UNSW Business School

COMM5007 Coding for Business

Lecture 3
Python Fundamentals Part 3

Jan 2024

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Reminder on Quiz 1

- Quiz 1 **at the beginning** of Lab 3 on Wed, Jan 10 and Thurs, Jan 11
- What to bring
  - **2B pencil and eraser**
  - Any printed material (Open book, but not open laptop)
  - Student card (tutor will verify)
- Each lab will use different questions, but at the same difficulty level
- The content in lecture 1 and 2 is covered
- No collaboration
- 7 Multiple choice questions; 15 minutes; 7.5% of final grade
- Only 1 answer for each question; no negative mark for wrong answers

Individual and Team Assignment

- 10%: One (1) individual assignment
  - Turnitin submission of .docx file
  - Publish on Wed, 10 Jan 2024
  - Submission by Fri, 19 Jan 2024, 14:59

- 30% team assignment
  - Lab 8: Team Assignment Presentation in person on campus (hence Monday tutorials in week 5 are in person)
  - Publish on Fri, 19 Jan 2024
  - Submission: .ipynb, .pptx by Mon, 29 Jan 2024, 12:59

Outline

- **Tuple**
- List
- Set
- Dictionary

Tuple

- A **tuple** is a sequence of values separated by commas.
  - The values stored in a tuple can be any type, and they are indexed by integers.
  - Tuples are used to store **multiple items** in **a single variable**.

```
my_tuple = ("country music", 5, 3.65)
                # music style, music typeID, avg length
my_tuple
```

- Check the type of the tuple

```
type(my_tuple)
```

Indexing tuple elements

- A tuple may have many elements
- Each element can be accessed via an index
- Relationship between the index and the items in the tuple

```
my_tuple = ("country music", 5, 3.65)
```

Index	Index	element
0	-3	"country music"
1	-2	5
2	-1	3.65

```
print(my_tuple[0])
print(my_tuple[1])
print(my_tuple[2])

print(my_tuple[-3])
print(my_tuple[-2])
print(my_tuple[-1])
```

Slicing tuples

- We can slice a tuple to obtain new tuples with the corresponding elements.

- We can obtain the first N elements of a tuple

```
tuple1 = (“country music”, 5, 3.65, 25010, "yes")
tuple1[0:3] # first 3 elements
```

- We can obtain the last N elements of a tuple

```
tuple1[-3:] # last 3 elements
```

Tuples are immutable

We cannot change the elements of the tuple or the tuple itself once it's created.

```
# an example of immutable
Creating a tuple
my_tuple = (1, 2, 3, 4, 5)

# Trying to change a value in the tuple
my_tuple[0] = 10  # what happens?
```

We can concatenate tuples by using the + sign

```
tuple1 = ("country music", 5, 3.65)
tuple2 = tuple1 + (25010, "yes") # total music count, availability
tuple2
```

Index	Index	element
0	-5	**"country music"**
1	-4	**5**
2	-3	**3.65**
3	-2	**25010**
4	-1	**"yes"**

Nested tuple

- A tuple can contain another tuple as well as other data types. This process is called “nesting”.
- Consider the following tuple with nesting:

```
tuple_nested = ( ("country music", "country and western") , 5, 3.65)
```

- In a nested tuple, an element can be a tuple.

Index	Element
0	**("country music", "country and western")**
1	**5**
2	**3.65**

Accessing the second level elements in a nested tuple

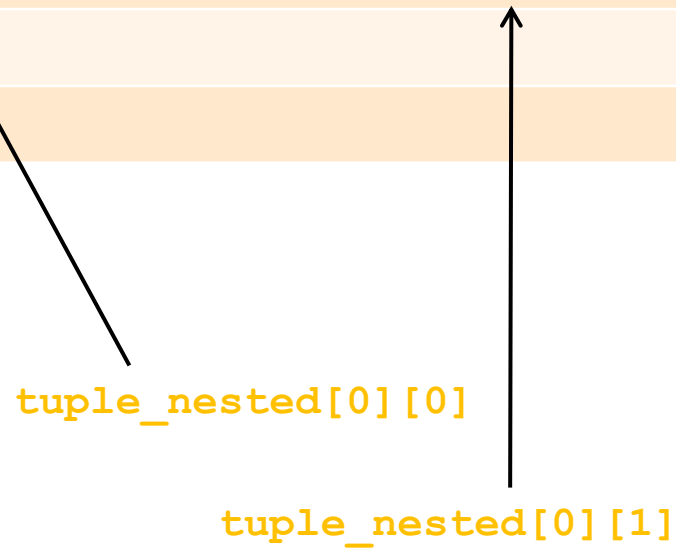
We can use the second index to access the 2nd level elements.

```
tuple_nested = ( ("country music", "country and western") , 10, 3.5)
```

Index	element
0	**("country music", "country and western")**
1	**10**
2	**3.5**

```
# Print element on each index, including nest indexes
print("tuple_nested[0] is:  ",   tuple_nested[0])
print("tuple_nested[0][0] is:  ",   tuple_nested[0][0])
print("tuple_nested[0][1] is:  ",   tuple_nested[0][1])
```

```
tuple_nested[0] is:   ('country music', 'country and western')
tuple_nested[0][0] is:   country music
tuple_nested[0][1] is:   country and western
```



Example: Employee Record

Imagine a human resources system where employee records are stored. Each employee record might include the employee ID, name, role, and hire date.

```
# Defining an employee record as a tuple
employee_record = (101, "John Doe", "Software Engineer", "2023-09-26")

# Accessing elements in the tuple
employee_id = employee_record[0]  # 101
employee_name = employee_record[1]  # "John Doe"
employee_role = employee_record[2]  # "Software Engineer"
hire_date = employee_record[3]  # "2023-09-26"
```

Summary

- A tuple is used to store multiple data items in a single variable.
- A tuple is written with **round** brackets **( )**.
- A tuple is a collection of data items which is **immutable**.

	Mutable	Ordered	Indexing	Duplicate Data
Tuple	✗	✓	✓	✓

Outline

- Tuple
- **List**
- Set
- Dictionary

List

- A list is a collection of elements or items (e.g., strings, numbers) enclosed by a square bracket with each element separated by a comma

```
months = ['Jan', 'Feb', 'Mar’]
```

- A list can contain other Python objects, e.g., a tuple

```
mixed = ['spam', 2.0, 5, (10, 20)]
```

- A list can be empty

```
mixed = []
```

- Print out the list directly will print each element one by one.

```
months = ['Jan', 'Feb', 'Mar']
print(months) # print the list directly
```

Building a new list can be done by two methods

- Method 1: use built-in function `list()`

```
fruits = list()
```

- Method 2: use square brackets

```
fruits = [] # more common
```

Positive indexing in a List

- The address of each element within a list is called an **index**. An index is used to access and refer to items within a list.
- Elements are indexed in list

```
months = ['Jan', 'Feb', 'Mar']
print(months[0])
print(months[1])
print(months[2])
```

Index	element
0	‘Jan’
1	‘Feb’
2	‘Mar’

Negative indexing in a List

The index starts from -1 at the end, and decreases as we go towards the left

Index	element
0 (-3)	‘Jan’
1 (-2)	‘Feb’
2 (-1)	‘Mar’

```
months = ['Jan', 'Feb', 'Mar']
print(months[-3])
print(months[-2])
print(months[-1])
```

List is mutable/changeable, unlike a tuple

- We can **change the items in a list or reassign an item in a list** after the list is formed
- When the index appears on the left side of an assignment, it identifies the element of the list that will be changed

```
days = ['Mon', 'Tue', 'Wed']
days[0] = 'Sun'
print(days)
```

Concatenating and slicing a list

```
first = ['Mon','Tue', 'Wed']
second = ['Thu', 'Fri']
third = ['Sat', 'Sun']

days_of_week = first + second + third   #concatenating
print(days_of_week)
print(len(days_of_week))
print(days_of_week[0:3])  #slicing
```

Note: [0:3] means the index starts with 0, and the ending index is up to but not including index 3

Exercise

Build a list with the following four elements

1, hello, [1,2,3,4] and True

```
my_list = [1, 'hello', [1,2,3,4], True]
```

What does the below retrieve?

```
print(my_list[2][3])
print(my_list[1][2])
```

Popular built-in functions for list operations: `append()`, `sort()`


```
fruits = list() # or fruits = [ ]
fruits.append('apple')
#append() can add ONE element to the end of the list

fruits.append('orange')
fruits.append('banana')
print(fruits)

fruits.sort()
print(fruits)
print(len(fruits))
```

Popular built-in functions for list operations: `insert()`, `extend()`

```
fruits = ['apple', 'orange', 'banana’]
fruits.insert(1, 'peach')
print(fruits)

fruits = ['apple', 'orange', 'banana’]
fruits.extend(['peach’, ‘pear’])
print(fruits)
```

Popular built-in functions for string operations: `.split()`

We can convert a string (a sentence with spaces between words) into a list of words

```
desc = 'This course introduces various techniques'
word_in_desc = desc.split()
print(word_in_desc)
```

Summary of List properties

	Mutable	Ordered	Indexing	Duplicate Data
Tuple	✗	✓	✓	✓
List	✓	✓	✓	✓

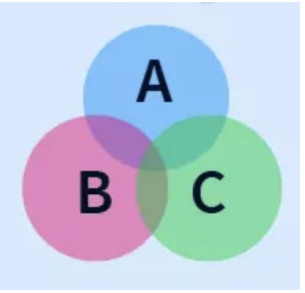
Key differences: Tuple vs. List

List	Tuple
Enclosed by square brackets [ ]	Enclosed by parentheses ( )
Mutable - Elements can be modified - We can add items to a list - We can remove items in a list	Immutable - Elements cannot be modified - We cannot add items to a tuple - We cannot remove items in a tuple
More functions can be performed on a list	Less functions can be performed on a tuple
Less memory efficient	More memory efficient

Outline

- Tuple
- List
- **Set**
- Dictionary

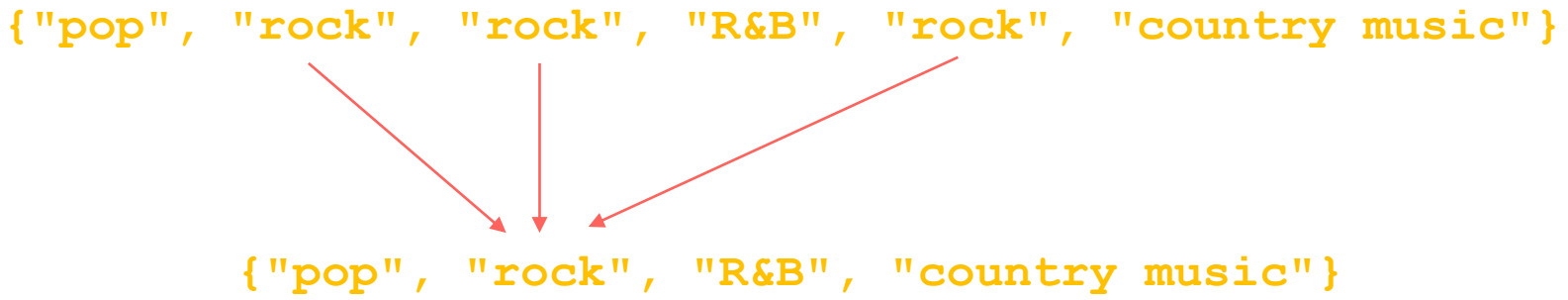
Set



- A set is a collection of **unordered unique** objects in Python. You can denote a set with a pair of curly brackets **{ }**.
  - Objects can be of different data types.
- Python will **automatically remove duplicate items** in a set when you create it.

```
set1 = {"pop", "rock", "rock", "R&B", "rock", "country music"}
set1
```

- What really happened?



Create a set from a list

```
album_list = [ "pop", "rock", "rock", "R&B", "rock" ]
album_set = set(album_list) #set() converts a list to a set
album_set
```

What is the printout?

```
{'R&B', 'pop', 'rock'}
```

Set Operations

- `add()` method: add an element to a set
- `remove()` method: remove an item from a set
- `in` command: verify if an element is in the set

```
A = set(["Yesterday once more", "Five hundred miles",
"Paradise"])
print(A)

A.add("My all in all")
print(A)

A.remove("My all in all")
print(A)

"My all in all" in A
```

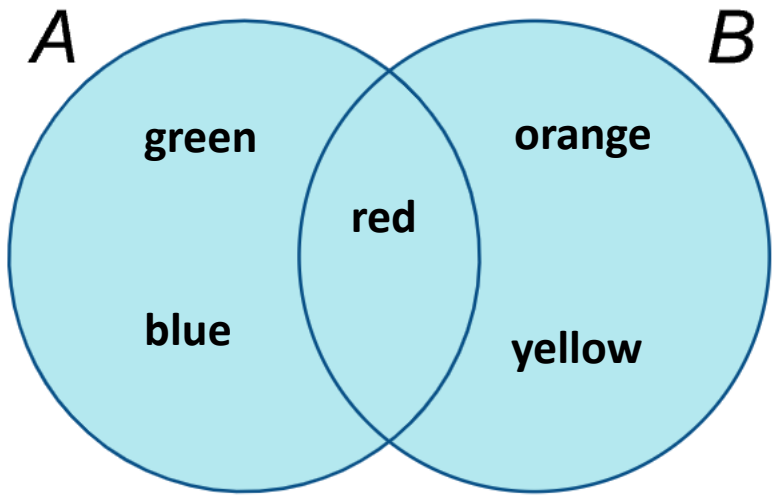
Set Operations: union on two or more sets

- `union()` method
- operator |

```
A = {'red', 'green', 'blue'}
B = {'yellow', 'red', 'orange'}

# by operator
print(A | B)

# by method
print(A.union(B))
```



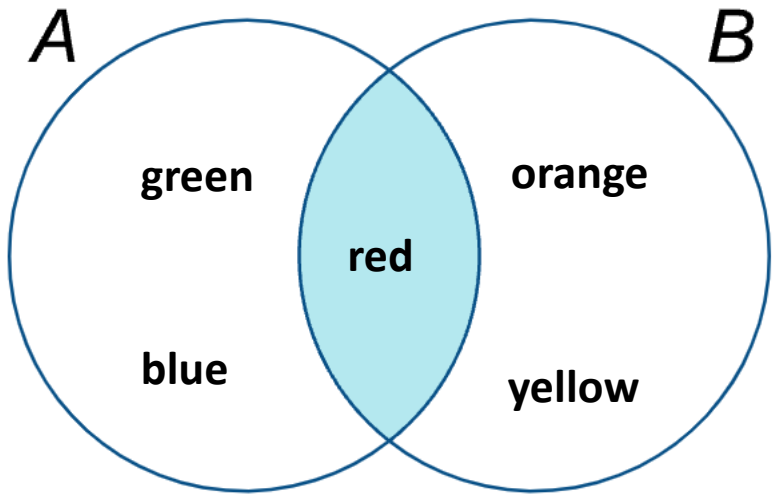
Set Operations: intersection on two or more sets

- `intersection()` method
- operator `&`

```
A = {'red', 'green', 'blue'}
B = {'yellow', 'red', 'orange'}

# by operator
print(A & B)

# by method
print(A.intersection(B))
```



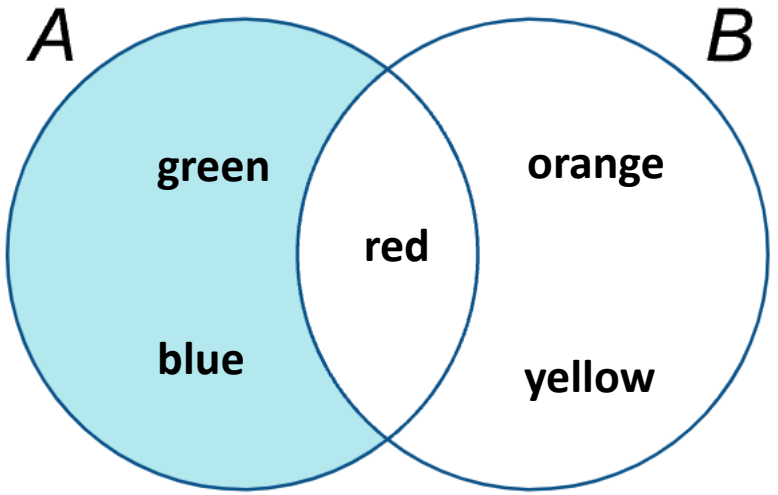
Set Operations: difference between two or more sets

- `difference()` method
- operator `-`

```
A = {'red', 'green', 'blue'}
B = {'yellow', 'red', 'orange'}

# by operator
print(A - B)

# by method
print(A.difference(B))
```



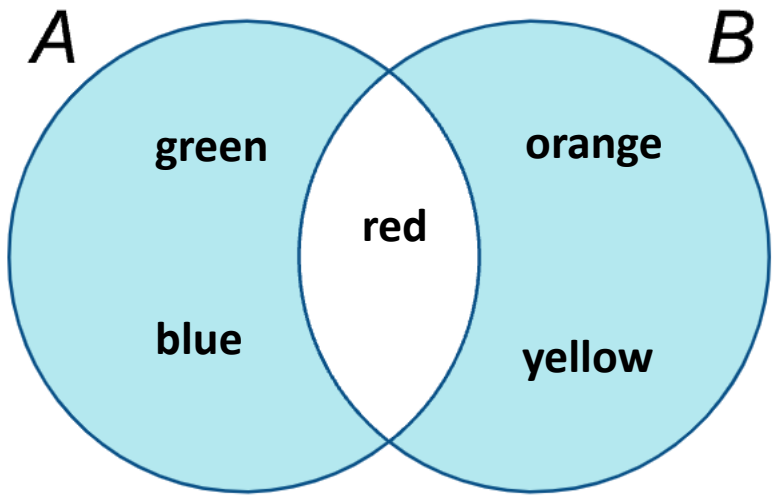
Set Operations: Symmetric difference between two or more sets

- `symmetric_difference()` method
- operator `^`

```
A = {'red', 'green', 'blue'}
B = {'yellow', 'red', 'orange'}

# by operator
print(A ^ B)

# by method
print(A.symmetric_difference(B)
```



Exercise: Perform set operations

```
A = {0, 2, 4, 6, 8}
B = {1, 2, 3, 4, 5}

# union
print("Union :", A | B)
# intersection
print("Intersection :", A & B)
# difference
print("Difference :", A - B)
# symmetric difference
print("Symmetric difference :", A ^ B)
```

What is the printout?

```
Union : {0, 1, 2, 3, 4, 5, 6, 8}
Intersection : {2, 4}
Difference : {0, 8, 6}
Symmetric difference : {0, 1, 3, 5, 6, 8}
```

Summary of Set properties

	Mutable	Ordered	Indexing	Duplicate Data
Tuple	✗	✓	✓	✓
List	✓	✓	✓	✓
Set	✓	✗	✗	✗

- **Mutable:** Elements can be changed.
- **Unordered:** Items stored in a set aren't kept in any particular order.
- **Unindexed** – You cannot access set items by referring to an index.
- **No duplicate data**

Outline

- Tuple
- List
- Set
- **Dictionary**

Dictionary

- A dictionary is **a mutable, unordered collection** that stores mappings of unique keys to values. The building blocks are **key-value pairs**
- Values can be of any data type
- Values of the Python dictionary may or may not be unique.
- Keys are always **unique/only a single element** within a dictionary, because keys help us locate the data in the dictionary.
- Keys must be **immutable**. Hence, the key can only be **strings, numbers or tuples**.

```
veggie_price = {'green pepper':15, 'tomato':6.9, 'green onion':3.5}
```

What is inside a dictionary?

- A dictionary holds a sequence of elements.
- Each element is a key-value pair

```
veggie_price = {'green pepper':15, 'tomato':6.9, 'green onion':3.5}
```

Key	Value
'green pepper'	15
'tomato'	6.9
'green onion'	3.5

Create a dictionary

- Straightaway type out the key-value pairs in {}

```
veggie_price = {'green pepper':15, 'tomato':6.9, 'green onion':3.5}
print(veggie_price)
```

- Start with an empty dictionary

```
fruit_price = dict()
fruit_price = {} # more common
fruit_price['apple'] = 3.5 # does the key exist previously?
fruit_price['orange'] = 5
fruit_price['blueberry'] = 20
print(fruit_price) #{'apple': 3.5, 'orange': 5, 'blueberry': 20}
```

Extracting data from a dictionary

- We can refer to a key in a dictionary and extract the value for that key, `Dictionary_name['key_name']`

```
veggie_price2 = {'green pepper':15, 'tomato':6.9}
print(veggie_price2 ['tomato’])
# does the key exist?
```

Another way to extract data from a dictionary…

`get()` returns the value given a key as an argument, and does not trigger an error if the key is non-existent

```
veggie_price2 = {'green pepper':15, 'tomato':6.9}
print(veggie_price2)

veggie_price2['potato'] # what happens?

veggie_price2.get('potato') # what happens?
```

Adding and changing the elements in a dictionary

How do we differentiate whether we are adding a new key-value pair, or changing the value of an existing key?

```
veggie_price2 = {'green pepper':15, 'tomato':6.9}
print(veggie_price2)

veggie_price2['green onion'] = 3.5 # add new key-value pair
veggie_price2['tomato'] = 3 # update an existing key's value
print(veggie_price2)
```

Other methods (1/2)

- Get all the keys in dictionary

```
veggie_price2.keys()
```

- Get all the values in dictionary

```
veggie_price2.values()
```

- **`items()`** returns a view object. The view object contains the key-value pairs of the dictionary, as a list of tuples.

```
veggie_price2 = {'green pepper':15, 'tomato':6.9}
veggie_price_tuple = veggie_price2.items()
print(veggie_price_tuple)
```

What's the printout?

```
dict_items([('green pepper', 15), ('tomato', 6.9)])
```

Other methods (2/2)

- Delete elements (key-value pairs) by the key

```
del(veggie_price2['tomato’])
```

- Checking the existence of a key in a dictionary using the ‘**in**’ operator

```
veggie_price2 = {'green pepper':15, 'tomato':6.9}
print('tomato' in veggie_price2.keys())
```

Summary of Dictionary properties

	Mutable	Ordered	Indexing	Duplicate Data
Tuple	✗	✓	✓	✓
List	✓	✓	✓	✓
Set	✓	✗	✗	✗
Dictionary	✓	✓	✓	✗

Built-in Function: `sorted()`

- `sorted()` function takes a given **tuple, list, string, set, or dictionary** as a parameter and return a sorted **list** with the same elements in ascending or descending order.

- E.g., sort a tuple of scores and save the sorted result to **a new list.**

```
scores = (0, 3, 2, 5, 10, 8, 9)
scores_sorted = sorted(scores)
scores_sorted # [0, 2, 3, 5, 8, 9, 10]
```

- How do we sort the tuple in descending order?

```
scores = (0, 3, 2, 5, 10, 8, 9)
scores_sorted = sorted(scores, reverse=True)
scores_sorted # [10, 9, 8, 5, 3, 2, 0]
```

Recap Exercise

- What happens if we sort the dictionary below?
- What are we sorting by?
- What do the sorted result contain? Key-value pairs?

```
name_scores = {'John':15, 'Mary':69, 'Atul': 63}
sorted_list = sorted(name_scores)
sorted_list
```