SD5913 · WEEK 01 · LECTURE

Programming for artists and designers

PolyU School of Design · pfad.ait4x.org

Today

01 Why are we here?

02 Who are we?

03 Computers

04 Programs

05 Programming languages

06 Python

07 Tools for the job

08 Assignments and tutorials

Why are we here?

One sentence. Why a programming course for art and design?

I came to this from economics.

No computer science degree. I learned to code because **I wanted to make things** that could not be made any other way. That is still the only reason I use it.

```
// what I made with it
```

- **Musical Fruitstand** — fruit you can play. No screen.
- **A-Eye** — the audience, repainted live at M+.
- **Featherman** — a mobile game, with WWF Mai Po.
- giovannilion.link — later, not now.

The robot rebooted minutes before the cue.

2017–2019 · Hanson Robotics · I was Sophia's operator for two years. Someone knocked out a power cable during setup, in front of thousands of people. It came back. The show went on.

02

Who are we?

ARTISTS AND DESIGNERS · WHAT'S YOUR X?

QUESTION · MULTIPLE CHOICE · YOUR ANSWERS

Are you an artist or a designer?

A Artist

B Designer

C Both / not sure

“...a subjective perspective that reminds us of the human condition.”

Artists? — Hannah Arendt, The Human Condition, 1958

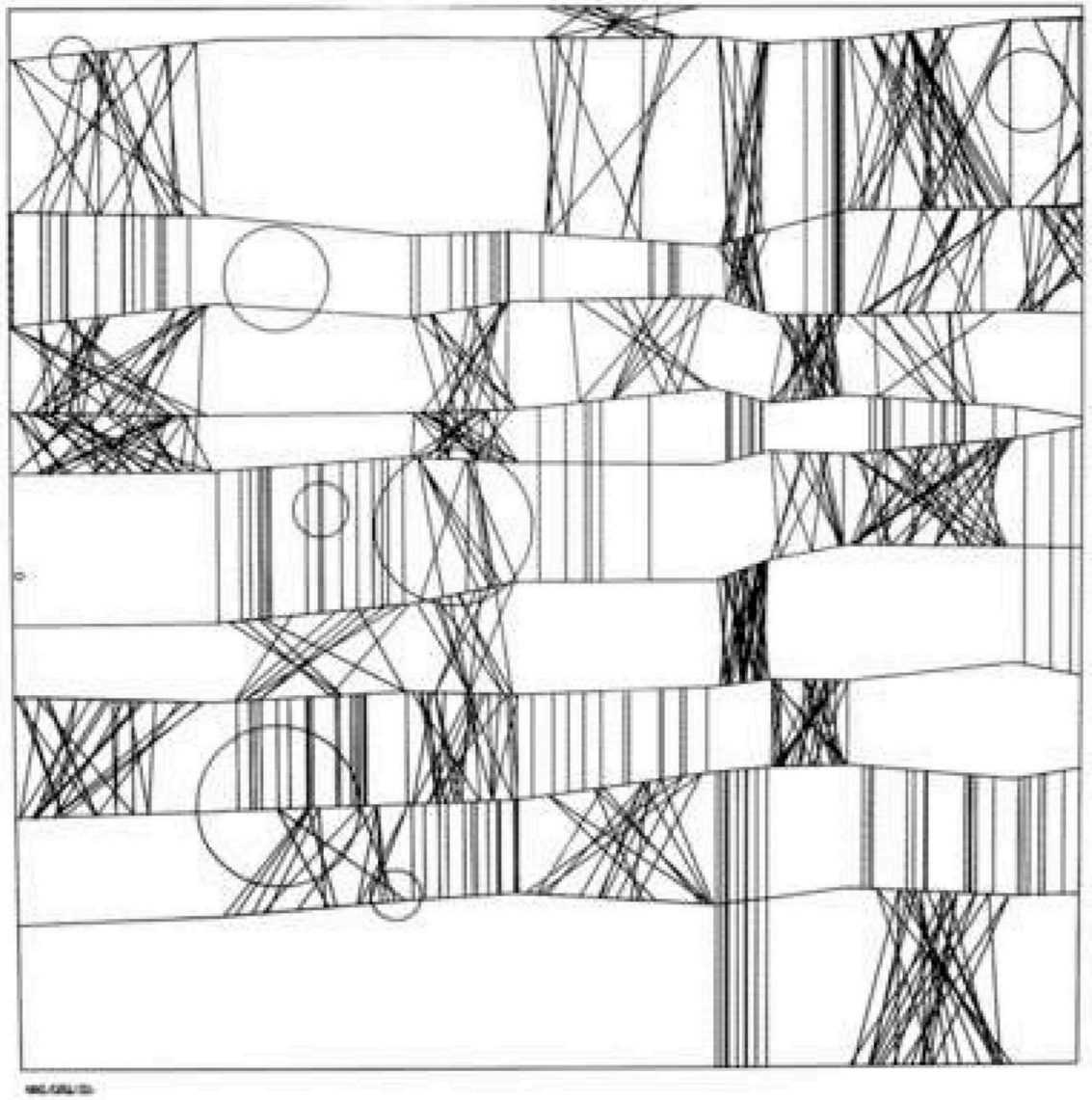
QUESTION · MULTIPLE CHOICE · YOUR ANSWERS

Is programming an art?

A Yes

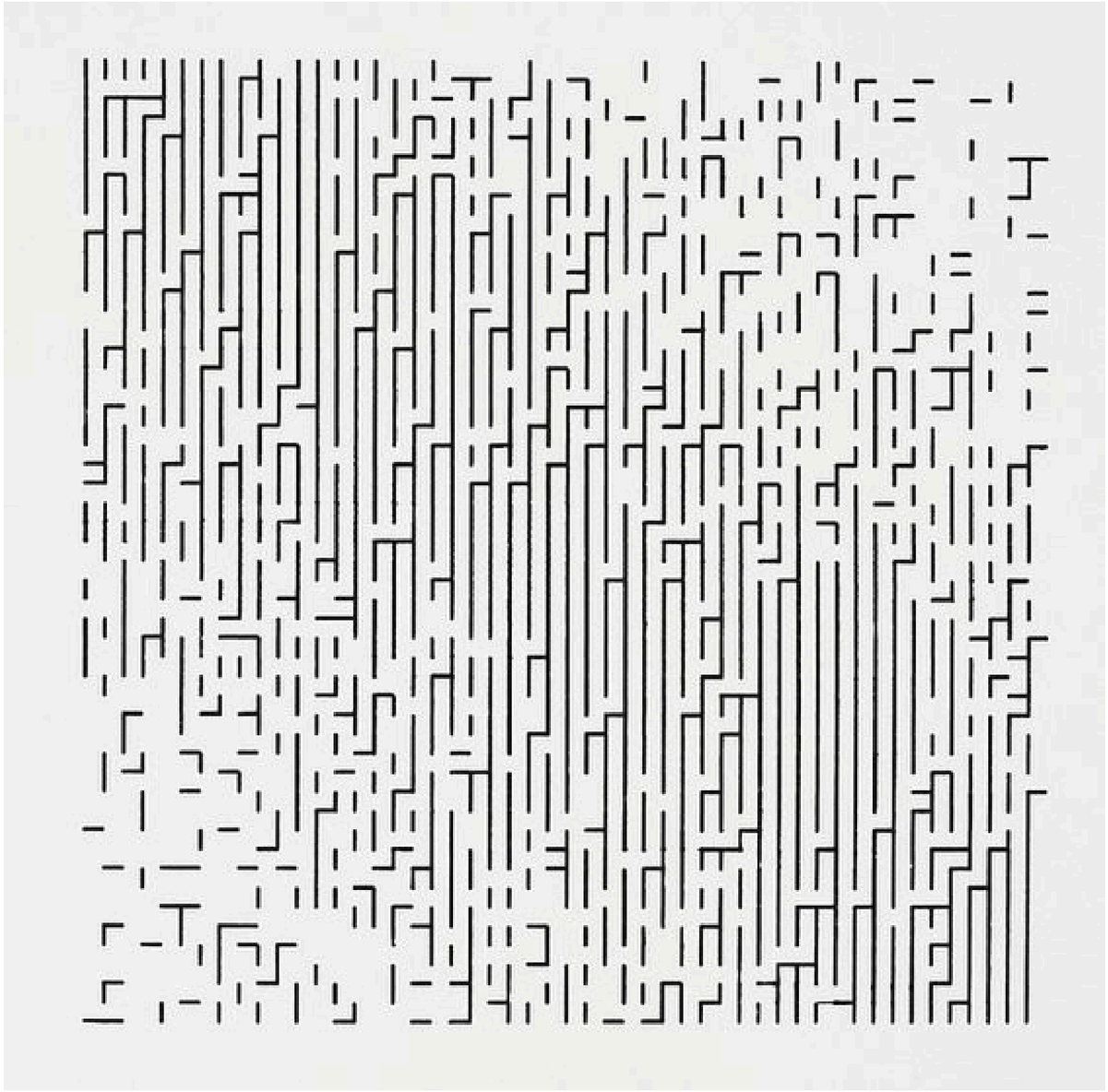
B No

C It can be



1965 · FRIEDER NAKE · HOMMAGE À PAUL KLEE, 13/9/65 NR.2

A program drew this. Screenprint after a plotter drawing, 49.2 × 49.2 cm. Victoria and Albert Museum, E.951-2008.



1966 · FRIEDER NAKE · WALK-THROUGH-RASTER, SERIES 2, 1-4

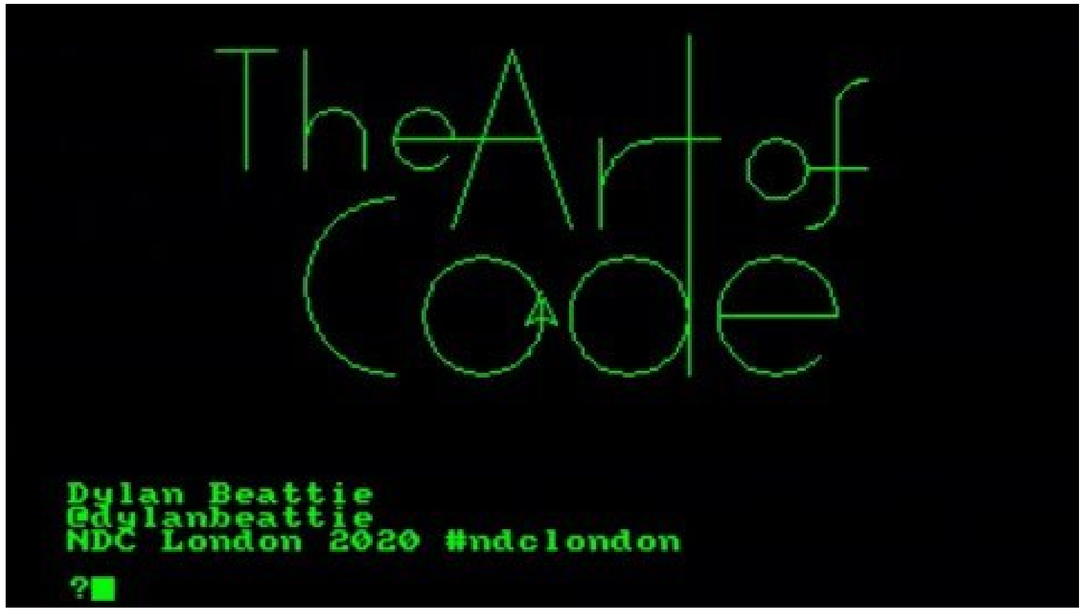
Same idea: a rule, run many times, with a little randomness. Photograph of a plotter drawing. Victoria and Albert Museum, E.955-2008.

TALK · DYLAN BEATTIE

The Art of Code

Inspiration for assignment 1.

youtube.com/watch?v=6avJHaC3C2U



GEORG NEES · SCHOTTER · 1968

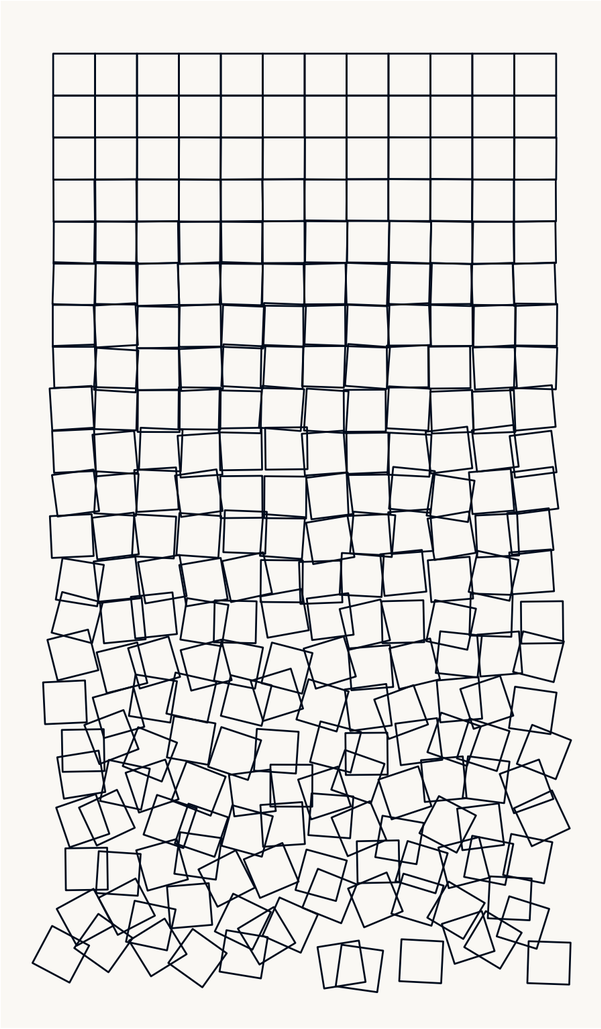
One rule. One number.

12 squares across, 22 down. The top row is perfect. Every row after it is rotated and moved a little more, until the bottom is rubble.

In the tutorial you change that number and watch it become a different picture.

```
CHAOS = 1.0
```

Drawn by the rule in pfad/week01/first-repo/sketch.py, seed 5913.



...a creative perspective that is data-driven and user-centric.

Designers?

1837 · CHARLES BABBAGE · THE ANALYTICAL ENGINE

A computer is a physical thing. Brass, steel and gears, cut by hand by craftsmen. This one was designed but never finished. Someone wrote a program for it anyway. Trial model, Science Museum Group 1878-3, CC BY-NC-SA 4.0.

Wrote the first program — for Babbage's Analytical Engine, a computer that did not exist yet.

Ada Lovelace, Note G, 1843 · Portrait by Margaret Sarah Carpenter, 1836, Government Art Collection

AGILEMANIFESTO.ORG · 2001

Is programming a craft?

Individuals and interactions over processes and tools

Working software over comprehensive documentation

Customer collaboration over contract negotiation

Responding to change over following a plan

Both want to change attitudes and behaviour.

Mediated perception

Technologies do not exist “in themselves.” They exist in relation to people and culture.

— Don Ihde

```
you  ↔  tool  ↔  world
```

What's your X?

One word. What do you want to make with code this semester?

Stay in flow

Bored? Find a harder problem.

Anxious? Learn a skill, or make the problem smaller.

Then sleep.

You will read this loop again in week 4, once while means something, and run it for real in week 13.

```
problem = None
while semester() == 1:
    if not problem:
        problem = Problem.current()
    while not problem.solved:
        try:
            code = self.challenge(problem)
            problem.solved = code.run(problem)
        except:
            panic = reality_check()
            break
    state = check_state()
    if state == "bored" or problem.solved:
        problem = Problem.find_harder(problem)
    elif state == "anxious" or panic:
        try:
            skill_upgrade(self)
        except:
            simplify(problem)
        finally:
            sleep(8 * 60 * 60)
```

ASSESSMENT

Five components

10%

Participation

Come, or tell us before you do not.

30%

Individual assignments

Three, on GitHub, on time.

10%

Mid-term quiz

In class, week 7.

40%

Group project

A GitHub repo with everyone's commits. Original code. Multimedia. Scope agreed by week 8.

10%

Final quiz

In class, week 13.

INDIVIDUAL ASSIGNMENTS · 30%

Three repos, three dates

01 · 5%

Reflection

Why are we here? 500–1000 words.

DUE SUN 13 SEP

02 · 10%

Data visualisation

Get data about a natural phenomenon. Show it.

DUE SUN 27 SEP

03 · 15%

Interactive experience

Something people can play with.

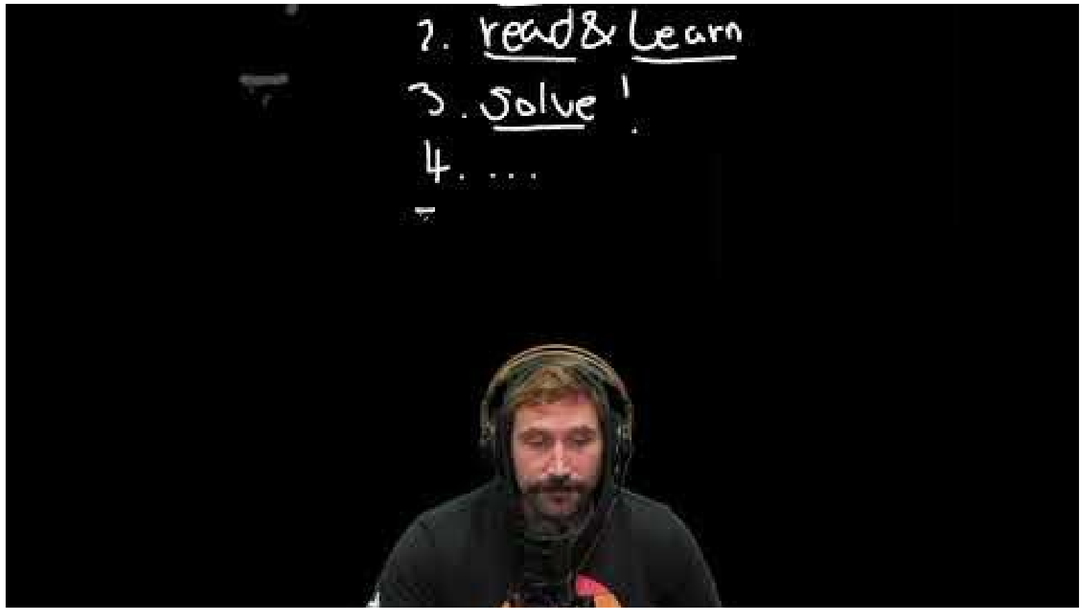
LATER IN THE SEMESTER

VIDEO

The programmer's mindset

Programmers are not smarter. They are used to being wrong and trying again.

youtube.com/watch?v=3o63D0-_x2k



03

Computers

TURING, 1936

Computers are Turing machines

Turing, 1936 — On Computable Numbers, with an Application to the Entscheidungsproblem.

A tape of symbols, a head that reads one at a time, and a table of rules.

Read a symbol. Follow a rule. Write. Move. Repeat.

The machine in the paper is a thought experiment. Turing never built one.

```
TAPE   … 1 0 1 1 0 0 …
                 ^
HEAD   reads one cell

RULES  (state, symbol) →
       (write, move, next state)

read . rule . write . move
repeat
```

04

Programs

INSTRUCTIONS FOR CHANGING STATE

Programs are instructions for changing state

STATE 0

Before

A blank canvas, a file, a number.

PROGRAM

Instructions

Step, step, step…

STATE 1

After

A picture, a saved file, a result.

A program might have...

01

Inputs

02

Outputs

03

Errors

04

Infinite loops

Where are your programs running right now?

All programs run as **processes** inside your operating system.

...except for one.

- **CPU** does the steps
- **RAM** holds what is running
- **Disk** — SSD, HDD — keeps files when the power is off

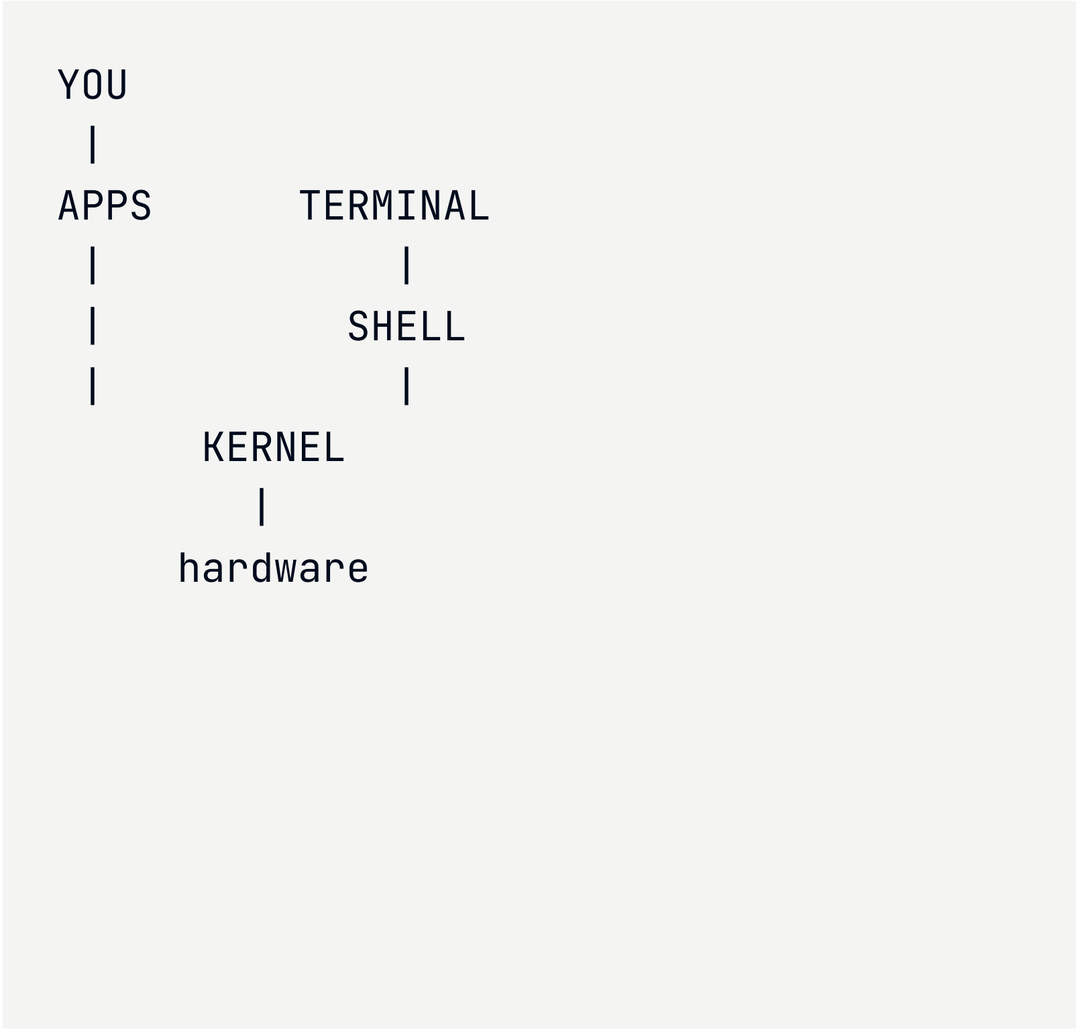
```
YOUR COMPUTER

  process: browser
  process: vscode
  process: python
  ...

  kernel

  CPU  RAM  disk
```

Kernel and shell

The **kernel** talks to the hardware.

The **shell** is the layer you talk to.

A terminal is a shell you type into.

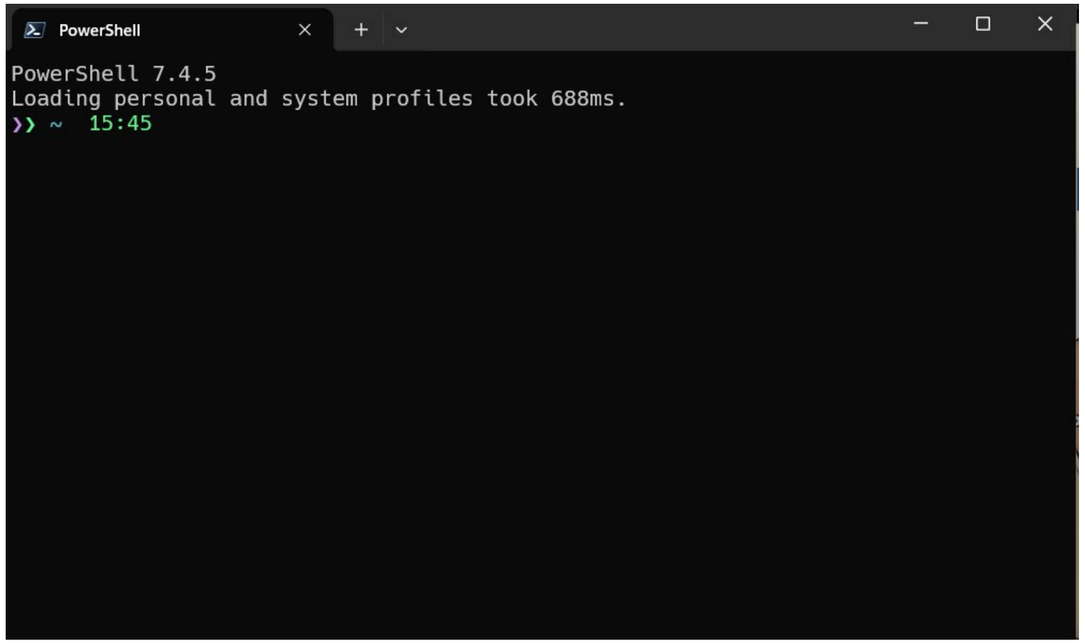


A terminal

When you type a program's name, the terminal looks for it inside the folders listed in the `PATH` variable.

- PowerShell · Terminal · bash · zsh

If it is not in one of those folders: command not found.



Programs that install programs

Set one up. It will make your life simpler. In the lab, setup.bat does this for you — see the tutorial.

WINDOWS

scoop

```
scoop.sh
scoop install git python
```

MACOS

brew

```
brew.sh
brew install git python
```

05

Programming languages

SHARED CONVENTIONS FOR GIVING INSTRUCTIONS

Compiled or interpreted

Hybrid — Java. Transpiled — TypeScript → JavaScript.

COMPILED

C, C++, Go, Rust, Zig

source code → compiler → machine code → run

Translate everything first. Then run fast, many times.

INTERPRETED

Python, JavaScript, Ruby

source code → interpreter reads and runs, line by line

No separate build step. Slower, but you see results right away.

Languages have syntax

- **Statements**
- **Variables**
- **Operators** and **functions**
- **Keywords** for flow control

You will see all four in the first tutorial file.

```
# variable
rows = 22

# operator + function
step = 90 / rows

# keyword: flow control
for row in range(rows):
    # statement
    draw(row, step * row)
```

06

Python

A PROGRAM THAT INTERPRETS TEXT

A program that interprets text and executes the instructions, following Python's conventions.

Python is...

01

Interpreted

No build step. Run it and see.

02

Dynamically typed

A variable can hold a number now and text later.

03

High-level

Close to how you think, far from the hardware.

04

Indented

Spaces decide what belongs to what.

05

Slower

Than C or Rust. Fast enough for us.

>>> import this

The Zen of Python, by Tim Peters. Nineteen lines. Here are eight.

Type it into any Python and read two or three lines aloud. The console on these slides will do — press backtick.

Beautiful is better than ugly.
Explicit is better than implicit.
Simple is better than complex.
Flat is better than nested.
Readability counts.
Errors should never pass silently.
Now is better than never.
If the implementation is hard to explain, it's a bad idea.

Python reads your code line by line while it runs. Python is...

- **A** — Compiled
- **B** — Interpreted
- **C** — Transpiled

07

Tools for the job

ENVIRONMENT · EDITOR · VERSION CONTROL

Three tools

01

A Python environment

Something that runs your code.

02

A way to edit code

Something that shows it to you properly.

03

A way to track changes

Something that remembers every version.

Environment and editor

INSTALL PYTHON

Many ways. Pick one.

`python.org/downloads`

`anaconda.com`

`github.com/pyenv/pyenv` · pyenv-win

or: `scoop` / `brew install python`

This year: uv. It fetches a Python for you.

TEXT EDITOR

VS Code. The easy choice.

`code.visualstudio.com`

The hacker's choice: vim · neovim

Git and GitHub

Git tracks every change on your computer. `git-scm.com`

GitHub keeps a copy online and lets others see it. `github.com`

- `github.com/settings/education/benefits` — add your PolyU email first
- `github.com/git-guides`

GitHub Education only accepts a PolyU address — polyu.edu.hk, connect.polyu.hk and the other school-issued domains.

Issue → fork → commit → pull request

01

Issue — say what is wrong

A bug, a feature idea, or “I want to help.” Explain how the code should behave.

02

Fork — your own copy

A fork is your version of the repo. It can pull in new changes from the original any time.

03

Commit — save a change

Each commit is a named snapshot. Push it and it is public.

04

Pull request — ask to merge

Propose your commits to the original repo. If accepted, they are merged in.

A PUBLIC REPO · THE COURSE LIVES ON GITHUB

github.com/sd5913/pfad

08

Assignments and tutorials

TWO REPOS, FOUR ROOMS

ASSIGNMENT 01 · 5% · DUE SUN 13 SEP, 23:59

Why are we here?

500–1000 words on why you are in this course.

- A **public GitHub repo**. Not a PDF.
- `README.md` is the essay
- `PROCESS.md` is how you used AI
- Submit the repo URL on Canvas — `canvas.polyu.edu.hk`

ASSIGNMENT 02 · 10% · WHAT TO EXPECT

Data visualisation — two high-level tasks

TASK 01

Obtain data about a natural phenomenon

TASK 02

Visualise the data you collected

Example: tides

01

Phenomenon

Tides in Hong Kong.

02

Data provider

`hko.gov.hk/en/tide/ttext.htm`

03

The problem

Find the pattern …inside a web page.

04

Weeks 2–3

Visualise. Art, or design?

“Find the pattern in a web page” — five steps

01

Get

Make an http request. `requests`

02

Save

Write the page to a file, so you ask the server only once.

03

Parse

Read the response as XML and find the pattern. `lxml`

04

Store

Keep the data you found in a clean shape.

05

Show

What data and metadata matter? How is it consumed? What must be validated?

Save the page

Check if the file exists. If not, request it and save it. If yes, just read it.

This is the first if/else you will write, and it is the reason your script does not hit the server every time you run it.

```
file exists?

  NO  → make the http request
        save the file

  YES → read the file

then: parse
```

ASSIGNMENT 02 · 10% · DUE SUN 27 SEP

Data visualisation

Code committed to a GitHub repo. Submit the URL on Canvas. It should obtain data about a natural phenomenon and visualise it.

Are you a precrastinator? Start here:

- 1 · Install Python
- 2 · Clone the repo
- 3 · Run the code
- 4 · Make it work for the website you need

Do you want to leave your current tutorial group and join the 15:30 laptop group instead?

A Yes — I will bring my own laptop

B No — I stay in my group

C I don't mind either

Use the tutorials to work on your assignments

V915 · PC

12:30–14:30

Gio

V915 · PC

14:30–16:30

Nicola

V915 · PC

16:30–18:30

Nicola

V1102 · YOUR LAPTOP

15:30–17:30

Gio — the laptop group

Leave today with…

- A GitHub account — 2FA on, PolyU email added
- [Laptop] git and VS Code installed; git name + email set
- Registered at `pfad.ait4x.org` — student ID matched
- [Laptop] A clone of the course repo + Python installed
- `github.com/sd5913/pfad` open, `week01/README.md` read
- **Your own public repo** — the sketch in it, run, two commits pushed

You can do every step inside VS Code. The terminal is optional today.

T

Tutorial

SIGN UP · REGISTER · RUN WEEK01 · MAKE YOUR OWN REPO

TUTORIAL · GITHUB

Your GitHub account is your portfolio

Every commit in this course shows up on your profile. Put it on your CV.

github.com/venetanji

```
# github.com/education/students

if not you.has_account:
    register("student email")
else:
    you.account.add_email(
        "student email")
```

[TASK] · DO IT NOW · ONE MINUTE

Sign up, then register

01 · GITHUB.COM

Sign up

Go to `github.com`. Use your student email.

Turn on **two-factor authentication** — you will need it.

02 · PFAD.AIT4X.ORG

Match your work

Go to `pfad.ait4x.org` and sign in with GitHub. Enter the last 4 digits and the letter of your PolyU student ID.

Public profile only · no password · no access to your repos

[TASK] · SET UP THE MACHINE

One file. Double-click it.

github.com/ait4x/v915-setup → download **setup.bat**, double-click.

- Installs git, VS Code and uv, then clones the course repo.
- Asks for your name and email — use the ones on your GitHub account.
- Windows will say "Windows protected your PC": **More info → Run anyway**.
- Safe to run again. Already have the folder? Double-click `setup.bat` inside it.

On a Mac: brew install git, then VS Code — week01/README.md has the lines.

Lab machine? Double-click signout.bat when you leave — or the next person pushes as you.

[TASK] · RUN WEEK01

VS Code + Copilot in agent mode

- **Step 1 · Open** — VS Code, sign in with GitHub, open Copilot chat. Choose **Agent**.
- **Step 2 · Clone** — if setup.bat did not: `Can you help me clone https://github.com/sd5913/pfad and open it?` Or from a terminal: `code pfad`
- **Step 3 · Run and commit** — open `week01/README.md`. Run the sketch. Commit from the Source Control panel.

Works best with Claude as the model.

OPTION · NO INSTALL

VS Code in Codespaces

A full VS Code in your browser, running on GitHub's computer. `github.com/codespaces`

- 1 · Create a codespace
- 2 · Assign it the repo `sd5913/pfad`
- 3 · Work as in VS Code

Stop the codespace when you are done — it uses your free hours.

[TASK] · YOUR REPO

Make your own repo

You cannot push to a public repo unless you are a collaborator — and being in the org is read access, not push. To commit code, create **your own new repo**.

Do it on `github.com` — Copilot cannot do this for you.

- **github.com** — New repository → public
- **VS Code** — copy the week01 sketch in, run it
- **Source Control** — two commits, pushed

See you next week

Want more challenges? Code Schotter, with your own number.

SD5913.GITHUB.IO/TEACHING

a·t4x