

Introduction to Python

Part 2

COMP 8347

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Python Basics

Topics

- ▶ Collection Data Types
 - ▶ Strings
 - ▶ Lists
 - ▶ Dicts
- ▶ Comparison/Logic Operations



Collection Data Types

- ▶ Holds a collection of items, which may or may not be of the same type.
- ▶ May be *mutable* (e.g. list, dict) or *immutable* (e.g. tuple, str)
- ▶ Lists and strings are examples of *sequence* data types.
- ▶ There is another sequence type known as *tuple*
- ▶ For more information:
 - ▶ <https://docs.python.org/3/tutorial/datastructures.html>



```
Python 3.8.3 Shell
File Edit Shell Debug Options Window Help
>>> list1
[1, 2.5, 'hi', -8]
>>> str1
'Hello World'
>>> list1[0] = 99.9
>>> list1
[99.9, 2.5, 'hi', -8]
>>> str1[0] = 'h'
Traceback (most recent call last):
  File "<pyshell#9>", line 1, in <module>
    str1[0] = 'h'
TypeError: 'str' object does not support item assignment
>>>
```

Mutable vs Immutable



Strings

- ▶ A collection data type that is *ordered* and *unchangeable (immutable)*.
- ▶ The string type in Python is called `str`
- ▶ String literals delimited by single or double quotes; e.g. `'hello'` or `"hello"`
- ▶ Access individual items using the index number and enclosing in square brackets, e.g. `str1[0]`
- ▶ The first element always has index 0



Strings

- ▶ Use `index([])` and 'slice' similar to lists

- ▶ `S1 = "A red car "`

- ▶ `>>> S1[4]`

`'d'`

- ▶ `>>> S1[:7]`

`'A red c'`

- ▶ `>>> S1[2:-6]`

`'re'`

- ▶ `>>> S1[1] = '*'`

`TypeError: 'str' object does not support item assignment`

- ▶ `>>> S1 = 'something else'`

`# This is ok`

S1	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
	A		r	e	d		c	a	r	
	[-10]	[-9]	[-8]	[-7]	[-6]	[-5]	[-4]	[-3]	[-2]	[-1]

String Methods

S1	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
	A		r	e	d		c	a	r	
	[-10]	[-9]	[-8]	[-7]	[-6]	[-5]	[-4]	[-3]	[-2]	[-1]

► S1.count('r')

2

► S1.split()

['A', 'red', 'car']

► S1.replace('r', '*')

"A *ed ca* "

► S1.upper()

"A RED CAR "



String Methods

S1	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
	A		r	e	d		c	a	r	
	[-10]	[-9]	[-8]	[-7]	[-6]	[-5]	[-4]	[-3]	[-2]	[-1]

► S1.index('r')

2

► S1.index('x')

ValueError

► S1.find('r')

2

► S1.find('x')

-1

► S1.startswith('A red')

True



Lists

- ▶ A collection data type that is ordered and changeable (mutable).
 - ▶ e.g. `[1, [3, 'hi', 4.5, [1,2,3]], []]`
- ▶ Use `[]` to index items; similar to strings
- ▶ Can have multiple indices, e.g. `list1[2][0]`, `list1[-2][-1][-3]`



```
Python 3.8.3 Shell
File Edit Shell Debug Options Window Help
>>> list1 = [1, 2.5, 'hello class', [2, 18, 12, 'house'], -8]
>>> list1[1]
2.5
>>> list1[2][0]
'h'
>>> list1[-2][-1][0:3]
'hou'
>>> list1[15]
Traceback (most recent call last):
  File "<pyshell#14>", line 1, in <module>
    list1[15]
IndexError: list index out of range
>>> list1[2:15]
['hello class', [2, 18, 12, 'house'], -8]
>>>
```

Lists (Examples)

List Methods

```
L = [1,2,3,[4,5,'a','b'], 'hello', '6', 7]
```

- ▶ `L.append([8,9])`

```
[[1, 2, 3, [4, 5, 'a', 'b'], 'hello', '6', 7, [8, 9]]
```

- ▶ `L += [8,9]`

```
[1, 2, 3, [4, 5, 'a', 'b'], 'hello', '6', 7, 8, 9]
```

- ▶ `L.index(3)`

```
2
```

range(n)

- ▶ *range(n)*: produces sequence 0, 1, 2, ... $n-1$
- ▶ *range([i,]stop[, k])*: sequence starts at i (instead of 0) and incremented by k (instead of 1)
- ▶ `range(5)` → produces sequence 0, 1, 2, 3, 4
- ▶ `range(3, 20, 4)` → produces 3, 7, 11, 15, 19

```
for i in range(5):  
    for j in range(10):  
        print(j)  
    print(i)  
print('done')
```



Dictionaries

- ▶ **dict**: an *unordered* collection of **key-value** pairs
 - ▶ *mutable*
 - ▶ unordered → no notion of index positions
 - ▶ Similar to “hash maps/associative arrays” in other programming languages
 - ▶ Key is the unique identifier and value is the data
- ▶ Example:
 - ▶ `student = {'name':'john', 'age':'25', 'courses':['8347','8117']}`



Dictionaries

```
student = {'name':'john', 'age':'25', 'courses':['8347','8117']}
```

```
>>>student['name']  
'john'
```

```
>>>student['25']
```

Traceback (most recent call last):

File "<pyshell#2>", line 1, in <module>

student['25']

KeyError: '25'

```
>>>student['marks']= 97
```

```
>>>print(student)
```

```
{'name': 'john', 'age': '25', 'courses': ['8347', '8117'], 'marks': 97}
```



Dictionaries

```
>>>del student['age']  
>>>print(student)  
{'name': 'john', 'courses': ['8347', '8117'], 'marks': 97}  
  
>>>student['name'] = 'Usama'  
>>>print(student)  
{'name': 'Usama', 'courses': ['8347', '8117'], 'marks': 97}  
  
>>>print(student.keys())  
#shows all the keys  
>>>print(student.values())  
#shows all the values
```

And so on....



Membership Operator

- ▶ **in**: tests for membership, returns True or False
- ▶ **not in**: tests for non-membership, returns True or False
- ▶ L = [1, [2,3], "ab", -23] S = "Python is great!"
 - ▶ [2,3] in L
True
 - ▶ 2 in L
False
 - ▶ 2 not in L
True
 - ▶ "on is" in S
True
 - ▶ "eat" not in S
False



Comparison Operators

- ▶ Basic comparison operators: $<$, $<=$, $==$, $!=$, $>=$, $>$
 - ▶ $a = 4, b=12$
 - ▶ $a < b \rightarrow \text{True}$
 - ▶ $a == b \rightarrow \text{False}$
 - ▶ $a >= b, a != b, a <= b \rightarrow (\text{False}, \text{True}, \text{True})$
- ▶ Can be chained
 - ▶ $2 <= a < b <= 20 \rightarrow \text{True}$



Logical Operators

Operator	Description	Example
and	Returns True if both statements are true	<code>x < 5 and x < 10</code>
or	Returns True if one of the statements is true	<code>x < 5 or x < 4</code>
not	Reverse the result, returns False if the result is true	<code>not(x < 5 and x < 10)</code>



References

- ▶ Programming in Python 3 A complete introduction to the python language (2nd Ed) by Mark Summerfield. Addison Wesley 2010.
- ▶ https://www.w3schools.com/python/python_operators.asp
- ▶ <https://www.youtube.com/watch?v=daefaLgNkw0>
- ▶ <https://www.scaler.com/topics/sequence-data-type-in-python/>
- ▶ <https://www.tutorialspoint.com/What-is-a-sequence-data-type-in-Python>
- ▶ <https://flexiple.com/python/comparison-operators-in-python/>
- ▶ https://www.w3schools.com/python/python_dictionaries.asp
- ▶ Slides from Dr. Jaekel and Dr. Saja

