COMP110: Principles of Computing

4: LaTeX

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Converting types

Weak vs strong typing

- In **weakly typed** languages, a variable can hold a value of any type
  - Examples: Python, JavaScript
- In **strongly typed** languages, the type of a variable must be **declared**
  - Examples: C#, C++, Java

Weak typing (example in Python)

```
x = 7
# Now x has type int

x = "hello"
# Now x has type string
```

Strong typing (example in C#)

```
int x = 7;
// x is declared with type int

x = "hello";
// Compile error: cannot convert type "string" to "int"
```

Type casting

- It is often useful to **cast**, or **convert**, a value from one type to another
- In Python, this is done by calling the type as if it were a function
  - `float(17)` → `17.0`
  - `int(3.14)` → `3`
  - `str(3.14)` → `"3.14"`
  - `str(1 + 1 == 2)` → `"True"`
  - `int("123")` → `123`
  - `int("five")` gives an error

Operations on types

- Certain operations can only be done on certain types of values
- Can add two ints: `2 + 3` → `5`
- Can add int and float: `2 + 3.1` → `5.1`
- Can add two strings: `"COMP" + "110"` → `"COMP110"`
- Can't add string and int: `"COMP" + 110` → error

Implicit type conversion

- The type casts we saw a few slides ago are **explicit**
- Some languages (not Python) can perform **implicit** type casts to make operations work
- Sometimes called **type coercion**
- E.g. in JavaScript, `"COMP" + 110` → `"COMP110"`
- The integer `110` is implicitly converted to a string `"110"` to make the addition work
- Equivalent in Python with explicit casts:

```
"COMP" + str(110)
```

Dangers of implicit type conversion

- Rules for implicit type conversion can sometimes be confusing
- E.g. in JavaScript:
  - `"5" + 3` → `"53"`
  - `"5" - 3` → `2`

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Introducing LaTeX

What is LaTeX?

- A **typesetting** system
- A **markup language** (like HTML or Markdown)
- **Not** a WYSIWYG system

Why LaTeX?

- Plain text format
  - Can use any text editor
  - Can use version control (e.g. Git)
  - Can use online editors (e.g. Overleaf)
- Separates content from formatting
  - Similar to HTML and CSS
  - Unlike most WYSIWYG systems
- Produces professional-looking papers, reports, theses, books, slideshows, ...
- Excellent facilities for typesetting mathematical equations, pseudocode, source code listings etc.
- Automatically handles cross-referencing of sections, figures etc.
- Automatic tools for managing bibliographies (BibTeX)

Getting LaTeX

- LaTeX is **free open source software**
- Consists of:
  - Several **executables** (pdflatex, bibtex, makeindex, ...)
  - A large library of **packages**
  - An **integrated development environment (IDE)** (optional)
- Distributions available for all major OSes
  - Windows: MikTeX
  - MacOS: MacTeX
  - Linux: TeXLive
- Online services e.g. Overleaf (should also work on iPad / Android)

Workshop Activity

- Go to `https://www.overleaf.com` and sign up for a free account
- Go to `https://www.latex-tutorial.com/tutorials/` and work through the tutorials
- Please prioritise the following tutorials (look at the others afterwards if you have time):
  - 01 Your first document
  - 02 Document structure (sections and paragraphs)
  - 03 Packages
  - 05 Adding pictures
  - 07 Bibliography
  - 13 Source code highlighting
  - 16 Hyperlinks
  - 17 Lists