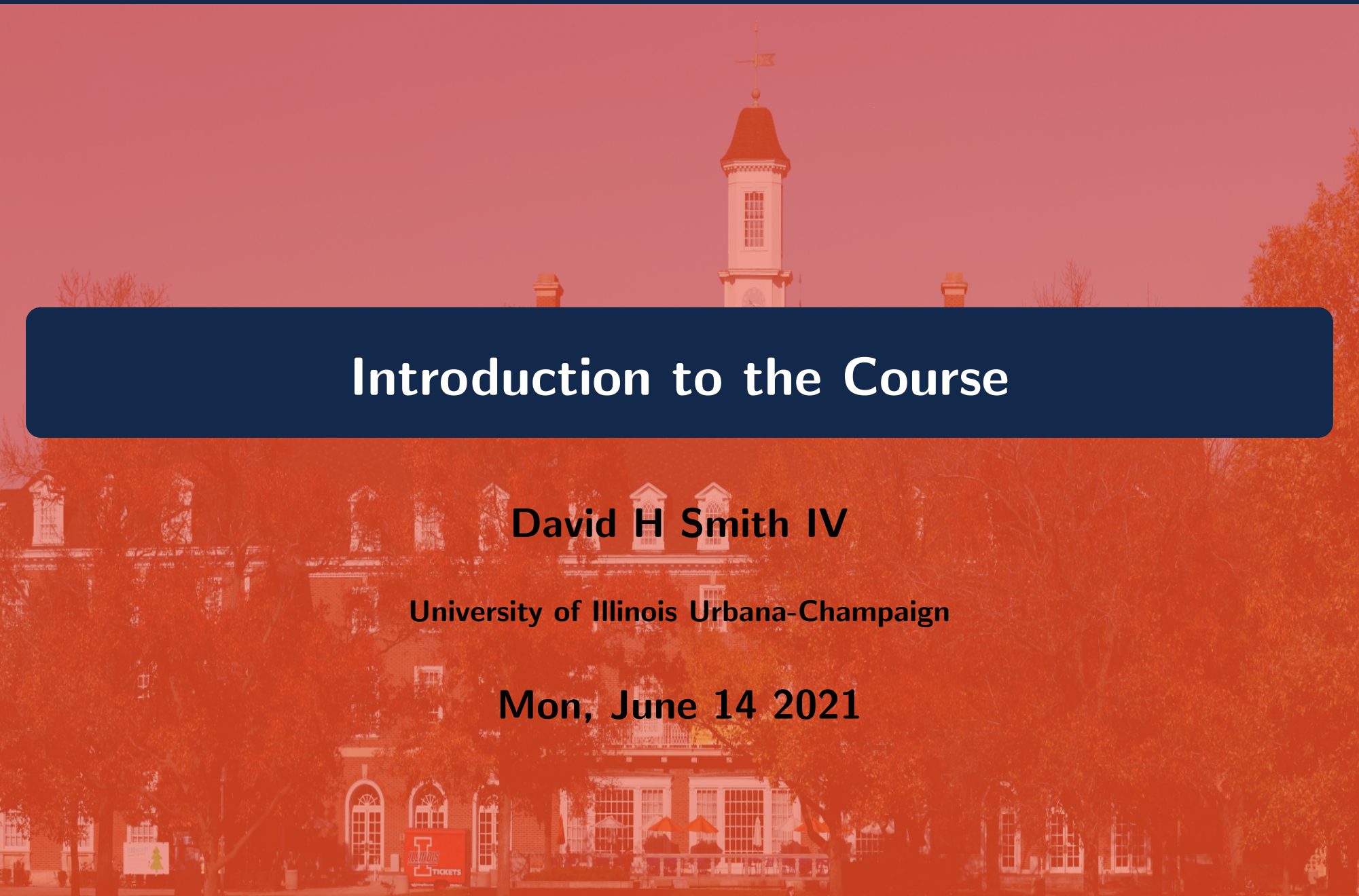

Introduction to the Course

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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 using the fundamentals you will learn in this course.
- Beginner and intermediate spreadsheet operations.
- Beginner level understanding of how the internet works and how to write basic HTML documents.

Today's Topics

- Quick overview of the course
- A history of CS and the general purpose computer
- The process of constructing programs

Lecture Time

- We ask multiple choice questions
- You answer the poll individually, for participation points.
- Then you discuss with your peers in your assigned lecture discord group.
- You will answer the poll a second time for, credit.

First poll question! - Getting Help

1. It is okay to hire random internet strangers to do all of your homework for you.
2. You must do all of your homework alone (not even TAs can help)
3. You can get any help you want as long as you type in the answers.
4. Students can only discuss the homework at a high level; code must not be shown to other students, but you can as TAs for help.
5. Assignments can be done in groups of two students.

What is Computer Science?

- CS is concerned with understanding:
  - Historically concerned with investigating 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
- **High Level Definition:** A series of instructions that a computer carries out.

The Journey to a General Purpose Computer

Early "Computers"

Figure: Fire Control System

Figure: Antikythera Mechanism

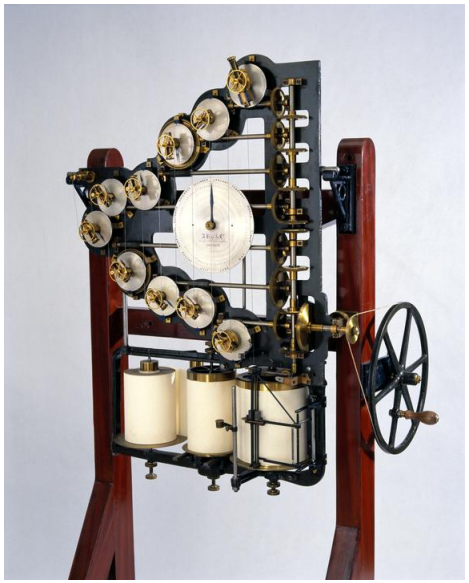
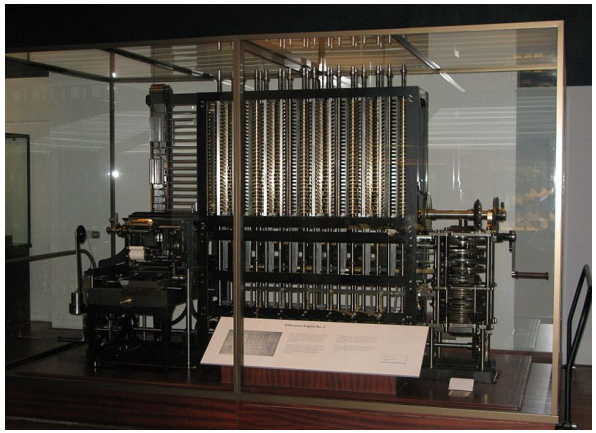
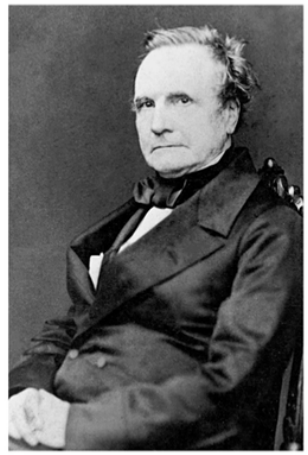


Figure: Tide Predicting Machine

The Difference & Analytical Engines

1. **Charles Babbage:** Created the Difference Engine and created plans for the Analytical Engine.
2. **Ada Lovelace:** The first computer programmer who worked with Babbage on the Analytical Engine.
3. **Difference Engine:** A large mechanical calculator capable of performing large computations.
4. **Analytical Engine:** The first model of a general purpose mechanical computer.





Turing Machines

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.

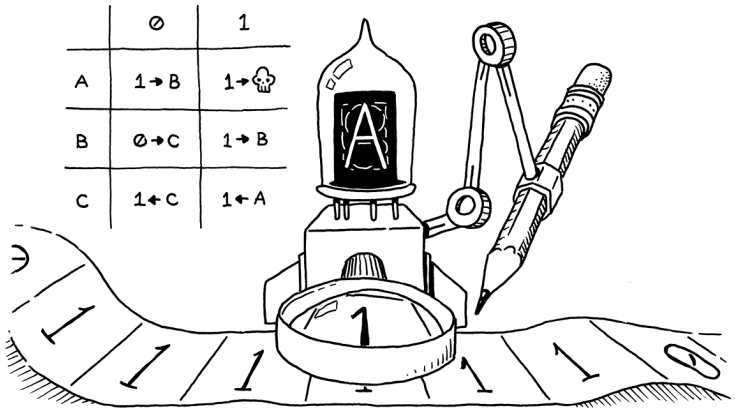


Figure: Artist's Representation of a Turing Machine

Von Neumann Architecture

1. **Input Devices:** Something with buttons and knobs.
2. **Central Processing Unit:**
   1. **Control Unit:** Manages everything.
   2. **Arithmetic/Logic Unit:** Does math and logical comparisons.
3. **Memory Unit:** Supplies info to CPU (i.e., Random Access Memory).
4. **External Storage Unit (Not Pictured):** We often need larger storage for data that isn't needed immediately (e.g., Hard Drive).
5. **Output Devices:** Flashing lights, monitor, etc.

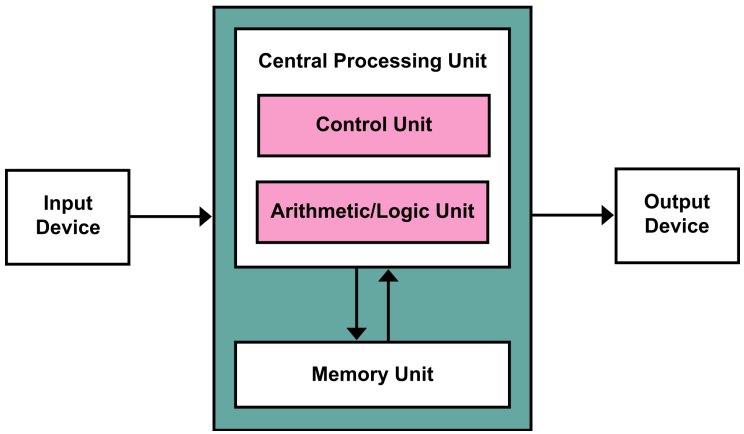


Figure: Von Neumann Architecture

How Programs are Constructed

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.

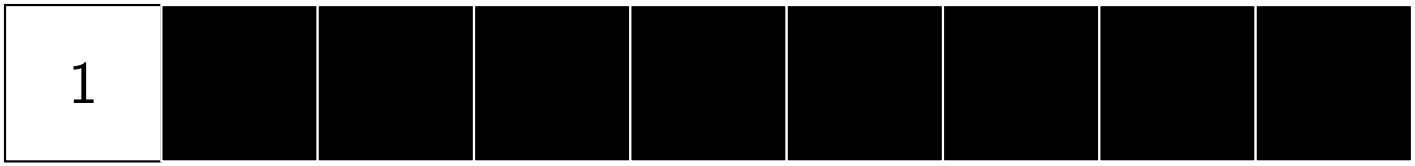
A Search Algorithm

- **Input:** (1) An array of numbers and (2) number for which we're searching.
- **Output:** Whether or not the number exists in the list of numbers.
- **Algorithm:**
  1. Look at first item.
  2. Check if it's the item we're looking for.
  3. If it's the item we're looking for stop otherwise go to next item.
  4. Repeat steps 2 & 3 if there are still items in the list.

Searching Number: 4

Input List:

1	2	3	4	5	6	7	8	9



Is 1 equal to 4? No, so we check the next one.

Is 2 equal to 4? No, so we check the next one.

Is 3 equal to 4? No, so we check the next one.

Is 4 equal to 4? Yes, so we stop searching.

Algorithm:

1. Look at first item.
2. Check if it's the item we're looking for.
3. If it's the item we're looking for stop otherwise go to next item.
4. Repeat steps 2 & 3 if there are still items in the list.

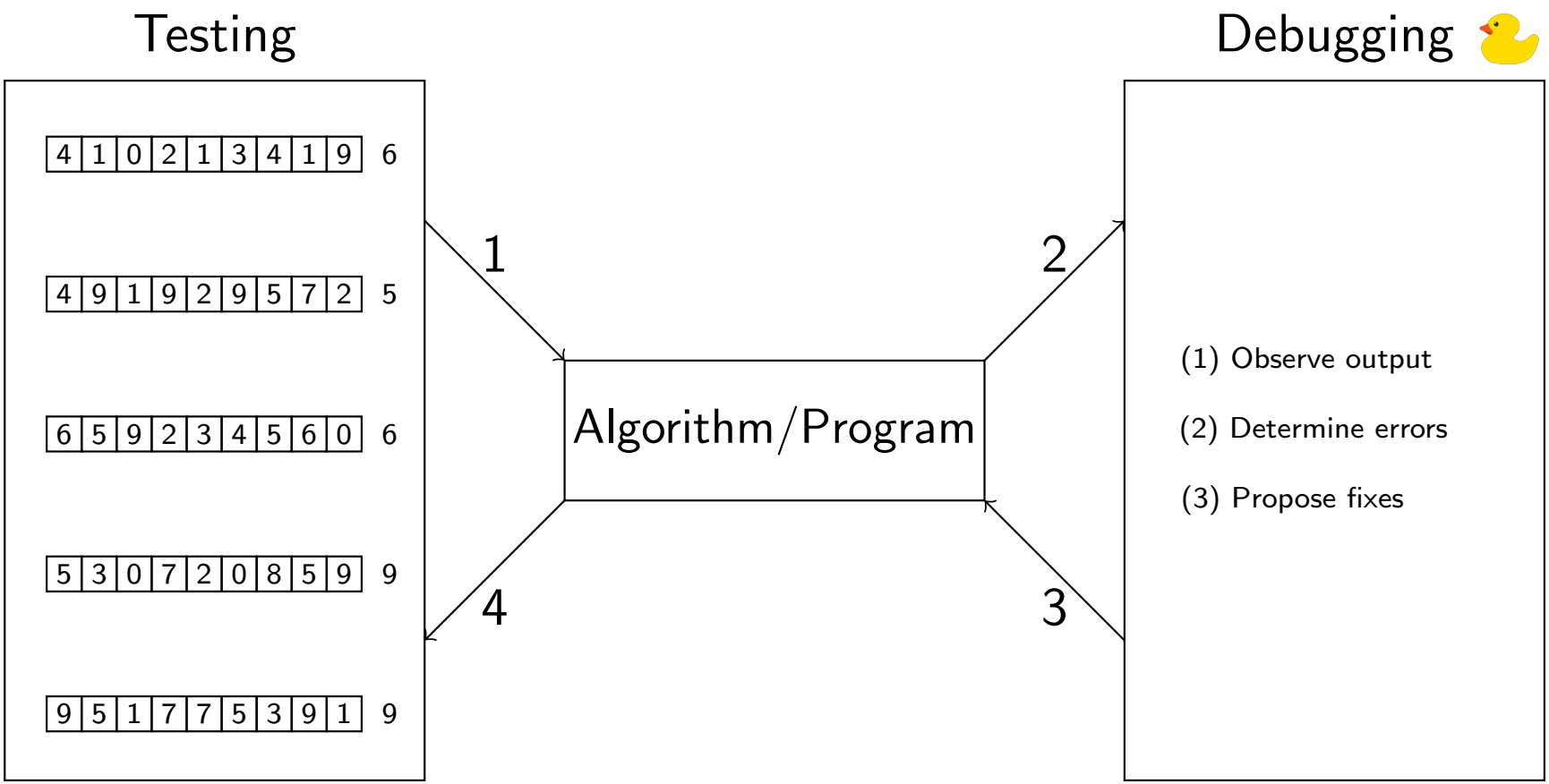
Code:

```
def search(list, searchitem):
    for item in items:
        if item == searchitem:
            return True
    return False
```

How Languages are Constructed

- **Syntax** →The rules specifying the structure and symbols that are allowable within the programming language.
- **Semantics** →Rules defining the behaviour of symbols or combinations of symbols.
- Something might be syntactically valid but not semantically valid but never the other way around.

Testing and Debugging



Next Lecture 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!".

Next Lecture: 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.