Coding in Python
Python Basics - Part 2
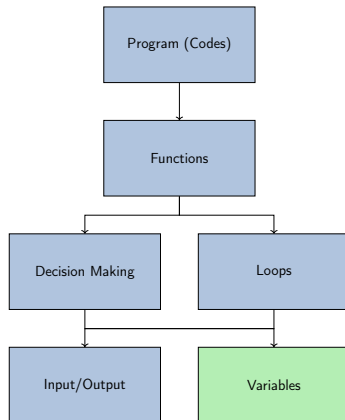
IDPO 2910 Group 5

4 May 2024

THE HONG KONG
UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Contents

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.

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...

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

```
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:
```

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:

```python
# 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.

Lists

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

Lists

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

```python
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.

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:
```

Lists

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

```python
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.

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:
```

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

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.

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:
```

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)
```

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:
```

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`.

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:
```

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.

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:
```

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:
```

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
```

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

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:
```

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:
```

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
```

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

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
```

Lists

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

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:
```

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:
```

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:
```

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
```

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

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:
```

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.

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:
```

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:
```

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
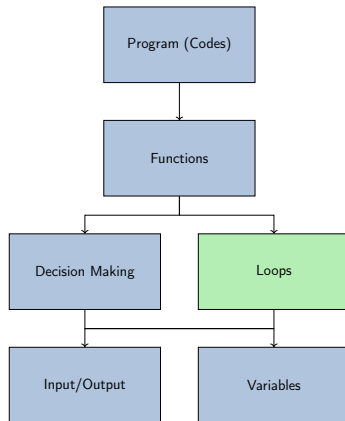
Loops

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

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.")
```

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.

Loops - while

Example:
```python
i = 10 # Initialising i as 10
while i > 0:
    print("Count:", i)
    i = i - 1
print("Done.")
```
Let's run through it together.

Loops - while

Example:

```python
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:

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

Loops - while

Example:

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

Loops - while

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

Loops - while

Example:
```
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:

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

Loops - `while`

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

Loops - while

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:

```python
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. . .

Loops - while

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.")
```

Loops - while

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.")
```

Loops - `while`

Example:

```python
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`

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
```

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 10, and give identical output.

Another example:

```python
for i in range(5):
    print(i*i, end=" ") # Print the square, end with a space
print() # Add new line at the end
# Output:
```

Another example:

```python
for i in range(5):
    print(i*i, end=" ") # Print the square, end with a space
print() # Add new line at the end
# Output: 0 1 4 9 16
```

Let's combine lists with a for loop.

```python
num = [1, 5, 9, 12, 4, 800]
for i in range(len(num)):
    print(num[i], end=" ") # Print num[i], end with a space
print() # Add new line at the end
# Output:
```

Let's combine lists with a for loop.

```python
num = [1, 5, 9, 12, 4, 800]
for i in range(len(num)):
    print(num[i], end=" ") # Print num[i], end with a space
print() # Add new line at the end
# Output: 1 5 9 12 4 800
```

Let's combine lists with a for loop.

```
num = [1, 5, 9, 12, 4, 800]
for i in range(len(num)):
    print(num[i], end=" ") # Print num[i], end with a space
print() # Add new line at the end
# Output: 1 5 9 12 4 800
```

This is how we go through a list.

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

```python
num = [1, 5, 9, 12, 4, 800]
for i in num:
    print(i, end=" ")
print() # Add new line at the end
# Output:
```

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

```python
num = [1, 5, 9, 12, 4, 800]
for i in num:
    print(i, end=" ")
print() # Add new line at the end
# Output: 1 5 9 12 4 800
```

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

```python
num = [1, 5, 9, 12, 4, 800]
for i in num:
    print(i, end=" ")
print() # Add new line at the end
# Output: 1 5 9 12 4 800
```

The output is identical to the previous example.

It also works for lists of other types.

```python
word = ["h", "k", "u", "s", "t"]
for w in word:
    print(w, end="")
print() # Add new line at the end
# Output:
```

It also works for lists of other types.

```python
word = ["h", "k", "u", "s", "t"]
for w in word:
    print(w, end="")
print() # Add new line at the end
# Output: hkust
```

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]`.

Lists functions

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

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

  e.g.: `if v in l:`
- get the index of the first occurence of a value `v` with `l.index(v)`.
- sort the list with `l.sort()`.

while loops

```python
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.

The end
Written in LaTeX
Last updated: 18 Mar 2024