Lab 1
Introduction to Python

Sep 14, 2023

Department of Computing

The Hong Kong Polytechnic University

Today's Arrangement

- Lecture and lab Schedule
- Introduction to lab sessions
- Python basics
  1. Prepare the Python Environment
  2. Data types
  3. Basic operators
  4. Conditions and Conditional statements
  5. Loops
  6. Function declaration
  7. File operations
  8. Module importing
- Practice with tutorials on Numpy, Pandas, Matplotlib, and networkX

Lecture and lab Schedule

Lecture and lab Schedule

Week	Date	Quiz in TU101 (12:30 - 12:50)	Lecture in TU101 (12:50 - 14:20)	Lab in PQ603& 604 A-C (14:30 - 15:20)	Remarks
1	Sept. 7	Introduction to COMP4431			
2	Sept. 14	Heuristic Search	Entrepreneurship in AI	Introduction to Python	
3	Sept. 21	Quiz 1	Constrains	Introduction to ChatGPT	The deadline of movie selection
4	Sept. 28	Quiz 2	Decision Tree	Generate PPT using ChatGPT	Announcement of the Presentation order
5	Oct. 5	Quiz 3	Machine Learning	Blind Search	
6	Oct. 12	Presentation 1		Heuristic Search	The deadline of Lab assignment 1 is Oct. 11
7	Oct. 19	Presentation 2		Decision Tree	The deadline of Lab assignment 2 is Oct. 18
8	Oct. 26	Presentation 3		Clustering	The deadline of Lab assignment 3 is Oct. 25
9	Nov. 2	Presentation 4		Classification	The deadline of Lab assignment 4 is Nov. 1
10	Nov. 9	Quiz 4	Neural Networks	Neural networks	The deadline of Lab assignment 5 is Nov. 8
11	Nov. 16	Quiz 5	Deep Learning	Convolutional neural networks	The deadline of Lab assignment 6 is Nov. 15
12	Nov. 23	Quiz 6	Bayesian	Bayesian	The deadline of Lab assignment 7 is Nov. 22
13	Nov. 30	Quiz 7	Final Exam Review	Transformer	The deadline of Lab assignment 8 is Nov. 29

Introduction to Lab Sessions

Introduction to Lab Sessions

- TA Responsible for the lab teaching:
  - Xiao MA
  - edward-xiao.ma@connect.polyu.hk
- Aims of Lab Sessions
  - Getting familiar with AI algorithms
  - Gaining hands-on experience in programming
  - Training for problem-solving abilities
- A few In-class Exercises in each lab session
  - Not influence your gradings
- Eight lab assignments
  - 1-4 members per group (the same groups as the Course Presentation by default)
  - Submit only one copy of your solutions on each lab assignment
  - All members are given the same score by default
  - 16 % of the final grading (each assignment contributes 2%)

Introduction to Lab Sessions

- All materials will be available on Blackboard (learn.polyu.edu.hk)
  - Lab slides (PDF files): Available after each session
    - Main contents of lab teaching, exercises, etc.
    - Release and check of assignments
  - Lab exercises (Jupyter Notebook files): Available before each session
    - Example code of problems of in-class exercises
    - Tutorials of some Python packages
  - Assignment answers (Jupyter Notebook files): Available after each session
- Self-learning resources
  - Stuart Russell and Peter Norvig, "Artificial Intelligence A Modern Approach", third edition.
  - Tutorials and documents of Python
    - https://www.learnpython.org/
    - https://www.w3schools.com/python/
  - Official documents of packages (scikit-learn, pandas, numpy, torch, etc.)
  - Ask ChatGPT

Python Basics

Python Basics

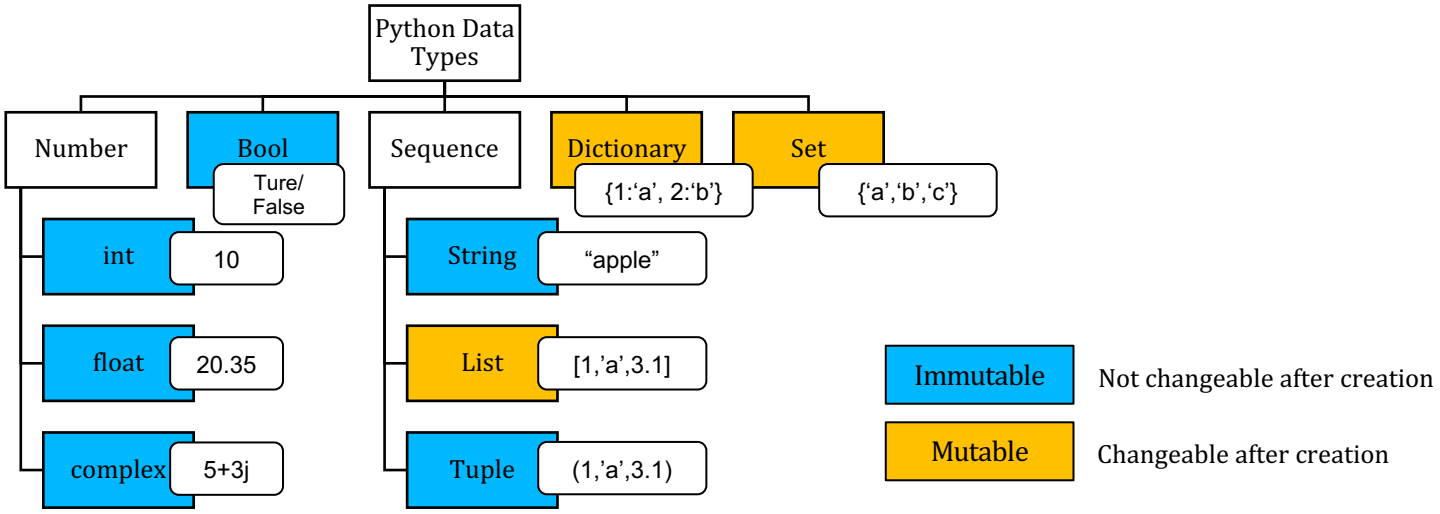
1. Prepare the Python Environment

- Anaconda
  - A popular distribution of Python, which comes with the most fundamental data science, AI, and machine learning packages (NumPy, Pandas, Matplotlib, seaborn, scikit-learn, etc.)
- Jupyter notebook
  - A web-based interactive computational application
  - Combine code, output, and rich text in a single document
  - You should submit a .ipynb file for each of the assignments
- Quick Start
  - Install Anaconda from https://www.anaconda.com/
  - Launch Jupyter notebook

Python Basics

2. Data Types

- Variables and Objects
  - Variables don't have an associated type or size, because they just hold references to objects.
  - Objects live in concrete memory positions.
- Mutable and immutable types



- Four collection data types: Tuple, List, Set, Dictionary

Reference: https://realpython.com/python-mutable-vs-immutable-types/

Python Basics

- Tuple
  - A tuple is an ordered, indexed, and **unchangeable** collection of elements
  - Written with round brackets ()
  - Tuple items can be of the same or different data types

```
In [1]: tuple1 = (1,'str', True)
        print(tuple1[0])

1
```

- List
  - A list is an ordered, indexed, and **changeable** collection of elements
  - Written with square brackets []
  - List items can be of the same or different data types

```
In [2]: list1 = [1,'str', True]
        print(list1[1])
        list1.append(3.14)
        print(list1)

str
[1, 'str', True, 3.14]
```

Python Basics

- Set
  - A set is an **unordered and unindexed** collection of elements
  - Written with curly brackets {}
  - Set items can be of the same or different data types
  - Duplicates are not allowed

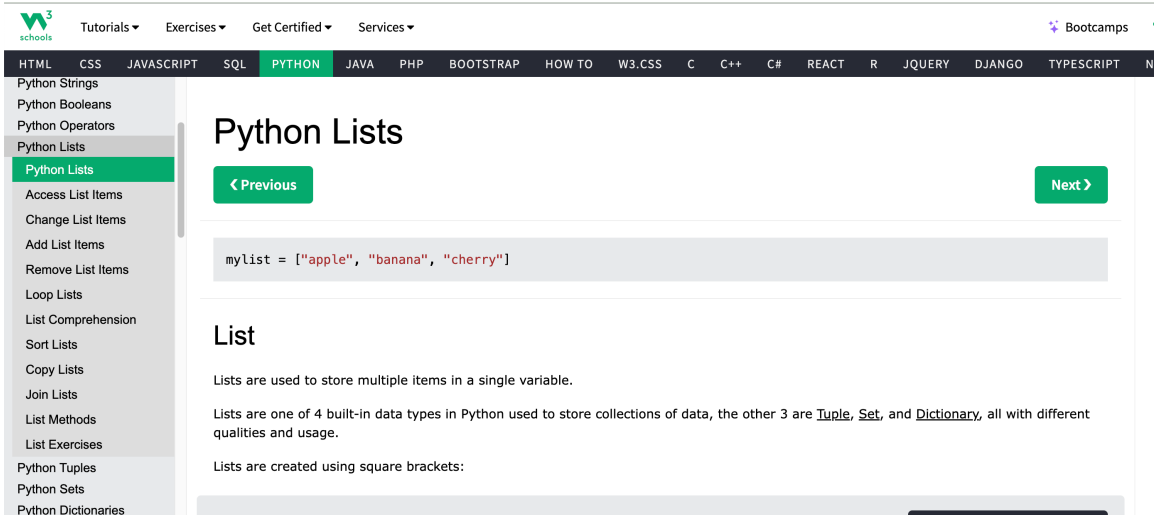
```
In [3]: set1 = {"18","19",True,32}
```

- Dictionary
  - A dictionary is a collection of key:value pairs.
  - Written with curly brackets, and has keys and values
  - The values in dictionary items can be of any data type
  - Duplicates are not allowed (cannot have two items with the same key)

```
In [4]: dict1 = {
          "brand": "Ford",
          "electric": False,
          "year": 1964,
          "colors": ["red", "white", "blue"]
        }
```

Python Basics

- Exercise 1: Create and modify variables
  - Use the assignment operator (=) to assign values to variables
  - Try different data types
  - Find more properties and operations of different data types through the online document. https://www.w3schools.com/python/



Python Basics

3. Basic operators

- Types of operators
  - Arithmetic Operators: Addition(+), Subtraction(-), Multiplication(*), Division(/), Modulus(%), Exponent(**), Floor Division (//)
  - Comparison (Relational) Operators: Equals(==), Not equals(!=), Greater than(>), Less than(<), Greater than or equal to(>=), Less than or equal to(<=)
  - Assignment Operators: =, +=, -=, *=, /=, %=, **=, //=
  - Bitwise Operators: &, |, ^, ~, <<, >>
  - Logical Operators: and, or, not
  - Membership Operators: in, not in
  - Identity Operators: is, is not

- Operators Precedence
  - https://www.geeksforgeeks.org/precedence-and-associativity-of-operators-in-python/

Python Basics

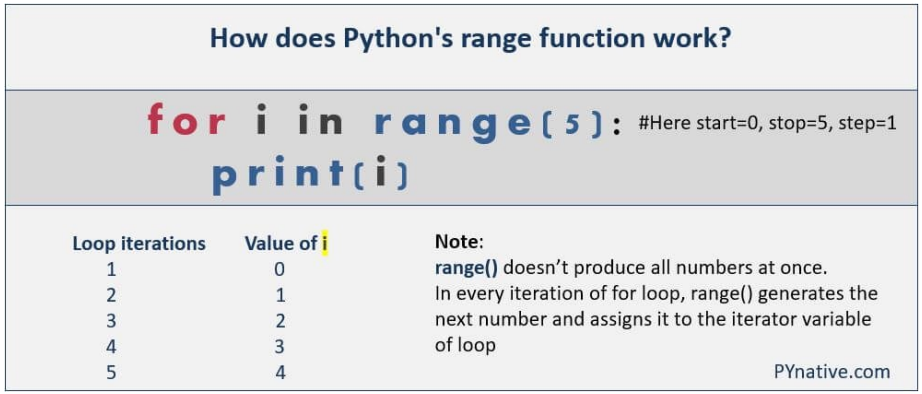
4. Conditions and Conditional statements

- Python supports the usual logical conditions from mathematics:
  - Equals: a == b
  - Not Equals: a != b
  - Less than: a < b
  - Less than or equal to: a <= b
  - Greater than: a > b
  - Greater than or equal to: a >= b
- Conditional statements: if…elif…else
- For multi-conditions, use “and”, “or” and “not” to connect.

Python Basics

5. Loops

- For Loop
  - *for …… in ……： statement A*
  - The most common used statement for loops
  - Usually combined with range (start, end, step)



- While Loop
  - *while …… ： statement A*
  - Will implement A until it satisfies the condition of while.

Python Basics

- Use the keyword *break* inside a loop to leave the loop.
- Use the keyword *continue* inside a loop to stop processing the current iteration of the loop and immediately go on to the next round.
- You can write another loop inside a loop.

Python Basics

- Exercise 2: Loops
  - Calculate the sum from 1 to 100.
  - Calculate the sum of the even numbers from 1 to 100 (2, 4, 6, …).
  - Try both “for loop” and “while loop”

Python Basics

6. Function declaration

- Functions are defined as:

```
def TheNameOfFunction (para1, para2):
    ……
    return Outcome
```

- Then the function will return the value of its outcome to wherever the function is called.

Python Basics

- Exercise 3: Function declaration
  - Write a function to calculate the area of a rectangle
  - It takes two arguments, length and width, and returns the area of a rectangle with the given dimensions
  - The function should check if the input values are positive numbers and print an Error message if they are not.

Python Basics

7. File operations

- Use the built-in open() function to work with files in Python
- open() function takes two parameters: filename and mode
- The mode can be:
  - "r" - Read - Default value. Opens a file for reading, error if the file does not exist
  - "w" - Write - Opens a file for writing, creates the file if it does not exist
  - "a" - Append - Opens a file for appending, creates the file if it does not exist
  - …
- Use write() function to write a specified text to the file
- Use close() function to close an open file.

Python Basics

- Exercise 4: File operations
  - Create a new file
  - Write to the file
  - Close the file
  - Read the content in the file

Python Basics

8. Module importing

- Import a module by typing:

  import numpy

- Or for short by:

  import numpy as np

- Sometimes you do not have to import the whole module, like:

  from scipy. stats import norm

- Some modules we will encounter:
  - Numpy: Efficient manipulation of multidimensional arrays. Efficient mathematical functions.
  - Matplotlib: Visualizations 2D and 3D plots.
  - Pandas: Statistical and data analysis
  - NetworkX: creation, manipulation, and study of graphs

Practice with tutorials on Numpy, Pandas, Matplotlib, and networkX

Check the Part 2 of Lab1-Exercise.