HKUST Future-Ready Scholars
Introduction to Game Programming using Python

Part 2
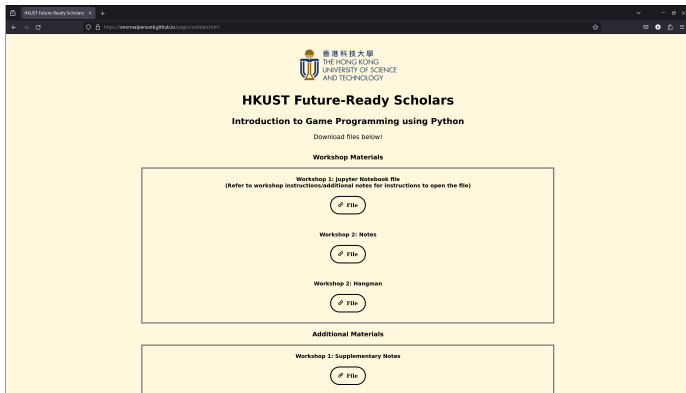
4 May 2024

THE HONG KONG
UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Login to your Gmail account.

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

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

Download all files that belong to **Workshop 2**.

Now upload your Jupyter Notebook file with **Files** $\rightarrow$ **Open Notebook**.

Upload the file **Hangman.ipynb**.

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

```
print("Mum I am in HKUST typing code in a code block")
```

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

```
print("Hello World!") # Prints "Hello World!"
```

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.

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.

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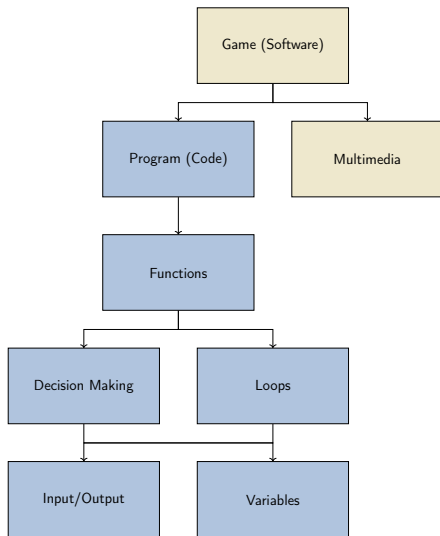
The not logic operator
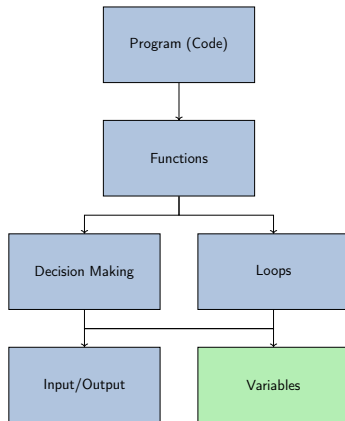The not operator reverses the condition is it attached to.

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

Lists

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

```python
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

```python
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 0th item, second is 1st item, etc...

We call this zero-indexing.

Note: Some programming languages use one-indexing instead.

If you approach another programming language, be careful.

Lists

```python
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]
```

Printing the whole list

To print the whole list, simply put it in the print() function.

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

```
numbers = [0, 1, 1, 2, 3, 5]
print(len(numbers)) # 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

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

```python
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

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

```python
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
```

Contents
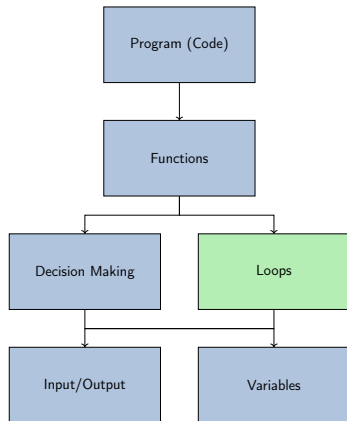
Loops

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

```python
print("Count:", 10)
print("Count:", 9)
print("Count:", 8)
print("Count:", 7)
print("Count:", 6)
print("Count:", 5)
print("Count:", 4)
print("Count:", 3)
print("Count:", 2)
print("Count:", 1)
print("Done.")
```

Let's turn this into a loop.

Example:

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

Let's run through it together.

Example:
```
i = 10
while i > 0: # i is 10, which is larger than 0
    print("Count:", i)
    i = i - 1
print("Done.")
```

Example:
```
i = 10
while i > 0:
    print("Count:", i) # Count: 10
    i = i - 1
print("Done.")
```

Loops - while

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

Example:
```
i = 10
while i > 0: # i is 9, which is larger than 0
    print("Count:", i)
    i = i - 1
print("Done.")
```

Example:

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

Loops - while

Example:

```python
i = 10
while i > 0:
    print("Count:", i)
    i = i - 1 # i goes from 9 to 8, then we go back up
print("Done.")
```

Loops - while

Example:

```
i = 10
while i > 0: # i is 8, which is larger than 0
    print("Count:", i)
    i = i - 1
print("Done.")
```

Example:
```
i = 10
while i > 0:
    print("Count:", i) # Count: 8
    i = i - 1
print("Done.")
```

Example:
```
i = 10
while i > 0:
    print("Count:", i)
    i = i - 1 # i goes from 8 to 7, then we go back up
print("Done.")
```

Example:

```
i = 10
while i > 0: # i is 7, which is larger than 0
    print("Count:", i)
    i = i - 1
print("Done.")
```

This goes on and on. . .

Example:

```
i = 10
while i > 0: # i is 1, which is larger than 0
    print("Count:", i)
    i = i - 1
print("Done.")
```

Example:

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

Example:

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

Example:

```
i = 10
while i > 0: # i is 0, which is NOT larger than 0, so we exit
    print("Count:", i)
    i = i - 1
print("Done.")
```

Example:
```
i = 10
while i > 0:
    print("Count:", i)
    i = i - 1
print("Done.") # "Done." is printed
```

Loops - while

Example:
```
i = 10
while i > 0:
    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 - `for`

Example:

```python
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`

Not getting the loop?

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

is equivalent to

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

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

Another example:

```python
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.

```python
words = ["haha", "hehe", "hoho"]
for i in range(len(words)):
    print(words[i]) # Print num[i]
# Output: haha
#         hehe
#         hoho
```

This is one way we go through a list.

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

```python
words = ["haha", "hehe", "hoho"]
for i in words:
    print(i) # Print the element
# Output: haha
#         hehe
#         hoho
```

The output is identical to the previous example.

Summary

Lists

Lists are represented with [ ] to hold multiple variables, where the ith 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:`

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

```python
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.
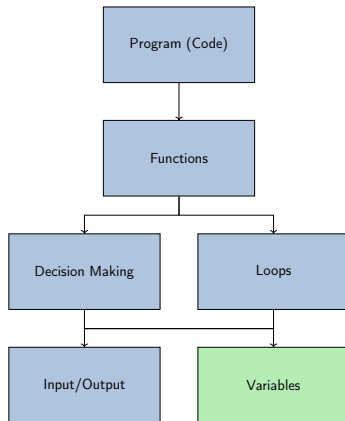
for loops and lists

```python
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.

The End
Thank you!

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

Contents

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.

```python
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`.

```python
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.

```python
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.

```python
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.

```python
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()`:

```python
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
```
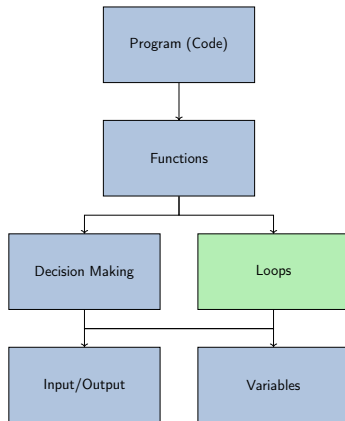
Lists

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

```python
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

Loops - `while`

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

```python
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.

```python
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`.

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.

```python
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.

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

End of Additional Contents
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