

Introductory Programming Using Python

Day 1

Republic Polytechnic

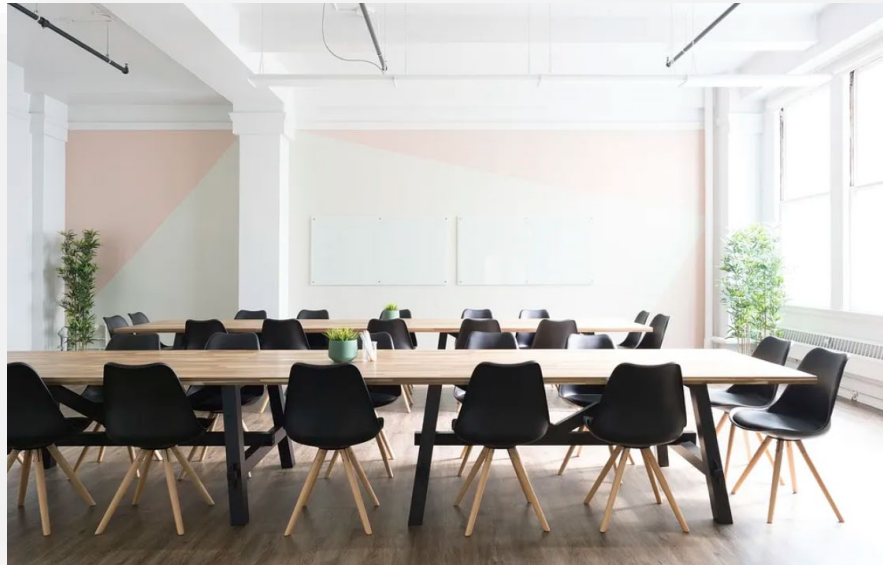


Trainers



Welcome and admin matters

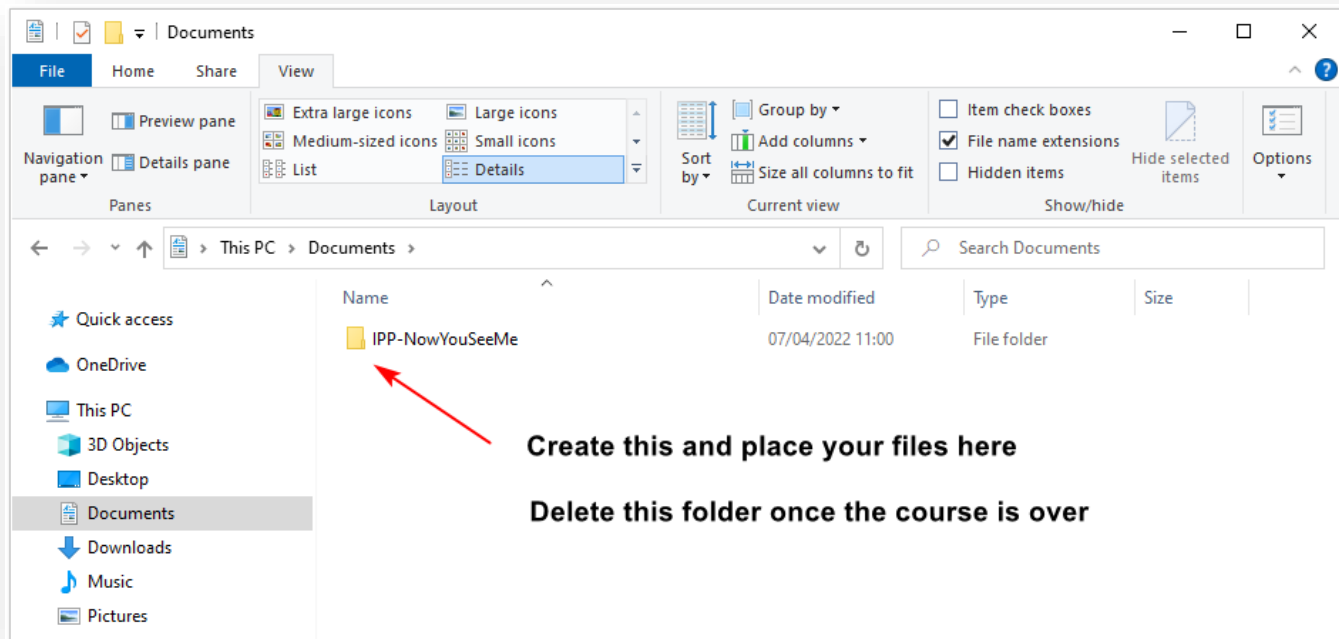
- Please ensure that:
 - your attendance has been captured
 - you have a learning laptop with you
 - you have a good view on the display





Welcome and admin matters

- A tidy/clean laptop is a good laptop for learning
- Created files on the laptop will linger on. To prevent this:
 - Create a folder in the "Documents" location for this workshop
 - E.g. "IPP-Alan" or "IPP-PeterPan"
 - All user created files to be placed in this folder
 - Delete that folder after the course





Outline for the day

Time	Agenda
9.00am	Welcome and admin matters
9.15am – 10.30am	
10.30am – 10.45am	Break
10.45am – 12.30pm	
12.30pm – 1.30pm	Lunch
1.30pm – 3.15pm	
3.15pm – 3.30pm	Break
3.30pm – 4.45pm	
4.45pm – 5.00pm	Wrap up, Q&A



About This Workshop

- Learn about Python 3, a very versatile and useful language
- Discuss its advantages and disadvantages (also what to look out for)
- Improve your problem-solving skills:
How to automate the most boring and repetitive stuff using Python
- Have an awareness of available tools and useful modules you can use to build your applications
- It is **NOT** about mastering python programming within 2 days



Pre-reqs and Preparations

For self learning outside of this workshop, please make sure:

- You have a working laptop with Internet access
- You have installed the latest version of Python 3
- You have installed a suitable editor:

Wing IDE Personal Edition, or other similar tools

- You have Chrome/Edge web browser



Programme Day One

Morning	Afternoon
<ul style="list-style-type: none">• Welcome Message• Variables, Values• Basic Data Types• Data Types Conversion• Display/Outputs• Writing Comments• User Inputs• Decision-Making: if/elif/else	<ul style="list-style-type: none">• For loops• Functions• Try/except• String functions• String formatting• Writing a complete program



Programme Day Two

Morning	Afternoon
<ul style="list-style-type: none">• Read and writing files• Copying, moving and deleting files and folders• Working with Excel• Image Processing	<ul style="list-style-type: none">• Connecting to the Web• Sending emails• Creating Chart• Generating PDF



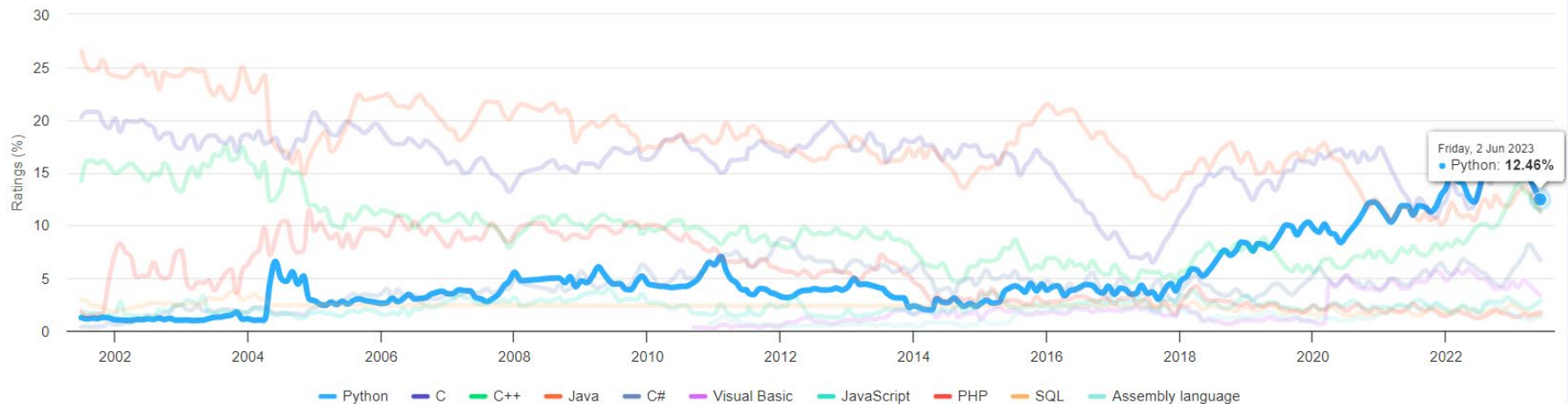
Introduction

• What is Python?

- Interpreted
- Interactive
- Functional
- Object-oriented
- Programming language, not just a scripting language

TIOBE Programming Community Index

Source: www.tiobe.com





Introduction to Python

- Allows modular programming
- Great emphasis on readability:
 - Code are forced to be **indented**
- Easy to embed in and extend with other languages
- Easy to learn for beginners
- Completely FREE!
- Copyrighted but use is not restricted

```
>>> print ("hello world")
hello world
```

Vs

```
HelloWorld.cpp* -p X
HelloWorld (Global Scope) main()
1 #include <iostream>
2
3 int main()
4 {
5     std::cout << "Hello, world!" << std::endl;
6     return 0;
7 }
```



Who uses Python?

Ref: <http://wiki.python.org/moin/OrganizationsUsingPython>

Web Development

- Google (in search spiders)
- Yahoo (in maps application)

Games

- Civilization 4 (game logic & AI)
- Battlefield 2 (score keeping and team balancing)

Graphics

- Industrial Light & Magic (rendering)
- Blender 3D (extension language)

Financial

- ABN AMRO Bank (communicate trade information between systems)

Science

- National Weather Center, US (make maps, create forecasts, etc.)
- NASA (Integrated Planning System)

Education

- University of California, Irvine
- University of New South Wales (Australia)
- Republic Polytechnic, Singapore
- National University of Singapore (NUS)
- Singapore University of Technology and Design (SUTD)
- Singapore Management University (SMU)



Why the name, Python?

- Originally not a snake, but from the British comedy "Monty Python's Flying Circus". The snake logo came later.
- Invented in 1990 by Guido Van Rossum
- First public release was in 1991





Python Versions

- Use Python 3.x if you are learning or starting a new project



Python has two major versions

- Python 2 – 2.7.18 (End of Life – 01 Jan 2020)
- Python 3 – 3.11.4 (Jun 2023)

<https://www.python.org/downloads/>



Python 2 vs. Python 3

- **2 distinct versions - Python 2 and Python 3**
 - **Not compatible**
- **Different syntax: e.g. print statement, division**
 - Python 2
 - `print "Hello World!"`
 - `x = 5 / 2` # x's value will be 2
 - Python 3
 - `print("Hello World!")` # brackets are compulsory now
 - `x = 5 / 2` # x's value will be 2.5
- **Which to learn?**
 - Many major frameworks and third-party modules have already migrated or are in the process of moving to Python 3
 - Python 2's EOL is in 2020, no Python 2.8
 - The obvious pick: Python 3



Why Python

- Focus on problem solving, and not on programming syntax

```
width = input("Enter Width: ")
height = input("Enter Height: ")

area = float(width) * float(height)
print("Area: " + str(area))
```

Python

```
import java.util.Scanner;

public class AreaApp {

    public static void main(String[] args) {

        Scanner scanner = new Scanner(System.in);

        System.out.println("Enter Width: ");
        double width = scanner.nextDouble();

        System.out.println("Enter Height: ");
        double height = scanner.nextDouble();

        double area = width * height;

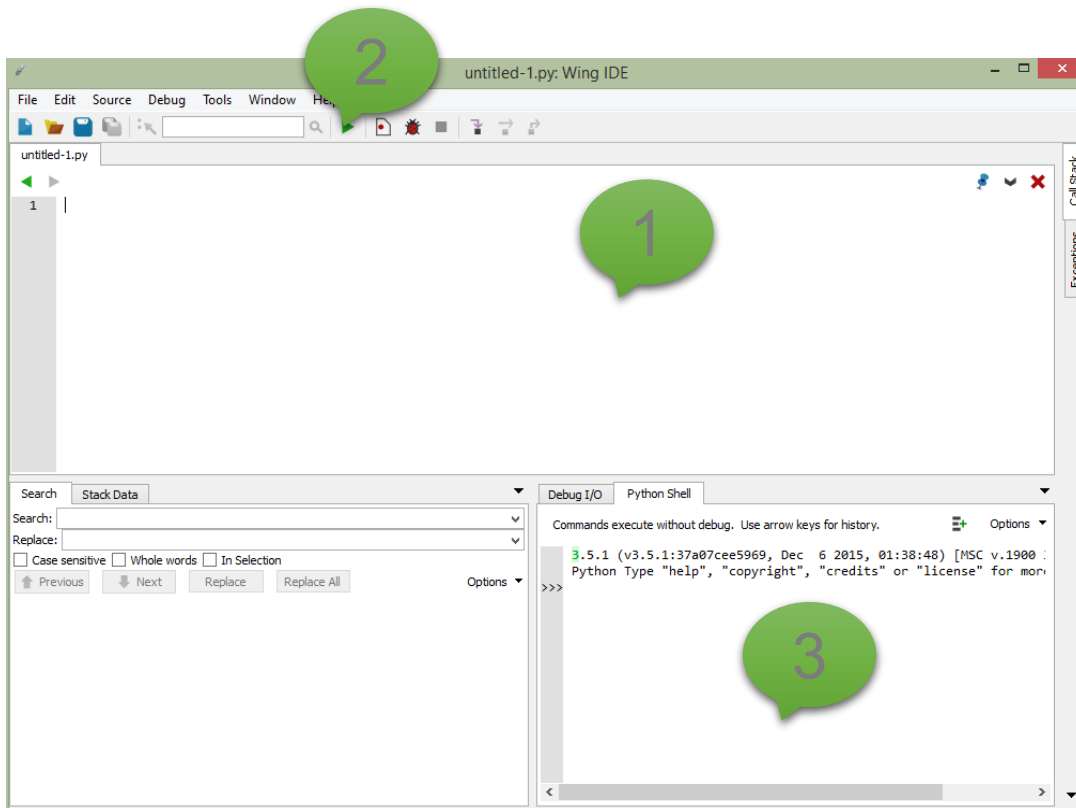
        System.out.println("Area: " + area);

    }
}
```

Java



Run Wing IDE



1. Editor
2. Run button
3. Output window / Console



Setting up Wing IDE

The screenshot displays the Wing IDE interface. A green circle with the number '1' points to the 'File' menu. A green circle with the number '2' points to the 'Project' menu. A green circle with the number '3' points to the 'Edit' menu. The 'Edit' menu is open, showing options like 'Undo', 'Redo', 'Cut', 'Copy', 'Paste', 'Clear', 'Copy Filenames', 'Select', 'Selection Mode', 'Multiple Selections', 'Search and Replace', 'Mini-search', 'Goto Line...', 'Show Line Numbers' (highlighted with a red box), 'Zoom', 'Start Macro Record', 'Execute Macro', 'Reload All Scripts', 'Command by Name', 'Keyboard Personality', 'Plugins...', and 'Preferences...'. The main editor window shows a Python script named 'bmi.py' with the following code:

```
1 weight = input("Enter your weight (kg):")
2 height = input("Enter your height (m):")
3
4 weight = float(weight)
5 height = float(height)
6
7 bmi = weight/(height * height)
8
9 print("bmi: " + str(bmi))
10
11 if bmi < 18:
```

The 'Python Shell' window at the bottom shows the command prompt with the text: 'Python 3.8.4 (tags/v3.8.4:dfa645a, Jul 13 2020, 16:30:28) [MSI] Type "help", "copyright", "credits" or "license" for more info'.

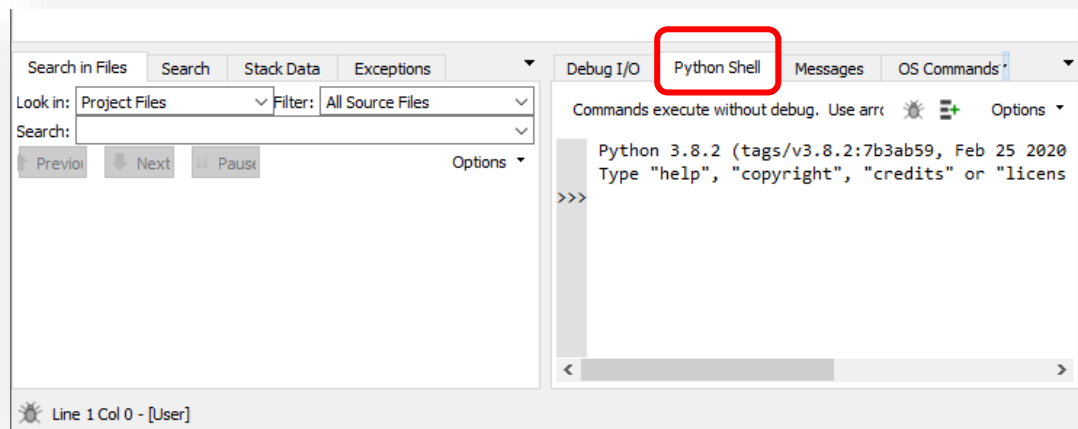
1. Load the project file workspace.wpr
2. Contains possible solutions for exercises
3. Select "Show Line Numbers" if required



Using the Console

- Also known as the **interpreter**
- See the output straightaway
- Usually used to test very small chunks of code
- Type code after >>>
- To clear the shell, right click in the shell and choose Clear

Let's try!





Interactive Python

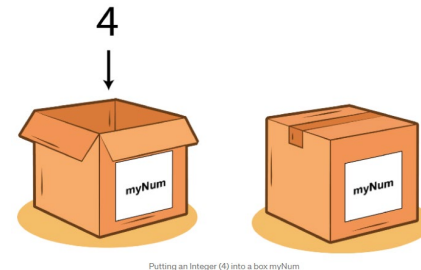
- Perform some simple Mathematics with Python
- Run the following pieces of code in Python interpreter to see how effortlessly Python does it

```
C:\Program Files (x86)\Wing IDE Personal 6.1\bin\dbg\src\debug\tserv
3.8.4 (tags/v3.8.4:dfa645a, Jul 13 2020, 16:30:28) [MSC v.1926 32 bi
Python Type "help", "copyright", "credits" or "license" for more inf
>>> 100 + 10
110
>>> 100 - 10
90
>>> 100 * 10
1000
>>> 100 / 10
10.0
>>> |
```



What are Variables?

- Variables are the **storage references** for data
- Some **rules** for naming the variables
 - Case sensitive
 - Cannot start with a number
 - One word
 - Can start with a “_” (underscore)
 - Valid variable names: x, y, abc123, _name
 - Invalid variable names: 1234abc
- To declare a variable to store a piece of data, simply assign a **value** to a name of your choice using the equal (=) sign
 - E.g. `x = 100`



Putting an Integer (4) into a box myNum



Display Variables

- We can use variables after declaring them in our codes
- To display (print) the contents of a variable, use the function **print()**

```
3.6.2 (v3.6.2:5fd33b5, Jul  8 2017, 04:57:36) [MSC v.1900 64 bit (AMD64)]
Python Type "help", "copyright", "credits" or "license" for more information.
>>> x = 100
>>> y = 10
>>> z = x + y
>>> print(z)
110
```



Data Types

- **Numbers**

- **int** for whole numbers, e.g. 12, 4, -51
- **float** for numbers with decimal point, e.g. 5.2, -2.0

- **Text**

- **str** for a sequence of characters enclosed with either single quote (') or double quotes ("), e.g. "How are you?"

- **Boolean**

- **bool** **True** or **False** only (without the single/double quotes)

- **Containers**

- **list** an ordered collection of objects, mutable access using index
- **tuple** an ordered collection of objects, immutable access using index
- **dictionary** an unordered collection of objects, access using keys



Basic Data Types

- Examples

int

```
>>> a = 5
>>> b = 2
>>> a + b
7
>>> type(7)
<class 'int'>
>>> a -= 1
>>> a
4
```

float

```
>>> c = 3.0
>>> type(c)
<class 'float'>
>>> 3/2
1.5
>>> 3//2
1
```

str

```
>>> s = "hello"
>>> type(s)
<class 'str'>
>>> s + " world"
'hello world'
>>> len(s)
5
>>> s[0]
'h'
```




Variable and Data Type

- Identify components in a statement

Example	Variable Name	Data Type	Value
my_name = "alan"	my_name	str	"alan"
age = 25	age	int	25
height = 1.75	height	float	1.75
over_age = True	over_age	bool	True



Conversion between Data type

- Three important functions: **int(x)**, **float(x)** and **str(x)**

Example	int(x)	float(x)	str(x)
x = 1	1	1.0	"1"
x = "alan"	error	error	"alan"
x = 1.5	1	1.5	"1.5"



Mathematics of Programming

- Also known as **operators**
- You can add, subtract, multiply and divide numbers with numbers
 - e.g. $2+3$, $2-6$, $2*3.0$, $3/2$

- Special uses of **+** and *****

- Add **string** to **string**
- Multiply **string** with **int**

"hello" + "world"

→ "helloworld"

"x" * 5

→ "xxxxx"

- Add **string** to **numbers**?

"5" + 5

→ Error



Commonly Made Mistake

- It is very common to miss the need to **convert a value to string** during display (print)

Example:

```
age = 25  
print("Age is " + age)
```

String number

Correct approach

```
age = 25  
print("Age is " + str(age))
```

String String



Basic Arithmetic Operators

Operator name	Code	Example (x = 2, y = 1)
Plus	x + y	x + y will give 3
Minus	x - y	x - y will give 1
Divide	x / y	x / y will give 2.0
Multiply	x * y	x * y will give 2 Use * instead of x for multiplication.
x to power of y	x ** y	x ** y means 2 to power of 1 and the result is 2
Modulus	x % y	x % y will give 0 0 is the remainder from 2 divides by 1
Integer division	x // y	x // y will give us the quotient when x divides y e.g. 7 // 3 the quotient is 2



Exercises

Example	Variable Name	Data Type	Value
weight = 65.5	weight	float	65.5
gpa = 3			
gender = "Female"			
enabled = False			
height = 180 + 5.0	height	float	185.0
w = float(4) + 3			
x = 7/2			
y = int(4.5) + 5.0			
z = str("1") * 4			



Comments in Computer Programs

- In computer programming, a comment is a programming language construct used to embed programmer-readable annotations in the source code of a computer program
- **Purpose:**
 - Make the source code easier to understand
 - Document Programmer's intent
 - Explain logic, methods or algorithms
- Ignored by compilers and interpreters
- Syntax: depends on programming language



Python Comments Syntax

- **Inline comment**

- Symbols or words after the hex symbol # will not be interpreted

- **Block comment**

- 3 single quotes sequence ''' marks the start/end of a comment block with multiple lines.

```
'''
```

```
An example of block comments  
The following codes display the  
numbers 0 to 9.
```

```
'''
```

```
numbers = range(10) #An example of inline comments  
for i in numbers: #Using a for loop  
    print(i)
```




Exercise – Homework Calculator

- Mick took 3.5 hours to finish his homework. Alice took 2.5 hours to finish her homework. Write a program to calculate the total amount of time in seconds that they took to finish their homework



5 mins



Exercise – Time Conversion

- Write a program (in 1 script file) to convert 1000 seconds to minutes and seconds.

Debug I/O (stdin, stdout, stderr) appears below

Minutes: 16

Remaining Seconds: 40

Time in mins and secs: 16min and 40sec|



10 mins



Lists

- In many other programming languages, arrays are used to store a collection of similar variables. Lists are Python's alternative for arrays
- What's unique about Python's lists:
 - Can have multiple data types in the same list
 - Lists are dynamic – can grow and shrink on demand
 - Lists are mutable, i.e. they can be modified after they are created

```
>>> mixed_list = [5, 1.5, "hello"]
>>> mixed_list.append(20)
>>> mixed_list
[5, 1.5, 'hello', 20]
```



Lists

- For example, colours of the rainbow can be grouped under a list data structure.
 - `rainbowColours = ["red", "orange", "yellow", "green", "blue", "indigo", "violet"]`
- To refer to the individual pieces of data, we can then use
 - `print (rainbowColours[1])`
- This prints orange, not red! Take note that the index starts from 0.



Accessing List Elements

```
>>> mylist2 = ["hello", 3.0, 5]
>>> mylist2[0]
'hello'
>>> mylist2[-1]
5
```

- Index starts with **0** and ends with **length-1**
- Negative indices, starting with -1 are used to refer to elements starting from the last. (-2 for 2nd last, etc.)
- To find out how many elements are there in a list:

```
>>> mylist3 = ["hello", 3.0, 5, [10, 20]]
>>> len(mylist3)
4
```



List Method Calls

Method	Meaning
<code><list>.append(x)</code>	Add element x to end of list
<code><list>.sort()</code>	Sort the list. A comparison function can be passed as parameter
<code><list>.reverse()</code>	Reverses the list
<code><list>.index(x)</code>	Returns index of first occurrence of x
<code><list>.insert(i, x)</code>	Insert x into list at index i. (same as <code>list[i:i] = [x]</code>)
<code><list>.count(x)</code>	Returns the number of occurrences of x in list
<code><list>.remove(x)</code>	Deletes the first occurrence of x in list
<code><list>.pop(i)</code>	Deletes the i^{th} element of the list and returns its value
<code>x in <list></code>	Checks to see if x is in the list (returns a Boolean)



Exercise – List Operation

- Write the code to
 - Create a list with 3 numbers: 1, 5, 15
 - Add the number 20 to the end of the list
 - Remove the number 5 from the list



5 mins



Getting User Input

- You can use input() function to ask for user input.
- The value entered by the user is stored into a variable as a string.
- If the value is to be used as a number, you can use the int() or float() function to convert the value to the appropriate number data type.

```
>>> word = input("Enter a word: ")
Enter a word: hello
>>> print(word)
hello
>>> type(word)
<class 'str'>
>>>
```

```
>>> num = input("Enter a Whole number : ")
Enter a Whole number : 8
>>> print(num)
8
>>> type(num)
<class 'str'>
>>> num = int(num)
>>> print(num)
8
>>> type(num)
<class 'int'>
>>> |
```




Exercise – Temperature Calculator

The normal human body temperature is 36.9 Degree Celsius. Write a program to ask the user for name and temperature and print a message on the screen that indicate the temperature difference from the normal body temperature.

```
Enter patient's name:-John
```

```
Enter patient's temperature:-37.5
```

```
John's temperature is 0.6 degree celsius from 36.9 degree celsius.
```



10 mins



Why 0.30000000000000000000000000000004?

- $0.1 + 0.2 \neq 0.3$ (surprised?)
- Why? Due to how decimal numbers are stored in computers
 - Floating-point numbers are represented in computer hardware as base 2 (binary) fractions.
 - <https://docs.python.org/3/tutorial/floatingpoint.html>
 - Conversion between base-2 fraction and floating point numbers
 - <https://ryanstutorials.net/binary-tutorial/binary-floating-point.php>
- <https://0.30000000000000000000000000000004.com/>



Decision Making

- An **if-else** statement is used in Python to alter the flow of execution of the code.

"if" syntax:

```
if cond : inst  
[ elif cond : inst ]  
[ else: inst ]
```

```
marks = 30  
if marks < 50:  
    print("Fail")  
else:  
    print("Pass")
```



Which code to run?

```
marks = 30
if marks < 50:
    print("Fail")
else:
    print("Pass")
```

- Code between "if" and the colon (:), which is `marks < 50` , equates to a `True` or `False` value
- If it is of a value `True`, then the first code, `print("Fail")` will run
- If it is of a value `False`, then **else** portion of the code, `print("Pass")` will execute
- `True` and `False` are constants in Python (`bool`)



Comparison Operators

Expression	What it does
<code>a == b</code>	Evaluates to True when a is equal to b
<code>a != b</code>	Evaluates to True when a is not equal to b
<code>a < b</code>	Evaluates to True when a is lesser than b
<code>a > b</code>	Evaluates to True when a is bigger than b
<code>a <= b</code>	Evaluates to True when a is lesser than or equal to b
<code>a >= b</code>	Evaluates to True when a is greater than or equal to b

```
>>> x = 10
>>> y = 20
>>> print (x == y)
False
>>> print (x != y)
True
>>> print (x < y)
True
>>> print(x <= y)
True
```



Nested Decision-Making

- A nested if-else statement.
- **"elif"** is a short form for "else if"

```
marks = 30
if marks < 50:
    print("Fail")
elif marks < 80:
    print("Pass")
else:
    print("Excellent!")
```



Example of using if/elif/else

- Ask user for the T-shirt size and display the result

```
size = input("Enter your T-shirt Size (s/m/l):")

if size == "s":
    print("You have chosen small size")
elif size == "m":
    print("You have chosen medium size")
else:
    print("You have chosen large size")
```

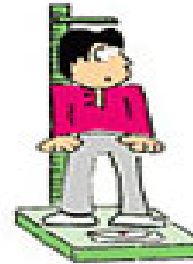
Notice the implicit assumption made that a user enters only "s", "m", or "l". What if the user enters "xl"?



Exercise - BMI Calculator

Develop a BMI Calculator to calculate the BMI of a patient given the weight and height.

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)} \times \text{Height (m)}}$$



Category	Underweight	Ideal	Overweight	Obese
$\text{BMI} = \frac{\text{weight(kg)}}{\text{height(m)}^2}$	< 18	≥ 18 , but < 25	≥ 25 , but < 30	≥ 30



15 mins

Lunch Break



Range

```
>>> print(list(range(10)))
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
>>>
>>> print(list(range(1,10)))
[1, 2, 3, 4, 5, 6, 7, 8, 9]
>>>
>>> print(list(range(1,10,2)))
[1, 3, 5, 7, 9]
>>>
>>> print(list(range(10,1,-1)))
[10, 9, 8, 7, 6, 5, 4, 3, 2]
>>> |
```

Three versions:

- `range(y)`
starts at 0
ends before `y`
step up by 1
- `range(x, y)`
starts at `x`
ends before `y`
step up by 1
- `range(x, y, s)`
starts at `x`
ends before `y`
step up by `s`

Note: if `s` is negative, then step down by its absolute value



For Loops

```
>>> numbers = range(10)
>>> for i in numbers:
...     print(i)
...
0
1
2
3
4
5
6
7
8
9
>>> |
```

- For loops often go hand-in-hand with lists
- Every object in the list will be processed by what is inside the for loop
- What is the data type of `i`?

Notice how each call of print at each loop will print at a different line.

How do we print numbers 0 to 9 all on the same line (0123456789)?



For Loops

```
>>> s = "freedom"
>>> for c in s:
...     print(c,end=" ")
...
f r e e d o m
>>> |
```

- A string is a sequence, like a list
- The for loop works similarly with strings



Exercise – Even Odd Counter

Write and test a program that will read 10 positive integer numbers, determine if it is even or odd, keep count of the number of even and odd numbers and display the final outcome as follows:

Enter number 1: 12

Enter number 2: 7

...

Enter number 10 : 67

Even #: 4

Odd #: 6

- Q: What if a user does not enter a positive integer?



Introduction to Function

- Functions are little self-contained programs that perform a specific task.
- You have to define a new function before you can use it.

Define a function



```
def cal_area(width, height):  
    return width * height
```

Use a function

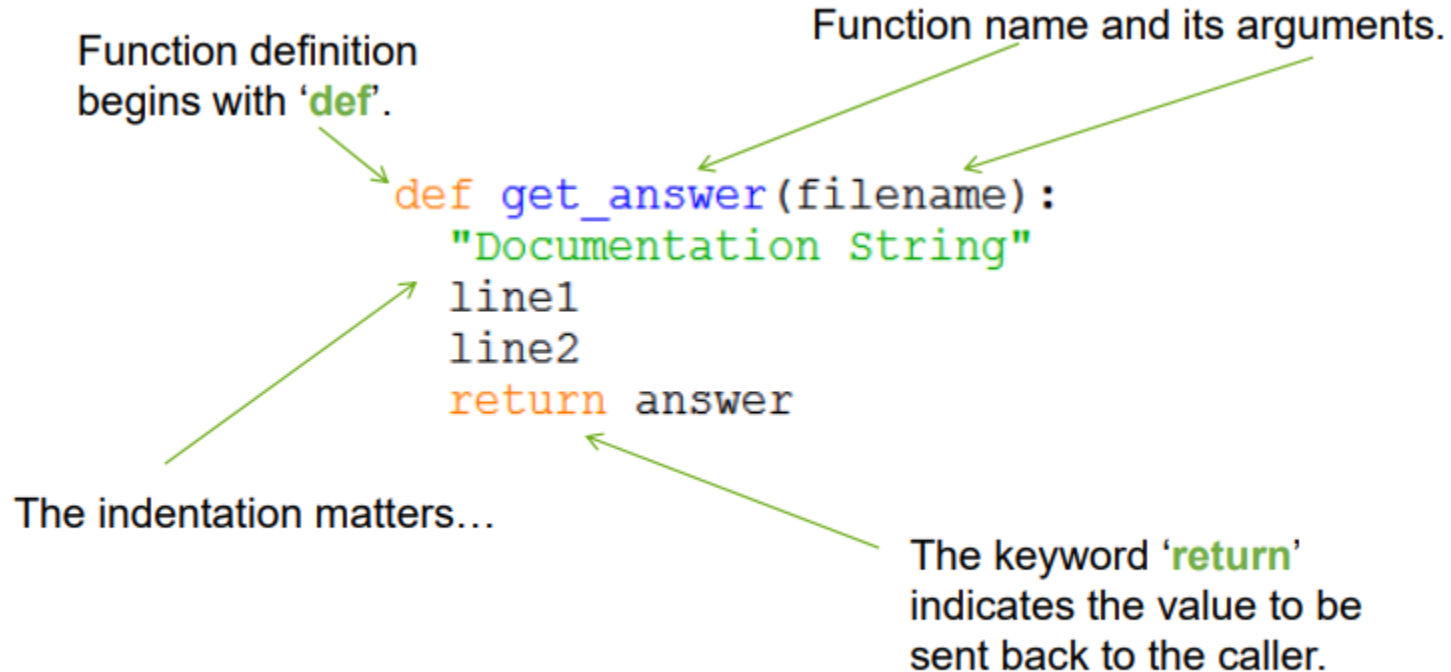


```
area = cal_area(5, 8)  
print("The area is " + str(area))
```



Defining Function **def**

- No type declarations needed
- Python will figure it out at run-time



No header file or declaration of types of function or arguments.



Why function?

- Function to calculate area of circle based on a given radius

```
def cal_area(radius):  
    area = 3.142 * radius * radius  
    return area
```

- Uses of function
 - reduce repetitive code
 - define new command by grouping existing commands
 - function name can provide more meaningful name to a series of commands



Example – User defined function

```
>>> def sayHello():  
...     print('Hello')  
...  
>>> sayHello()  
Hello  
>>> def addNumbers(x, y):  
...     return x + y  
...  
>>> z = addNumbers(3, 4)  
>>> z  
7  
.
```

Note the differences:
sayHello() does not return a value

addNumbers() return a value



Returning value from Function

- Compare the two functions:
 - **return**: Get back a value after calling a function, assign this value to a variable
 - **print**: Display a value to a user

```
def cal_area(width , height):  
    return width * height
```

← return a value

```
def cal_area(width , height):  
    print (width * height)
```

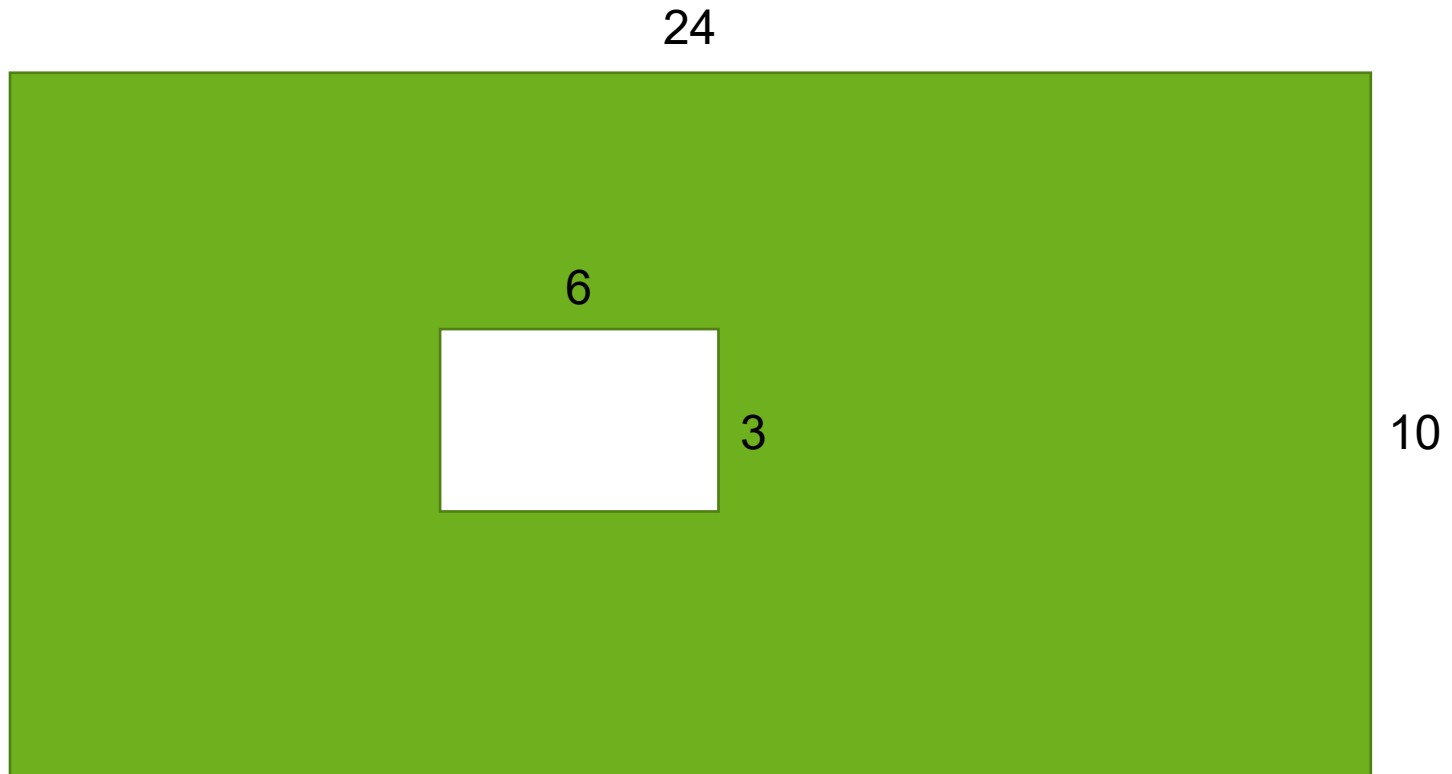
← print a value

- Most functions should return instead of print a value
- How a function should work is dependent on the design of the programmer



Example – Calculate area

- Write a program to calculate the area of the shaded region





Example: Function with return value

- Create and use a function to calculate area of rectangle

Define the function

```
def cal_area (width, height):  
    return width * height
```

Using the function

```
area1 = cal_area(24, 10)  
area2 = cal_area(6, 3)  
shared_area = area1 - area2  
print("Shared area: " + str(shared_area))
```



Example: Define and Use Function

- Write a function that takes in two numbers as arguments and returns the bigger number.

```
def getBiggerNumber(num1, num2):  
    if num1 > num2:  
        return num1  
    else:  
        return num2
```

Argument list



Exercises

- Write a function that takes in a number as argument, and returns that number
- Write a function that takes in a number as argument, and returns that number incremented by 1
- Write a function that calculates and returns the double of the number given as argument



10 mins



Exercises

- Write a function to calculate the discounted price given the original price and the discount in percentage.
- For example, if an item costs 100 dollar, and given 10% discount, the function will print a value of 90.0.

Samples:

```
>>> get_discount(100, 10)
90.0
>>> get_discount(50, 20)
40.0
```

get_discount.py

- Write a function that takes in a list of number and return the sum of the numbers.

Samples:

```
>>> get_sum([1, 2, 3, 4])
10
>>> get_sum([3, 3, 3])
9
```

get_sum.py



15 mins



try .. except

Error handling is done through the use of exceptions that are caught in try blocks and handled in except blocks

```
>>> try:
...     5/0
... except Exception as e:
...     print("Exception ",type(e),": ",e.args)
...
Exception <class 'ZeroDivisionError'> : ('division by zero',)
>>>
```

```
>>> try:
...     5/0
... except:
...     print("error")
...
error
>>>
```




try .. except

You can also use the finally block. The code in the finally block will be executed regardless of whether an exception occurs.

```
>>> try:
...     5/0
... finally:
...     print("oops, just before we run into an exception.")
...
oops, just before we run into an exception.
Traceback (most recent call last):
  File "<string>", line 301, in runcode
  File "<interactive input>", line 2, in <module>
ZeroDivisionError: division by zero
>>>
```



try .. except

Another example is to check if a website is available:

```
1 from urllib.request import urlopen
2 def isOnline(reliableserver='http://www.google.com'):
3     try:
4         urlopen(reliableserver)
5         return True
6     except IOError:
7         return False
```

```
>>> isOnline()
True
>>>
```



String functions

Split

```
>>> a='python or java'
>>> b=a.split(' ')
>>> type(b)
<type 'list'>
>>> b
['python', 'or', 'java']
>>>
```

```
>>> a='python or java'
>>> b=a.split('on')
>>> b
['pyth', ' or java']
>>>
```

Join

```
>>> a=['python','and','java']
>>> b=' '.join(a)
>>> b
'python and java'
>>> c=','.join(a)
>>> c
'python,and,java'
>>>
```



String Slicing

```
>>> s = "freedom"
>>> print(s[:4])
free
>>> print(s[-3:])
dom
>>> |
```

Slicing works for any sequence (eg. list), so it works for strings too.

`[:4]` gets from the start till the fourth character

`[-3:]` gets the last third till the last character.



Exercise – Find Longest Word

Create the function `findLongestWord` that takes in a sentence and returns the longest word. Hint: Use `split()`



15 mins



String formatting

```
>>> import math
>>> print("Pi is " + str(math.pi))
Pi is 3.141592653589793
>>> print("Pi is approx %.2f"%(math.pi))
Pi is approx 3.14
>>> print("Pos or Neg: %+d %+d"%(-5,3))
Pos or Neg: -5 +3
>>> |
```

Formatting numbers

%d	int
%f	float

Special formatting

%.2f	float two decimal places
------	-----------------------------

%+d	sign printing (+)
%+f	E.g. +5.6

%03d	leading zeroes
------	----------------



String formatting

Try this out yourself !

```
>>> import math
>>> a = math.pi
>>> a
3.141592653589793
>>> b=5
>>> c="python"
>>> line="%s %f %d"%(c,a,b)
>>> line
'python 3.141593 5'
>>>
```

```
>>> line="%03d"%(b)
>>> line
'005'
```





More string formatting

With `c="python"`, `a=3` and `b=5`

```
>>> "%-15s"%(c)
'python'

>>> line="%15s %.0f %d"%(c,a,b)
>>> line
'          python 3 5'
>>> |

>>> "%(language)s has %(#)03d quote types"%({'language':'python','#':2})
'python has 002 quote types'
>>> |
```

More about this string formatting technique can be found here:

<http://docs.python.org/library/stdtypes.html>



Exercise - string formatting

Given the variable

`I = "admin:$E*G$@R:/users/root:"`

Can you print it like

User	: admin
Password	: \$E*G\$@R
Homedir	: /users/root



10 mins



The random library

`random.randint(a, b)`

Return a random integer N such that
 $a \leq N \leq b$

`random.random()`

Return the next random floating point number in the range [0.0, 1.0]

Other random functions

`random.shuffle(List)`

`random.choice(List)`

More at <http://docs.python.org/library/random.html>



Exercise - Guessing Game

- Create a random number between 1 and 20 and prompt the user to guess the secret number. He is allowed a maximum of 6 guesses after which the secret number will be displayed and the program exits. For every guess, the program will display a message saying if the number guessed is higher or lower than the secret number. If he guessed the correct number, the program will display the number of tries he had taken and the program exits.



20 mins



Exercise - Guessing Game

- **Sample output**

```
What is your name?  
John  
Well, John, I am thinking of a number between 1 and 20  
Take a guess  
5  
Your guess is too low.  
Take a guess  
10  
Your guess is too low.  
Take a guess  
15  
Your guess is too high.  
Take a guess  
12  
Your guess is too low.  
Take a guess  
14  
Good job, John! You guessed my number in 5 guesses!  
  
Process finished with exit code 0
```

```
What is your name?  
John  
Well, John, I am thinking of a number between 1 and 20  
Take a guess  
10  
Your guess is too high.  
Take a guess  
10  
Your guess is too high.  
Take a guess  
10  
Your guess is too high.  
Take a guess  
10  
Your guess is too high.  
Take a guess  
10  
Your guess is too high.  
nope. The number I was thinking of was 6  
  
Process finished with exit code 0
```



End Day 1