ENGG1811: Computing For Engineers

2025 Term 2

Style, Debugging & Libraries

Week 2: Monday 9th June, 2025

Monday 13:00 - 15:00 | TETB LG34

Today

- Reminders
- Style Outline
- Conventions Around Variable Names
- Commenting
- Formatting
- Doc-Strings
- Debugging
- Math Library
- Lab Tips

Reminders

Marking

- Marking starts this lab!
- If you weren't able to get your work marked off in a lab, you can:
  - Get your work marked off during the following week's lab if time permits
  - If you can't attend a lab, contact me. You can attend another lab in the same week to get marked off if you are available
  - In these cases we will mark you as a lower priority to students needing the current week's lab marked unless it is your first instance
- If you have completed the lab work before the start of class, you still have to wait until after I go through the slides before you get marked
- Do not forget to do the MCQ before the end of class!

Remember to reach out if you need help!

- Is everyone getting emails for this lab?
- If you have any questions you would like to ask about labs, assignments, or content, you can ask in the labs or email me at b.mabbutt@student.unsw.edu.au.
- If you have more general issues with this course such as for the self-directed labs or setup, contact the course account at en1811@cse.unsw.edu.au.
- If there arises a situation out of your control affecting your performance in this course, consider applying for special consideration through UNSW. Feel free to loop us in about this.
- You can also get help in PASS, Help sessions, or the Live Coding Sessions. Times and details are on the course website. Help sessions will begin in Week 4.

Style Outline

Demo: More than just a calculator

- Last week we treated Spyder as a big, clumsy calculator
- Hopefully everyone has kept up to date with the lectures, and knows how to now utilise the panel on the LHS of Spyder to create *scrips*
  - Allows us to save results
  - Reuse calculations
  - Print results

Goal For Today

Goal

Today, our lab will focus on style — making sure our code looks presentable and follows agreed upon conventions.

- **To get marked off today:**
  - You must create one of your programs — either the revolutions script or the projectile motion script — with near *perfect* style
  - This is only meant for today's lab, all labs after this we will not explicitly be marking for style—the assignments will though. I will be marking the style components of all your assignments!

Why should we care about style?

- We want to make our work presentable so that others can easily read and interpret our work with minimal effort
- This means that certain *conventions* have developed over the decades that are accepted by most programmers
  - This is not a hard and fast rule — rarely will your programs halt because you fail to adhere to them

The Four Main Elements of Style

1. **Conventions regarding variable names**
   - Distinguishing between *variables* and *constants*
   - Providing names which are *descriptive*
2. **Commenting**
   - When to make a comment
   - Exactly why we are making comments in the first place
3. **Formatting**
   - Making sure code looks *aesthetically* clean
4. **Doc-string**
   - This is the most annoying part
   - Most of your effort will be spent here

You must adhere to the above four for perfect style. We will go through more on style as it shows up in the content throughout the course.

The Ultimate Source of Truth and Information

- The style guide, found on the course website, contains everything you need to know regarding style.
- The rest of these slides contains some further justification and explanations of some of these points, but the main source is the style guide.
- The style guide will be the marking criteria for style for both assignments!

Conventions Around Variable Names

Classifying Data

- Values we assign names to, essentially, fall into two categories:
  - **Variables:** These are values that, within the context of the program, can be *possibly* changed — you do not need to alter any other detail of your program if you change this variable
  - **Constants:** These are values that, within the context of the program, never makes sense for us to change — there is never a circumstance where these values could be different without fundamentally altering the program or reality

Examples of Variables & Constants

Questions:

1. If my program calculates the area of a circle, is the radius of the circle a variable or a constant?
2. If my program wants to calculate the number of times a disk completes a revolution, would the number of degrees in *one* revolution be a variable or a constant?
3. If my program is to calculate the profit of a business, would the gross income be a variable or a constant?
4. If my program is to calculate the time dilation of a particle in a vacuum, would the speed of light be a variable or a constant?
5. Say I was writing a financial program. Is the price of houses in Sydney a variable or a constant?

Convention for the Names of Variables

- For *variables*, our names must be written in all lower case and separated by underscores:
  - `profit = -200`
  - `projectile_speed = 3.6`
  - `time_in_seconds = 0.003`
- For *constants*, our names must be written in all upper case and separated by underscores:
  - `GRAVITY = 9.8`
  - `LIGHT_SPEED = 3 * 10 ** 8`
  - `ANGLES_IN_FULL_CIRCLE = 360`

Descriptive Names

- **Question:** Writing `GRAVITY = 9.8` every time can prove really tiresome. Am I allowed to cut some corners and simply say `G = 9.8`? Why or why not?

Descriptive Names (Cont)

Descriptive Names

We will **always** write the slightly longer and descriptive name, where reasonable.

- This does not mean we place zero value on being concise. Compare the following:
  - `GRAVITY = 9.8` (Preferred if the meaning is clear)
  - `ACCELERATION_DUE_TO_GRAVITY_NEAR_SURFACE = 9.8` (never do this)
- **Question:** What if its important to know that this value of gravity is only valid near the surface of the Earth? How do we inform the reader of certain details without making every name verbose?

Commenting

Comments

- The better solution to providing clarification and description to code is **comments**.
- These are placed *above* the code we want to clarify and further explain when it is not *immediately* obvious otherwise
- Examples:
  - ```
    # measured at the surface of the Earth
    GRAVITY = 9.8
    ```
  - ```
    # standard application of formula for speed
    distance_travelled = speed * total_time
    ```
  - ```
    MERIDIEM = 12
    # converts 24-hr time to 12-hr time but
    # discards the AM-PM distinction
    regular_time = military_time % MERIDIEM
    ```
    ```

Pointers on Comments

- Does not need to be used for every single line of code!
- Can be short and straight to the point
- The goal is to give important information that might be lost on the reader: if you do something creatively, assume something, ignore a case, etc.
- As a general rule of thumb, it is better to write *more* comments than *less*
- Ideally, comments should be placed only above complicated lines or blocks of code.

Formatting

Maximum Line Length

- In Spyder, everyone should be able to see a grey vertical line running down your screen
  - This indicates to you when you have used up 79 characters on any particular line
  - We have all come to accept that this limit works best for most monitor sizes
- What if we go past this point?
  - If it's a little bit over (≈ 5 characters) then this is fine
  - If it's significantly over, then use the `\`, the break symbol, to inform Python that the current lines continues to the next — does not apply to comments!
- Example:

```
income = profit_from_business_one \
         + profit_from_business_two
```

Spacing

There are some small details which make our code easier to read

- Adding space near operators:
  - `2 + 3` rather than `2+3`
  - `(2 % 3) // 4` rather than `(2%3)//4`
- Space near equality or commas:
  - `meaning = 42` as opposed to `meaning=42`
  - `print("Hello", "World!")`

Spacing (Cont)

- Space between different 'sections' of code:
  - ```
    # Do this
    length = 3
    height = 4

    area = length * height
    print(area)
    ```
  - ```
    # Don't do this
    length = 3
    height = 4
    area = length * height
    print(area)
    ```

Spacing (Cont II)

- Don't be excessive with line spacing or horizontal spacing.
  - ```
    # Don't do this either

    length   =   3

    height   =   4

    area = length   *   height

    print(area)
    ```
    ```

Doc-Strings

Why Bother With Documentation?

- At a certain point, your programs can get
  really long and convoluted
  - What if someone just wants to analyse a certain portion of your script, or wants to just get the general gist?
- We answer these problems by creating a **doc-string**

Doc-String Structure

1. **Purpose**
   - A short 1-2 line overview of what this program ultimately does
2. **Author**
   - This is your name, and any person you wish to credit
3. **Date**
   - This should be the date it was last revised
4. **Data Dictionary**
   - This is a list of **all** important variables *and* constants
5. **Method**
   - This is the bulk of your doc-string — you will be explaining how your program reaches its purpose and exactly what choices you made along the way.

Doc-String Pointers

- Everyone always gets the purpose, author and date correct, but most people trip up with the data dictionary and method
- Data-dictionary Structure:
  - Must give the name of every* variable/constant
  - Must include the data-type of each variable/constant
  - Must include a short description of each variable/constant
- Method Structure:
  - Must be written in full sentences
  - Must be written in such a way so that if you only had the method and the rest of the doc-string to work with, you could recreate your entire program with all necessary details

Data Types

- We begin with three main data types and will explore more as we progress through the course.
  - Integers (`int`): Integers in the mathematical sense.
    - `5`
    - `0`
    - `-4`
  - Floats (`float`): Floating-point numbers (decimals).
    - `2.99792458`
    - `0.0`
    - `9.999999`
  - Strings (`str`): Text of characters.
    - `"Hello"`
    - `"1.2"`
    - `"P@3sw0R|)"`

Data-Dictionary Example

- Consider the following program:

```
# speed of a tenis ball
distance = 1000.4
time = 3

speed = distance / time
```

- **Questions:**
  - What is the data-type of distance, time and speed?
  - What could be a description for distance, time and speed?

Complete Doc-String Example

At the *top* of your program:

```
"""
Purpose: To calculate the average speed of a tennis ball
         during its flight.

Author:  Brendan Mabbutt
Date:    18/10/24
Method:  Define the distance and time variables.
         Then calculate the speed by taking the quoteint of
         distance over time and assign it to speed.

Data dictionary:
 [float] distance    The distance in meters the tennis ball
                     has traveled during its time of flight
 [int] time          The tennis ball's time of flight
                     in seconds
 [float] speed       The average speed of the tennis ball
                     while airborne in meters per second
"""
```

Debugging

Common Errors

It is best to tackle each code error as they naturally occur. You will get better at this as the term progresses, so we will not drown you with techniques that you will likely forget to use. In general, however, there are some common errors that you should be on the look out for:

- Utilising a variable before assigning
- Incorrect usage of the assignment operator (‘=’)

```
# wrong
x + 1 = x
30 = speed
```

- Leaving out parentheses
- Forgetting that variables are case-sensitive

Math Library

Why do we need to import?

- Base Python is quite skeletal
  - It does not come equipped with many things we might deem useful such as certain math operations, or the ability to create graphs or tables
  - **Question:** Why do we think that is? Shouldn't Python just include these for us from the get-go?

Importing Math

- We give Python additional functionality by importing a module/library with certain functions — all we need to know is the name of said module/library
- Example:

```
import math
print(math.sin(30) ** 2 + math.cos(30) ** 2)
```

  - Note that we must inform Python to look inside Math, otherwise it will search for $\sin$ inside its base. For example:

```
import math
print(sin(30) ** 2 + cos(30) ** 2)
```

    will NOT work!
  - You can shorten the import name to make life easier:

```
import math as m
print(m.sin(30) ** 2 + m.cos(30) ** 2)
```

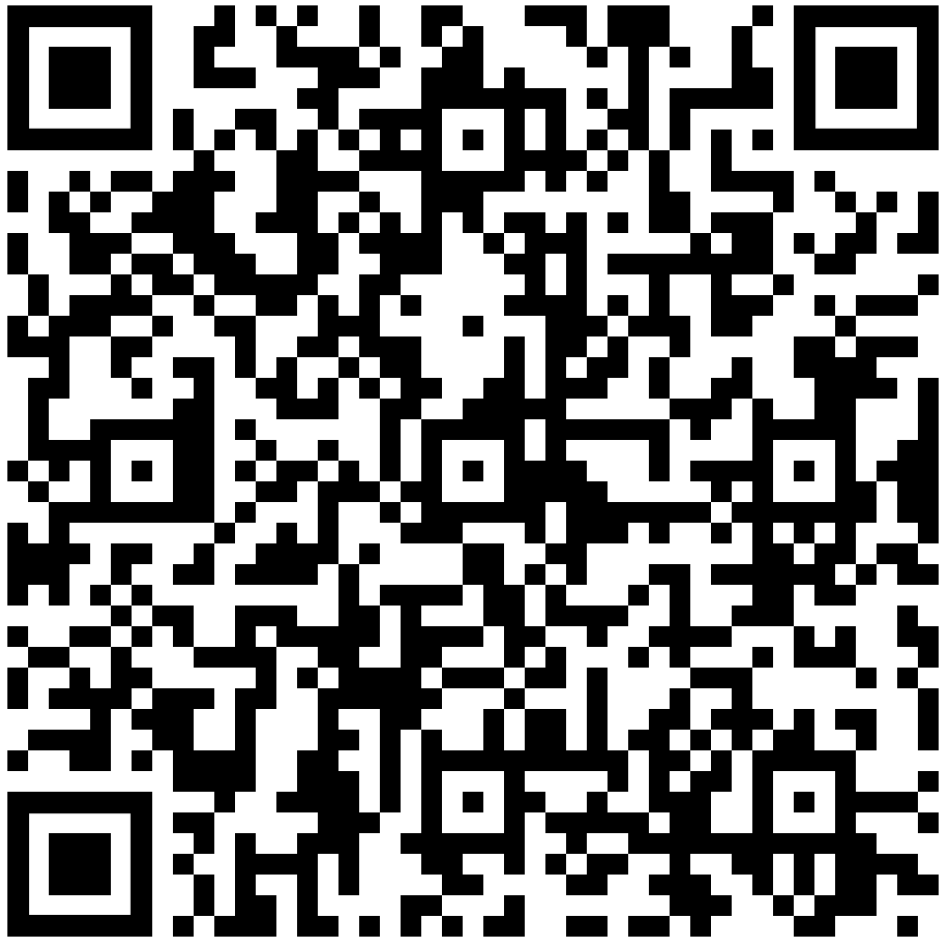
Lab Tips

Lab Tips

- Exericse 1:
  - The error is the same as one of the examples we went through
- Exercise 2:
  - Make sure you remember the convention for defining `constants and variables`
  - Part of this exercise is very similar to last week's Exercise 2
- Exercise 3:
  - Read the equations carefully
  - You need to use `*` for every instance of multiplication

Feedback

Feel free to provide anonymous feedback about the lab!



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