HKUST Future-Ready Scholars

Introduction to Game Programming using Python

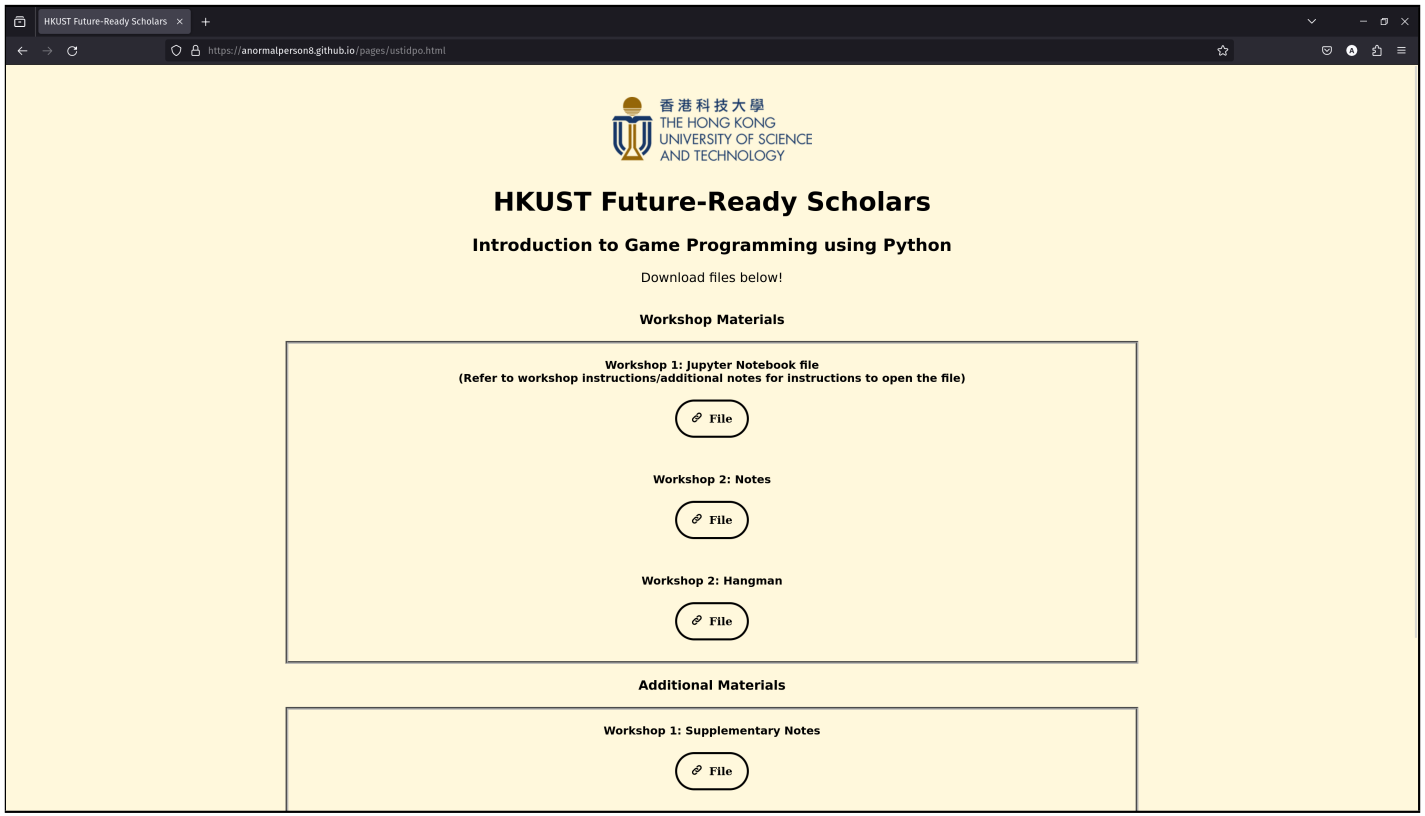
Part 2

4 May 2024

THE HONG KONG
UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Files

All materials today are at:
https://bit.ly/ustidpo



Summary from Last Workshop

Let's look at what we learnt last time.

Summary from Last Workshop

Examples of valid integers

```
a = 5
b = 1000000
c = -1984
```

Examples of valid strings

```
a = "5"
b = "haha"
c = 'some words'
```

Arithmetic Operators

Some basic and commonly-used operators:

+:	add	-:	minus,
*:	multiply	/:	divide

Summary from Last Workshop

The `print()` statement

`print(*objects)`

`*objects` - the things you want to print (put on the screen)

The `input()` statement

`input(prompt)`

where `prompt` is quite literally what it means. It prints the prompt, then returns the value inputted as a string.

Summary from Last Workshop

Comparison Operators

There are 6 comparison operators:

Operator	Meaning
==	equal to
>	larger than
>=	larger than or equal to
<	smaller than
<=	smaller than or equal to
!=	not equal to

Summary from Last Workshop

if, elif and else

if, elif and else clauses are used to decide whether some code should be executed. Whenever one is fulfilled, all others are ignored.

```
if condition1: # if condition1 is true
    # Do something, ignore all elif and else below

elif condition2: # if condition2 is true
    # Do something, ignore all elif and else below

elif condition3: # if condition3 is true
    # Do something, ignore all elif and else below

else: # if all the conditions above are false
    # Do something
```

Summary from Last Workshop

The `and` logic operator

The `and` operator makes it so that both conditions have to be fulfilled in order for the code it is under to execute.

The `or` logic operator

The `or` operator makes it so that only 1 of the conditions have to be fulfilled in order for the code it is under to execute.

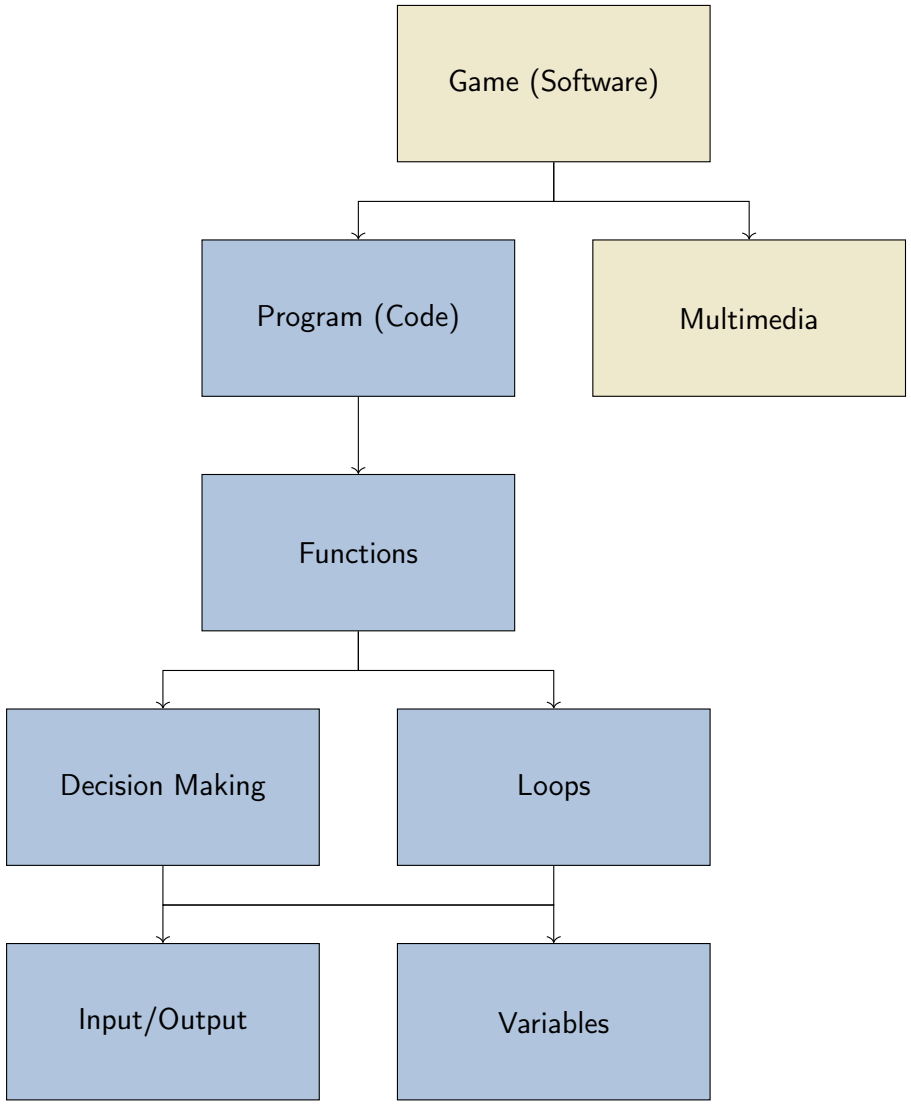
The `not` logic operator

The `not` operator reverses the condition is it attached to.

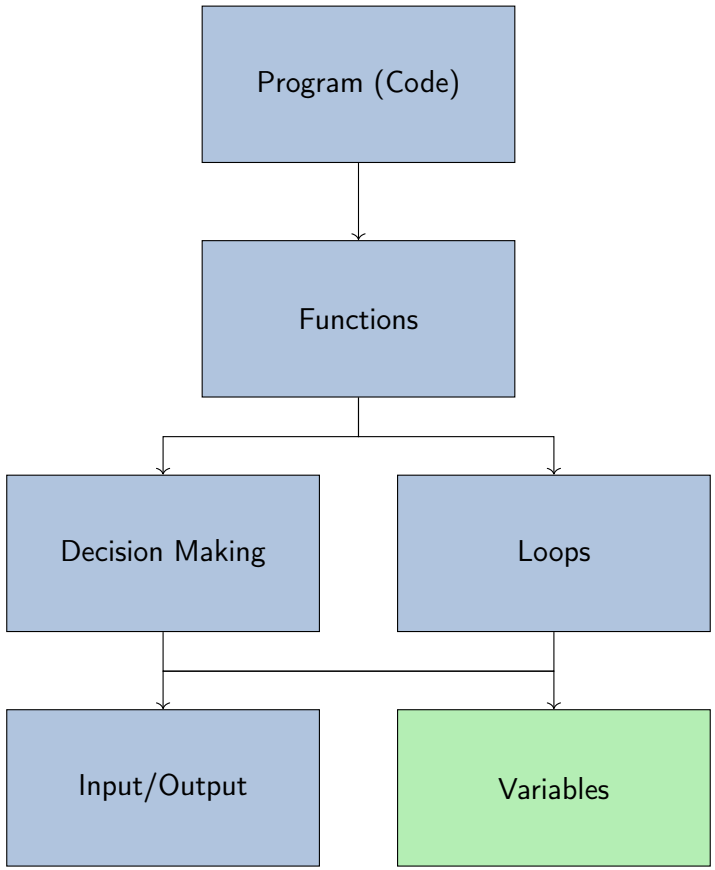
Multiple logic operators

One can chain multiple logic operators together, but to be safe add brackets () to make sure the condition works as intended.

World of Game Coding



Contents


Program (Code)
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More on Boolean values

There are 2 Boolean values in existence: `True` and `False`.
The meaning of them are very similar to their English counterparts.

```
status = True
if status:
    print("status is True")
else:
    print("status is False")
```

More on Boolean values

Another example:

```
game_over = False
if not game_over:
    print("Continue your game!")
else:
    print("Game Over!")
```

Lists

Imagine you have a bunch of variables you want to store. For example, if you have a bunch of people's names.

```
name0 = "Chris Wong"
name1 = "Desmond Tsoi"
name2 = "Phoebe Mok"
name3 = "Nancy Ip"
```

That is annoying to store and access.
What if instead, we store it in the same thing, as a... list?

Lists

```
names = ["Chris Wong", "Desmond Tsoi",
         "Phoebe Mok", "Nancy Ip"]
print(names[0]) # Chris Wong
```

Lists are declared by surrounding the items with [ ], and separating each item with a comma.
We can get the name from a list by getting the corresponding item.
How? With list[index].
The first item in the list is the 0^{th} item, second is 1^{st} item, etc...
We call this zero-indexing.

Note: Some programming languages use one-indexing instead.

If you approach another programming language, be careful.

Lists

```
names = ["Chris Wong", "Desmond Tsoi",
         "Phoebe Mok", "Nancy Ip"]
print(names[0], names[1], names[2], names[3])
# Output: Chris Wong Desmond Tsoi Phoebe Mok Nancy Ip
```

Lists

Another example:

```
# Indices: 0  1  2  3  4  5
numbers = [0, 1, 1, 2, 3, 5]
print(numbers[0], numbers[1], numbers[2],
      numbers[3], numbers[4], numbers[5])
# Output: 0 1 1 2 3 5

print(numbers)
# Output: [0, 1, 1, 2, 3, 5]
```

Lists

One more example in the context of Hangman:

```
# Indices:    0    1    2    3    4    5
word_list = ["p", "y", "t", "h", "o", "n"]
print(word_list[0], word_list[1], word_list[2],
      word_list[3], word_list[4], word_list[5])
# Output: p y t h o n

print(word_list)
# Output: ['p', 'y', 't', 'h', 'o', 'n']
```

Lists

To get the length of a list, we can use the `len()` function.

```
numbers = [0, 1, 1, 2, 3, 5]
print(len(numbers)) # 6
word_list = ["p", "y", "t", "h", "o", "n"]
print(len(word_list)) # 6
```

Lists

To edit an element of a list, assign the new value to the correct index.

```
numbers = [0, 1, 1, 2, 3, 5]
print(numbers) # [0, 1, 1, 2, 3, 5]
numbers[1] = 100 # Edit the second element (index 1)
print(numbers)
# Output:  [0, 100, 1, 2, 3, 5]
```

Lists

Another example in the context of Hangman:

```
word_list = ["p", "y", "t", "h", "o", "n"]
print(word_list) # ['p', 'y', 't', 'h', 'o', 'n']
word_list[3] = "a" # Edit the fourth element (index 3)
print(word_list)
# Output:  ['p', 'y', 't', 'a', 'o', 'n']
```

Lists

To add an element to the end to a list, we use the `append(value)` list function.

```
numbers = [0, 1, 1, 2, 3, 5]
print(numbers, "length:", len(numbers))
# Output: [0, 1, 1, 2, 3, 5] length: 6
numbers.append(100) # Add 100 to the end of the list
print(numbers, "length:", len(numbers))
# Output: [0, 1, 1, 2, 3, 5, 100] length: 7
```

Lists

Another example in the context of Hangman:

```
word_list = ["p", "y", "t", "h", "o", "n"]
print(word_list, "length:", len(word_list))
# Output: ['p', 'y', 't', 'h', 'o', 'n'] length: 6
word_list.append("a") # Add "a" to the end of the list
print(word_list, "length:", len(word_list))
# Output:  ['p', 'y', 't', 'h', 'o', 'n', 'a'] length: 7
```

Lists

We can check if an element is in a list with the `in` operator.

```
numbers = [0, 1, 1, 2, 3, 5]
if 0 in numbers:
    print("0 is in numbers.") # This line is run
else:
    print("0 is not in numbers.")
if 8 in numbers:
    print("8 is in numbers.")
else:
    print("8 is not in numbers.") # This line is run
```

Lists

Another example in the context of Hangman:

```
word_list = ["p", "y", "t", "h", "o", "n"]
if "y" in word_list:
    print("y is in the word list.") # This line is run
else:
    print("y is not in the word list.")
if "a" in word_list:
    print("a is in the word list.")
else:
    print("a is not in the word list.") # This line is run
```

More about the in operator

The in operator works very similarly when applied to strings.

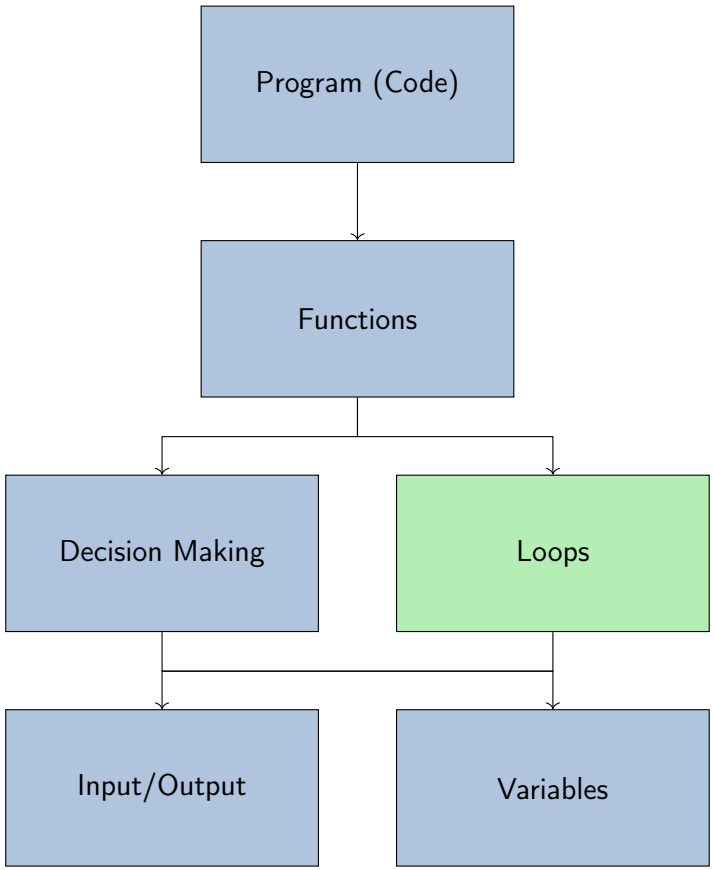
```
word = "python"
if "y" in word:
    print("y is in the word list.") # This line is run
else:
    print("y is not in the word list.")
if "a" in word:
    print("a is in the word list.")
else:
    print("a is not in the word list.") # This line is run
```

More about the in operator

You can combine the not and in operators.

```
word = "python"
if "a" not in word:
    print("a is not in the word list.") # This line is run
else:
    print("a is in the word list.")
word_list = ["U", "S", "T"]
if "u" not in word_list:
    print("u is not in the list.") # This line is run
else:
    print("u is in the list.")
```

Contents


Program (Code)
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Loops

What do you do if you want to do something repeatedly in code?

```
print("Count:", 0)
print("Count:", 1)
print("Count:", 2)
print("Count:", 3)
print("Count:", 4)
print("Count:", 5)
print("Count:", 6)
print("Count:", 7)
print("Count:", 8)
print("Count:", 9)
print("Done.")
```

Let's turn this into a loop.

Loops - while

Example:

```
i = 0 # Initialising i as 0
while i < 10:
    print("Count:", i)
    i = i + 1
print("Done.")
```

Let's run through it together.

Loops - while

Example:

```
i = 0
while i < 10: # i is 0, which is smaller than 10
    print("Count:", i)
    i = i + 1
print("Done.")
```

Loops - while

Example:

```
i = 0
while i < 10:
    print("Count:", i) # Count: 0
    i = i + 1
print("Done.")
```

Loops - while

Example:

```
i = 0
while i < 10:
    print("Count:", i)
    i = i + 1 # i goes from 0 to 1, then we go back up
print("Done.")
```

Loops - while

Example:

```
i = 0
while i < 10: # i is 1, which is smaller than 10
    print("Count:", i)
    i = i + 1
print("Done.")
```

Loops - while

Example:

```
i = 0
while i < 10:
    print("Count:", i) # Count: 1
    i = i + 1
print("Done.")
```

Loops - while

Example:

```
i = 0
while i < 10:
    print("Count:", i)
    i = i + 1 # i goes from 1 to 2, then we go back up
print("Done.")
```

Loops - while

Example:

```
i = 0
while i < 10: # i is 2, which is smaller than 10
    print("Count:", i)
    i = i + 1
print("Done.")
```

Loops - while

Example:

```
i = 0
while i < 10:
    print("Count:", i) # Count: 2
    i = i + 1
print("Done.")
```

Loops - while

Example:

```
i = 0
while i < 10:
    print("Count:", i)
    i = i + 1 # i goes from 2 to 3, then we go back up
print("Done.")
```

Loops - while

Example:

```
i = 0
while i < 10: # i is 3, which is smaller than 10
    print("Count:", i)
    i = i + 1
print("Done.")
```

This goes on and on...

Loops - while

Example:

```
i = 0
while i < 10: # i is 9, which is smaller than 10
    print("Count:", i)
    i = i + 1
print("Done.")
```

Loops - while

Example:

```
i = 0
while i < 10:
    print("Count:", i) # Count: 9
    i = i + 1
print("Done.")
```

Loops - while

Example:

```
i = 0
while i < 10:
    print("Count:", i)
    i = i + 1 # i goes from 9 to 10, then we go back up
print("Done.")
```

Loops - while

Example:

```
i = 0
while i < 10: # i is 10, which is NOT smaller than 10
    print("Count:", i)
    i = i + 1
print("Done.")
```

Loops - while

Example:

```
i = 0
while i < 10:
    print("Count:", i)
    i = i + 1
print("Done.") # "Done." is printed
```

Loops - while

Example:

```
i = 0
while i < 10:
␣␣␣␣print("Count:", i)
␣␣␣␣i = i + 1
print("Done.")
```

Indentation

Just like `if`-clauses, the indentation must be consistent for statements in the loop. This also applies to `for` loops, which we will get into very soon.

Loops - while

Example in the context of Hangman:

```
max = 6
wrong_guess = 0
while wrong_guess < max:
    print("You have", max - wrong_guess, "guesses left.")
    # Some more code to decide if the guess is wrong
```

Loops - for

Example:

```
for i in range(10):
    print("Count:", i)
print("Done.")
```

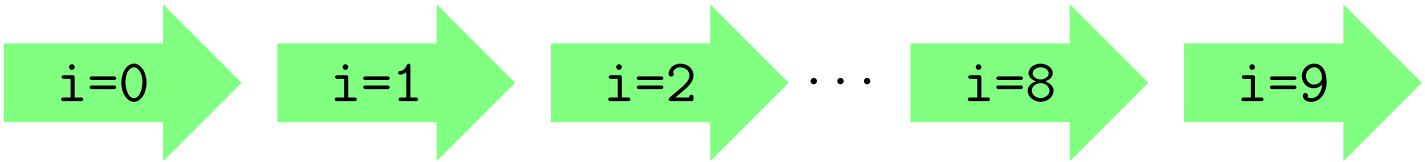
Python range

Python `range` is a thing of mystery. When you do `range(n)`, where `n` is an integer, Python generates a *range* of integers from 0 to `n` - 1.

Loops - for

Example:

```
for i in range(10):
    print("Count:", i)
print("Done.")
```



Loops - for

```
for i in range(10):
    print("Count:", i)
print("Done.")
```

is equivalent to

```
i = 0
while i < 10:
    print("Count:", i)
    i = i + 1
print("Done.")
```

Both loops go from 0 to 9, and give identical output.

Loops - for

Another example:

```
for i in range(3):
    print(i * i) # Print the square, end with a space
# Output: 0
#         1
#         4
```

Loops - for

Let's combine lists with a for loop.

```
word = ["p", "y", "t", "h", "o", "n"]
for i in range(len(words)):
    print(word[i]) # Print word[i]
# Output: p
#         y
#         t
#         h
#         o
#         n
```

This is one way we go through a list.

Loops - for

Instead of using the index, there is another way to go through a list:

```
word = ["p", "y", "t", "h", "o", "n"]
for i in word:
    print(i) # Print the element
# Output: p
#         y
#         t
#         h
#         o
#         n
```

The output is identical to the previous example.

Summary

Boolean values

There are only 2 Boolean values: `True` and `False`.
They are very similar to their English counterpart and `True`/`False` are opposites.

Lists

Lists are represented with [ ] to hold multiple variables, where the i^{th} item is at index $i - 1$.

Lists with functions

If a list is called `l`, one can:

- print the list with `print(l)`.
- get the length of `l` with `len(l)`.
- get/edit the element at index `i` with `l[i]`.

Summary

List functions

If a list is called `l`, one can:

- append a value `v` to `l` with `l.append(v)`.
- use the `in` operator to check if a value `v` is in a list.

  e.g.: `if v in l:`

`in` operator

You can use `in` operator for strings too, and even combine it with the `not` operator.

```
w = "HKUST"
if "H" not in w:
    print("No H.")
else:
    print("Yes H.") # This line is run.
```

Summary

`while` loops

```
while condition:
    # Do code
```

Code in the `while` block are run while the condition is fulfilled.
Do make sure that the `while` loop can be exited.

Summary

for loops and range

```
n = 5 # Example
for i in range(n):
    # Do code with each number from 0 to n - 1
```

`range(n)` returns a range of integers that starts from 0 and ends at `n - 1`.

for loops and lists

```
l = [...] # A list with items
for i in l:
    # Do code with each item in the list
```

`for` loops can be directly applied onto lists.

Summary

`in` operator for strings

```
word = "word"
if "w" in word:
    print("w is in word")
```

You can use the `in` operator to check if a string is part of the target string.

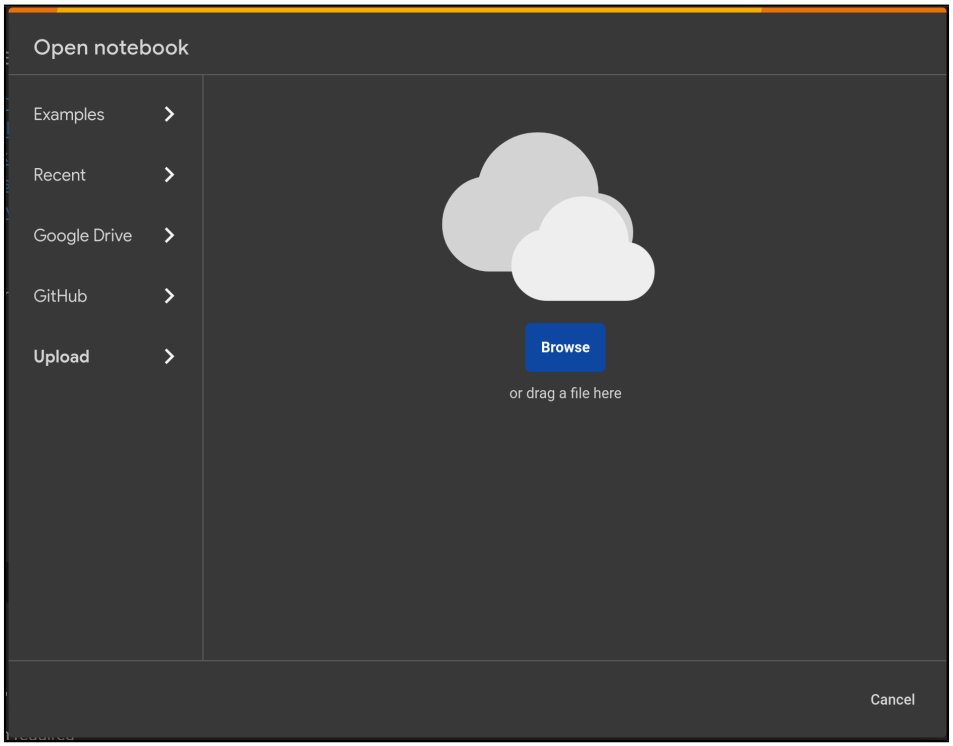
Google Colab

Login to your Gmail account.

Then head to
https://colab.research.google.com/

Jupyter Notebook

Now upload your Jupyter Notebook file with **Files** → **Open Notebook**.



Upload the file **Hangman.ipynb**.

Using Jupyter Notebook

You can type your code in these blocks. We call these blocks code cells.

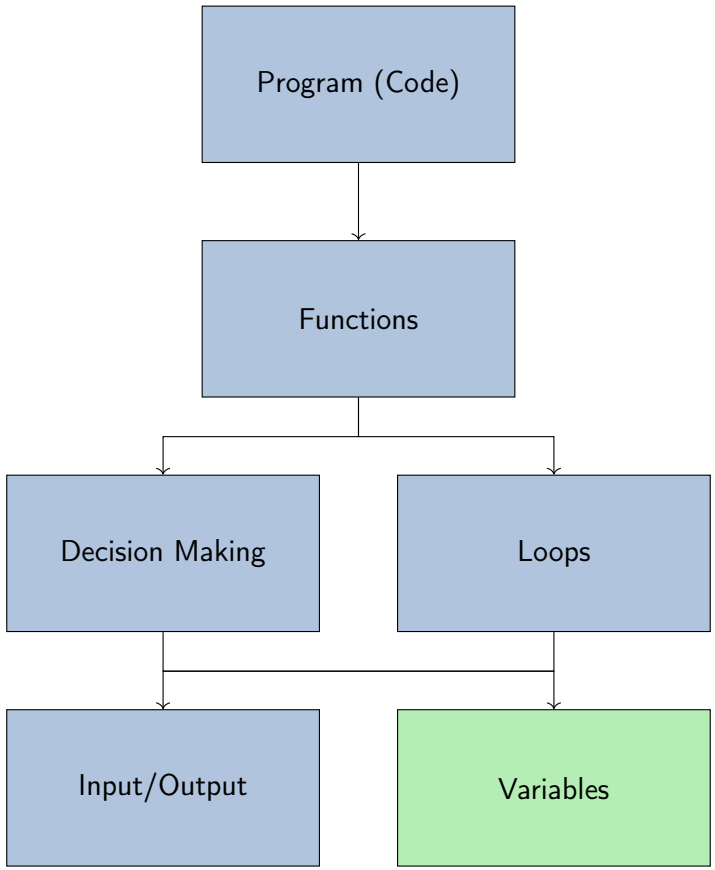
You can run a code cell with the button on the left.

The End
Thank you!

Additional content

Here are some additional content that we didn't have time to mention in the workshop.

Contents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Lists

To insert an element to a particular position in a list, we use the `insert()` list function.
The `insert(i, value)` inserts the `value` at index `i`, and push everything after to the right.

```
numbers = [0, 1, 1, 2, 3, 5]
print(numbers, "length:", len(numbers))
# Output: [0, 1, 1, 2, 3, 5] length: 6
numbers.insert(2, 100) # Add 100 to index 2 of the list
print(numbers, "length:", len(numbers))
# Output: [0, 1, 100, 1, 2, 3, 5] length: 7
numbers.insert(7, 200) # Same as numbers.append(200)
print(numbers, "length:", len(numbers))
# Output: [0, 1, 100, 1, 2, 3, 5, 200] length: 8
```

Lists

To remove an element from a list, we use the `remove()` list function. The `remove(value)` function removes the **first** occurence of `value`.

```
numbers = [0, 1, 1, 2, 3, 5]
print(numbers, "length:", len(numbers))
# Output: [0, 1, 1, 2, 3, 5] length: 6
numbers.remove(1) # Remove the first occurence of number 1
print(numbers, "length:", len(numbers))
# Output: [0, 1, 2, 3, 5] length: 5
```

Lists

The `reverse()` list function reverses a list's contents.

```
numbers = [0, 1, 1, 2, 3, 5]
print(numbers, "length:", len(numbers))
# Output: [0, 1, 1, 2, 3, 5] length: 6
numbers.reverse() # Reverse the list
print(numbers, "length:", len(numbers))
# Output: [5, 3, 2, 1, 1, 0] length: 6
print(numbers[0])
# Output: 5
```

Lists

The `count(item)` list function counts the number of occurence of `item` in a list.

```
numbers = [0, 1, 1, 2, 3, 5]
print(numbers.count(1))
# Output: 2
print(numbers.count(100))
# Output: 0
```

Lists

The `index(item)` list function finds the index of the first occurence of `item` in a list.

```
numbers = [0, 1, 1, 2, 3, 5]
print(numbers.index(1))
# Output: 1
print(numbers.index(5))
# Output: 5
print(numbers.index(100))
# Output: No output, error, 100 is not in the list
```

Lists

Combining `in` and `list.index()`:

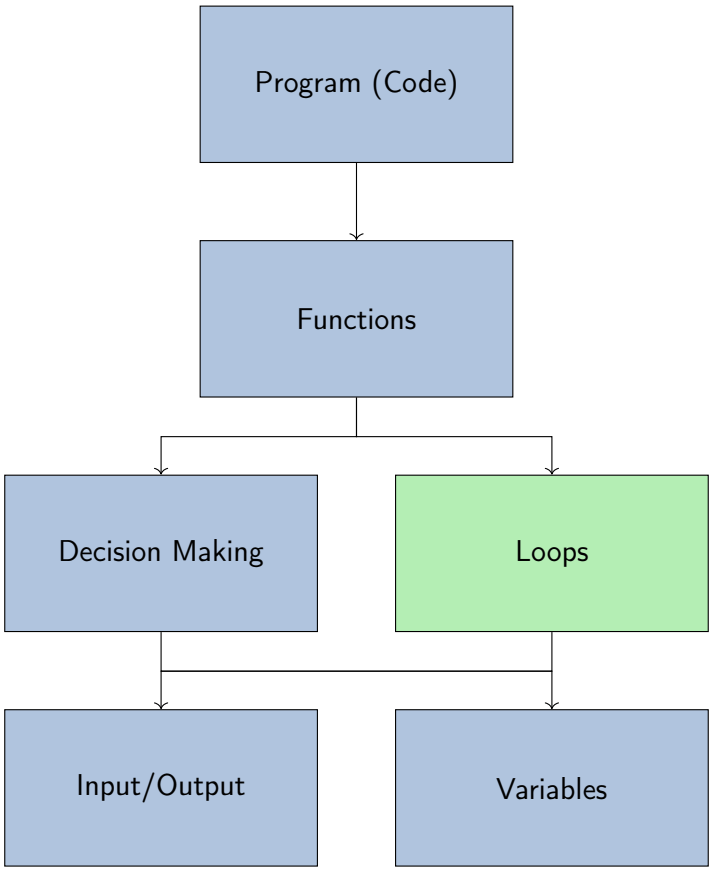
```
numbers = [0, 1, 1, 2, 3, 5]
if 5 in numbers:
    print("The index of 5 in the list is", numbers.index(5))
# Output: The index of 5 in the list is 5
```

Lists

The `sort()` list function sorts a list's contents.

```
numbers = [6, 5, 1, 2, 3]
print(numbers, "length:", len(numbers))
# Output: [6, 5, 1, 2, 3] length: 5
print(numbers[0])
# Output: 6
numbers.sort() # Sort the list
print(numbers, "length:", len(numbers))
# Output: [1, 2, 3, 5, 6] length: 5
print(numbers[0])
# Output: 1
```

Contents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Loops - while

We can also apply boolean values to `while` loops.

```
equal_to_5 = False
count = 0
while not equal_to_5:
    if count == 5:
        equal_to_5 = True
    count = count + 1
print("Done.") # "Done." is printed
```

Summary

The `range` in Python does not always have to start at 0.

```
for i in range(2, 5):
    print(i)
# Output: 2
#         3
#         4
```

Custom `range`

Given `range(a, b)`, a `for` loop will iterate from `a` to `b - 1`.

Summary

List functions

If a list is called `l`, one can:

- insert a value `v` to `l` at index `i` with `l.insert(i, v)`.
- remove the first occurence of a value `v` with `l.remove(v)`.
- reverse the list with `l.reverse()`.
- count the occurence of value `v` with `l.count(v)`.
- get the index of the first occurence of a value `v` with `l.index(v)`.
- sort the list with `l.sort()`.

Summary

Boolean conditions of `while`

You can apply boolean conditions to `while` loops.

```
status = True # Or False, or a condition with variables
while status: # Can also add "not"
    # Do something
```

Custom `range`

Given `range(a, b)`, a `for` loop will iterate from `a` to `b - 1`.

```
sum = 0
for i in range(100, 102):
    sum = sum + i
print(sum) # Output: 201
```

End of Additional Contents

Made in LaTeX

Last updated: 22 Apr 2024