CS305 Lab2
Introduction to Python & WireShark

Dept. Computer Science and Engineering
Southern University of Science and Technology

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Part. A

Introduction to Python

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Python

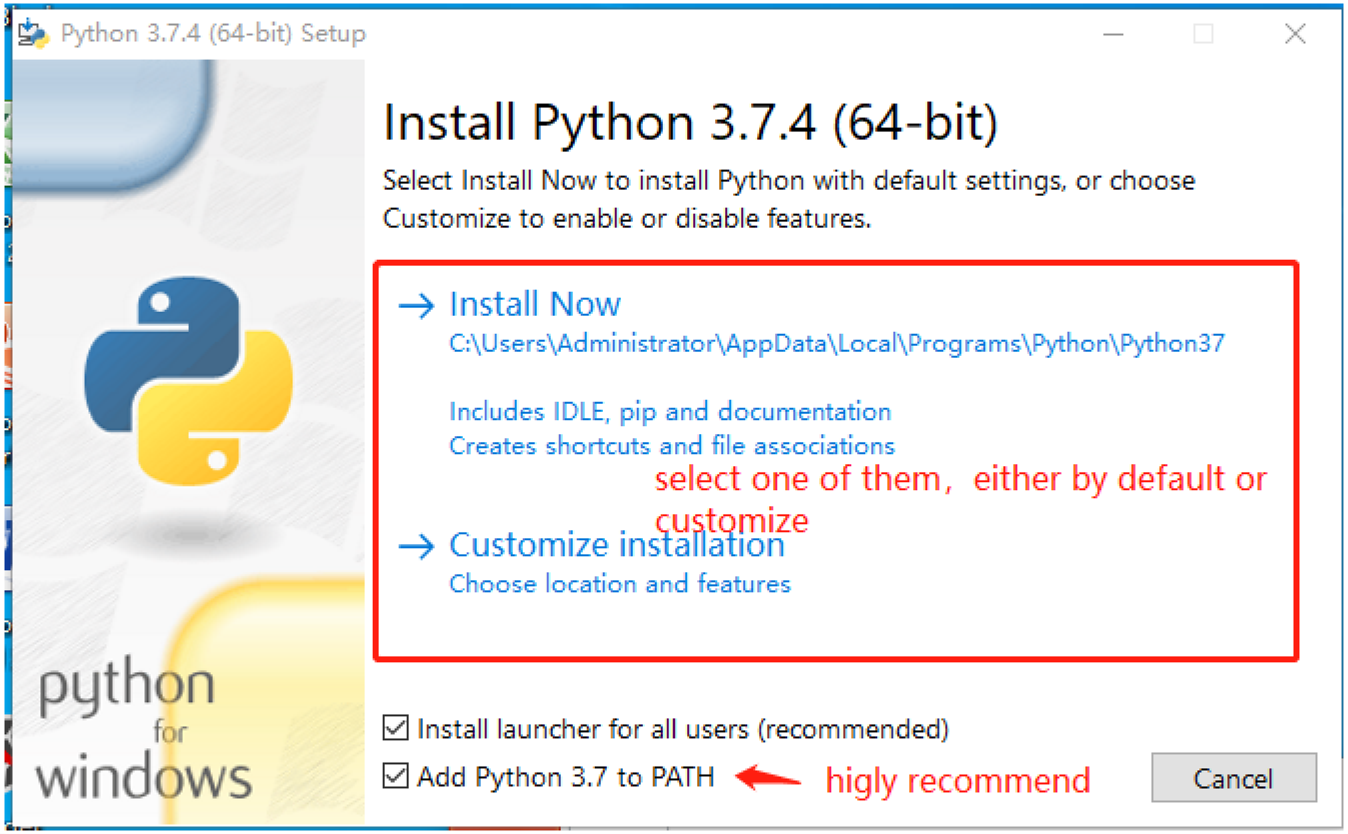
- Python is an interpreted high-level object-oriented programming language.
- First release in 1991.
- Official Tutorial: https://docs.python.org/3/tutorial/

Install python(1)

The Installation package can be got from https://www.python.org/downloads/

You can choose install it by default settings or customize installation.

It is highly recommend that choose 'Add Python xx to PATH', or you need to set PATH by hand.



Python 3.7.4 (64-bit) Setup

Install Python 3.7.4 (64-bit)

Select Install Now to install Python with default settings, or choose Customize to enable or disable features.

→ Install Now
C:\Users\Administrator\AppData\Local\Programs\Python\Python37

Includes IDLE, pip and documentation
Creates shortcuts and file associations

select one of them, either by default or customize

→ Customize installation
Choose location and features

☑ Install launcher for all users (recommended)
☑ Add Python 3.7 to PATH ← higly recommend

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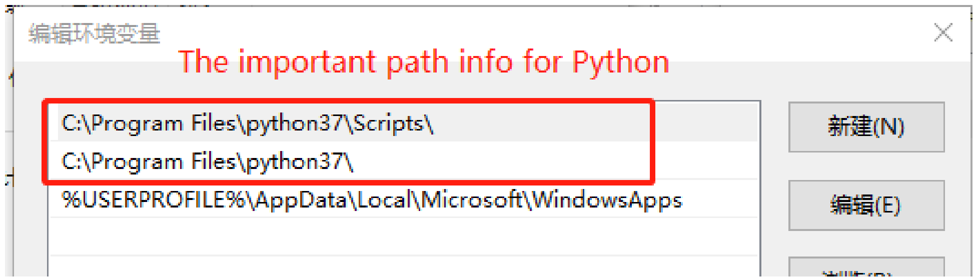
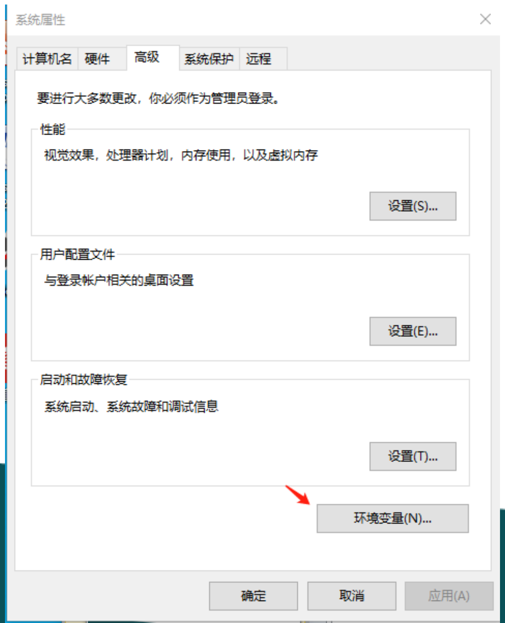
Install python(2)

- If the ‘Add Python xx to PATH’ is not set while installing, configure ‘Path’ manually according to the following steps after the installation.
  - Right click ‘my computer’ on the desktop
  - select ‘attribute’ -> ‘advanced attribute’ ->environment variable
  - configure ‘Path’ with the path where python.exe belongd and it’s subdirectory ‘Script’



The important path info for Python

```
C:\Program Files\python37\Scripts\
C:\Program Files\python37\
%USERPROFILE%\AppData\Local\Microsoft\WindowsApps
```



要进行大多数更改，你必须作为管理员登录。

性能

视觉效果，处理器计划，内存使用，以及虚拟内存

用户配置文件

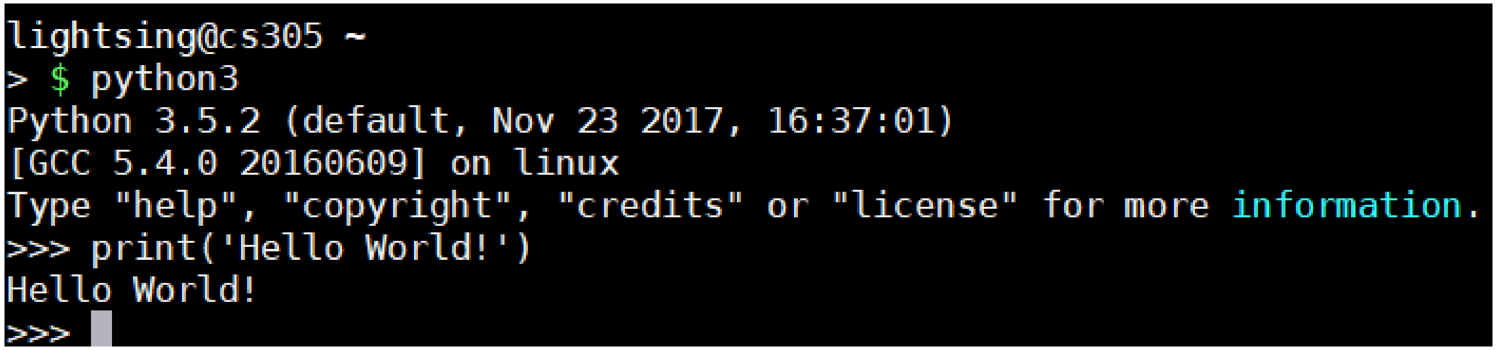
与登录帐户相关的桌面设置

启动和故障恢复

系统启动、系统故障和调试信息

Read-Eval-Print Loop

- Python has an REPL playground.
- Type and get feedback.



```
lightsing@cs305 ~
> $ python3
Python 3.5.2 (default, Nov 23 2017, 16:37:01)
[GCC 5.4.0 20160609] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> print('Hello World!')
Hello World!
>>>
```

Basic Types and Operations

- The following standard types are built in the interpreter:
  - Numeric Types — int, float, complex
  - Boolean Type — True, False
  - Text Sequence Type — str
  - Sequence Types — list, tuple, range
  - Set Type & Dict Type
  - Binary Sequence Types — bytes, byte array
- There are predefined operations on each type
- Ref: https://docs.python.org/3/library/stdtypes.html

Sequence Types

- List

```
animals = ['dog', 'cat', 'bird']
animals[0] # => 'dog'
animals[0] = 'puppy'
```

- Tuple

```
animals = ('dog', 'cat', 'bird')
animals[0] # => 'dog'
animals[0] = 'puppy'
Traceback (most recent call last):
    File "<stdin>", line 1, in <module>
TypeError: 'tuple' object does not support item assignment
```

Unpacking from Sequence Types

- List

```
foo, bar = ['dog', 'cat']
foo # => 'dog'
bar # => 'cat'
```

- Tuple

```
foo, bar = ('dog', 'cat')
foo # => 'dog'
bar # => 'cat'
```

Set & Dict

- Set

```
animals = set()
animals.add('dog')
animals    # => {'dog'}
```

- Dict

```
alias = dict()
alias['dog'] = 'puppy'
alias[['pig']] = ['hog']
Traceback (most recent call last):
   File "<stdin>", line 1, in <module>
TypeError: unhashable type: 'list'
```

Immutable & Mutable

- mutable: it is possible to change its content
- Immutable Type: Numeric, Boolean, str, tuple, bytes, etc.
- Mutable Type: list, dict, set, etc.
- Example:

```
>>> cubes = [1, 8, 27, 65, 125]  # something's wrong here
>>> 4 ** 3  # the cube of 4 is 64, not 65!
64
>>> cubes[3] = 64  # replace the wrong value
>>> cubes
[1, 8, 27, 64, 125]
```

Boolean Values

- Following values are treated as False:
  - `None, False`
  - `0, 0.0, 0j, Decimal(0), Fraction(0, 1)`
  - `'', (), [], {}, set(), range(0)`
- Otherwise they are True

Flow Control — if

- Example:

```
foo = []
if foo:
    print(foo)
else if foo == []:
    print('100% sure foo is empty')
else:
    print('what hell?')
```

Flow Control — if

- Example:

```
foo = [1, 2, 3, 4]
if foo:
    print(foo)
else if foo == []:
    print('100% sure foo is empty')
else:
    print('what hell?')
```

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Flow Control — for

- Example:

```
foo = ['dog', 'cat', 'bird']
for bar in foo:
   print(bar)
for index, value in enumerate(foo):
   print('%d: %s' % (index, value))
   print('{0}: {1}'.format(index, value))
for i in range(10):
   print(i)
```

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Flow Control — while

- Example:

```
foo = 10
while foo > 0:
    print(foo)
    foo -= 1
```

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Defining Functions

- Example:

```
def fib(n):  # write Fibonacci series up to n
    a, b = 0, 1
    while a < n:
        print(a, end=' ')
        a, b = b, a+b
    print()
```

Defining Functions

- Example:

```
def fib2(n): # return Fibonacci series up to n
    result = []
    a, b = 0, 1
    while a < n:
        result.append(a)    # see below
        a, b = b, a+b
    return result
```

Closure

- A closure is an inner function that has access to the outer (enclosing) function's variables.
- Example:

```
def add(x):
    def addX(y):
        return y + x
    return addX
foo = add(1)
print(foo(2)) # => 3
```

Defining Classes

```
class Animal:
    def __init__(self, name):
    self.name = name

class Duck(Animal):
    def __init__(self, name):
        super(Duck, self).__init__(name)
   @staticmethod
    def quack():
        print('Quack')
```

Duck Type

- ″If it walks like a duck and it quacks like a duck, then it must be a duck″

```
class Dog(Animal):
    def __init__(self, name):
        super(Duck, self).__init__(name)
    @staticmethod
    def quack():
        print('Quack')
```

Duck Type

- ″If it walks like a duck and it quacks like a duck, then it must be a duck″

```
func testDuck(duck):
    duck.quack()

duck = Duck('Tommy')
dog = Dog('Fox')
testDuck(duck)
testDuck(dog)
```

Module

- Save our fib functions into fib.py

```
import fib
fib.fib(5) # => 0 1 1 2 3
result = fib.fib2(5) # => [0, 1, 1, 2, 3]
```

Part. B

Packet Capture and Analysis

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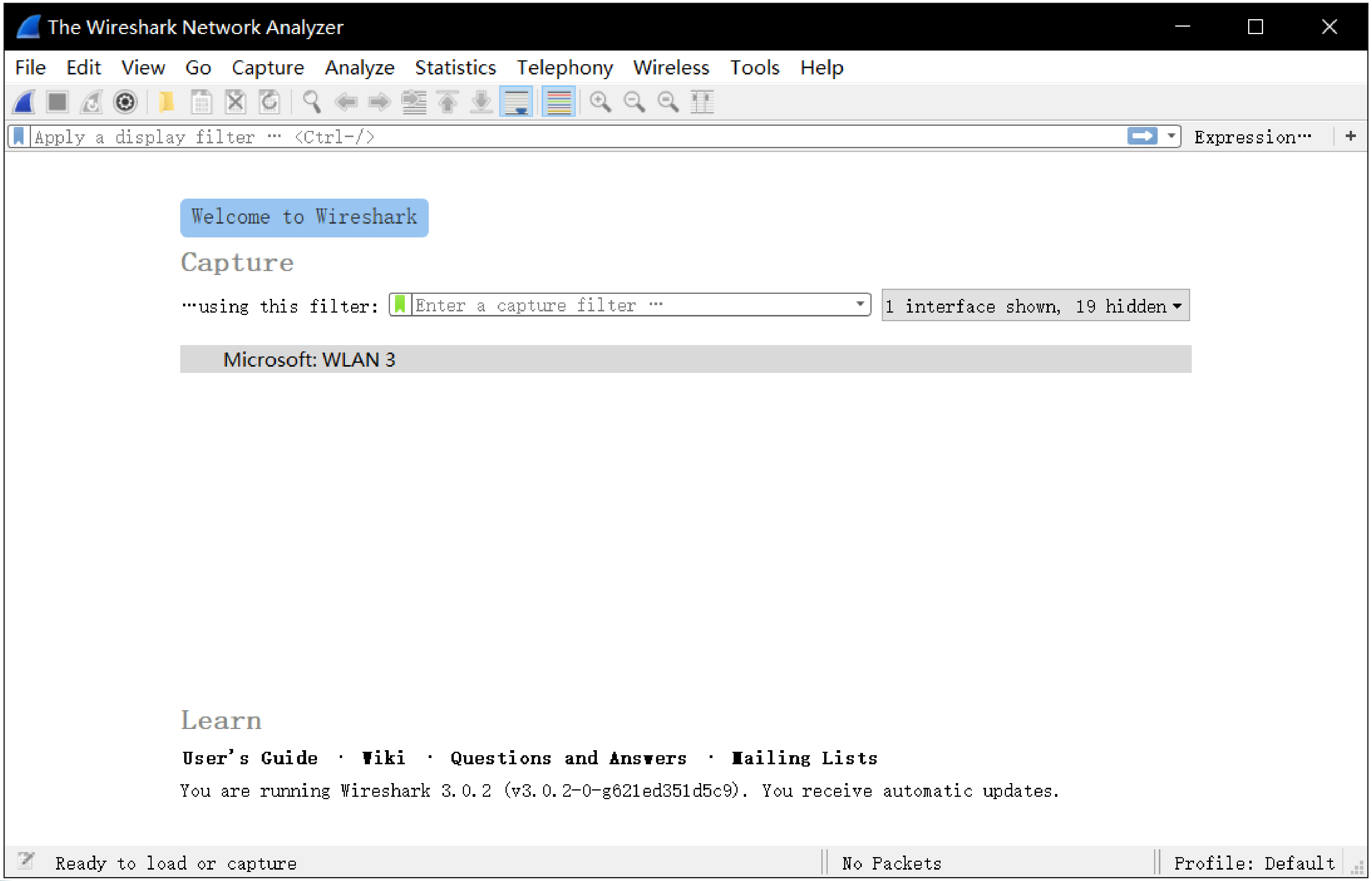
Wireshark

- Wireshark is a free and open-source packet analyzer. It is used for network trouble shooting, analysis, software and communications protocol development, and education.
- Alternative utilities:
  - tcpdump
  - Tshark

*Tip: new version of Wireshark uses Npcap instead of Winpcap.


The Wireshark Network Analyzer
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter … <Ctrl-/>
Expression…
+

Welcome to Wireshark

Capture

…using this filter: Enter a capture filter … 1 interface shown, 19 hidden

Microsoft: WLAN 3

Learn

User's Guide · Wiki · Questions and Answers · Mailing Lists

You are running Wireshark 3.0.2 (v3.0.2-0-g621ed351d5c9). You receive automatic updates.

Ready to load or capture | No Packets | Profile: Default

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Capture Filter

- Capture filter allows you to select the packets you want from all the packets captured by Wireshark.
- A proper capture filter can reduce the workload of Wireshark and the size of raw packets.

Capture Filter

- Example:
  - host 172.18.5.4
  - port 53
  - tcp port 80
- For more syntax explanation: http://www.tcpdump.org/manpages/pcap-filter.7.html

Display Filter

- After the capture starts, the display filter can be set to accurately hide the packet you don’ t care.
- Display filter can be change at anytime on the fly.

Assignment 2.1 Find Prime

- filename: prime.py
- requirement:

  implement a function to find prime in a range

  function signature:

```
def find_prime(start: int, end: int) -> list
```

Assignment 2.2

Use Wireshark to capture packets and answer the questions with your screenshots:

1. Open http://example.com in your browser, what kind of display filter do you need to filter out HTTP packets?
2. How many layers do you see in the HTTP request packet? What’ s the src ip addr, src port, dst ip addr and dst port of the request packet?
3. What kind of information can be found in the HTTP response packet? Is there anything same with the information which is displayed on your browser?

Assignment 2.3

Use Wireshark to capture packets and answer those questions with your screenshots (both Wireshark and tracert display):

1. Using a proper capture filter/display filter to capture/display a tracert traffic. And start tracert baidu.com.
2. How many packets did tracert send for each hop?
3. How many kinds of response did tracert receive from the remote? What’s the source IP address of these response message?
4. Try to calculate the RTT (round-trip time) between your host and baidu.com based on your capture instead of tracert display. Are they same with tracert display?

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