

# Coding in Python

## Python Basics - Part 2

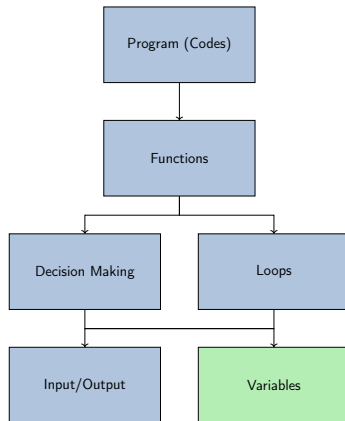
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4 May 2024



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# Contents



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.

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

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name2 = "Phoebe Mok"  
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```

That is annoying to store and access.

What if instead, we store it in the same thing, as a...

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<sup>th</sup> item, second is 1<sup>st</sup> 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:
```

```
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
```



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.

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```
numbers = [0, 1, 1, 2, 3, 5]  
print(len(numbers)) # 6
```

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

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```
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:
```

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]
```

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

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```
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:
```



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.

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```
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.

```
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.

```
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.

```
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
```

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

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```
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 occurrence of number 1
print(numbers, "length:", len(numbers))
# Output:
```



To remove an element from a list, we use the `remove()` list function. The `remove(value)` function removes the **first** occurrence 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 occurrence of number 1
print(numbers, "length:", len(numbers))
# Output: [0, 1, 2, 3, 5] length: 5
```

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

# 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:
```

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:
```

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
```

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

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

# Output:

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

```
numbers = [0, 1, 1, 2, 3, 5]
```

```
print(numbers.count(1))
```

```
# Output: 2
```

```
print(numbers.count(100))
```

```
# Output:
```



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

```
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.

```
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
```

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

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```
numbers = [0, 1, 1, 2, 3, 5]  
print(numbers.index(1))
```

# Output:

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

```
numbers = [0, 1, 1, 2, 3, 5]
```

```
print(numbers.index(1))
```

```
# Output: 1
```

```
print(numbers.index(5))
```

```
# Output:
```

The `index(item)` list function finds the index of the first occurrence 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:
```

The `index(item)` list function finds the index of the first occurrence 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()`:

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:
```

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
```

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

# 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:
```

# Lists

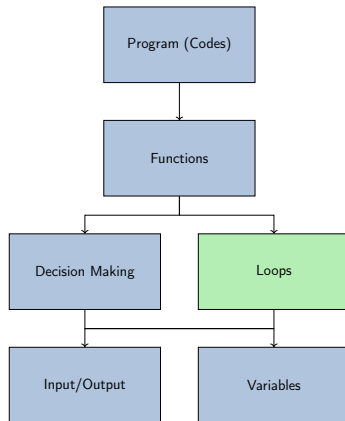
The `sort()` list function sorts a list's contents.

```
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:
```

# 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
```





# 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?

```
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?

```
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:

```
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:

```
i = 10
```

```
while i > 0: # i is 10, 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: 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.")
```

# Loops - while

Example:

```
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:

```
i = 10
while i > 0: # i is 8, 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: 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.")
```

# Loops - while

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...

# Loops - while

Example:

```
i = 10
while i > 0: # i is 1, 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: 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:

```
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.")
```

# Loops - while

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.

```
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:

```
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?

```
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 10, and give identical output.

# Loops - for

Another example:

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

# Loops - for

Another example:

```
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
```



# Loops - for

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:
```

# Loops - for

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
```

# Loops - for

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.

# Loops - for

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

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

# Loops - for

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

```
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
```

# Loops - for

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

```
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.

# Loops - for

It also works for lists of other types.

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

# Loops - for

It also works for lists of other types.

```
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  $i^{\text{th}}$  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]`.

## 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 occurrence of a value `v` with `l.remove(v)`.
- reverse the list with `l.reverse()`.
- count the occurrence 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 occurrence of a value `v` with `l.index(v)`.
- sort the list with `l.sort()`.

## 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.

The end  
Written in  $\text{\LaTeX}$   
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