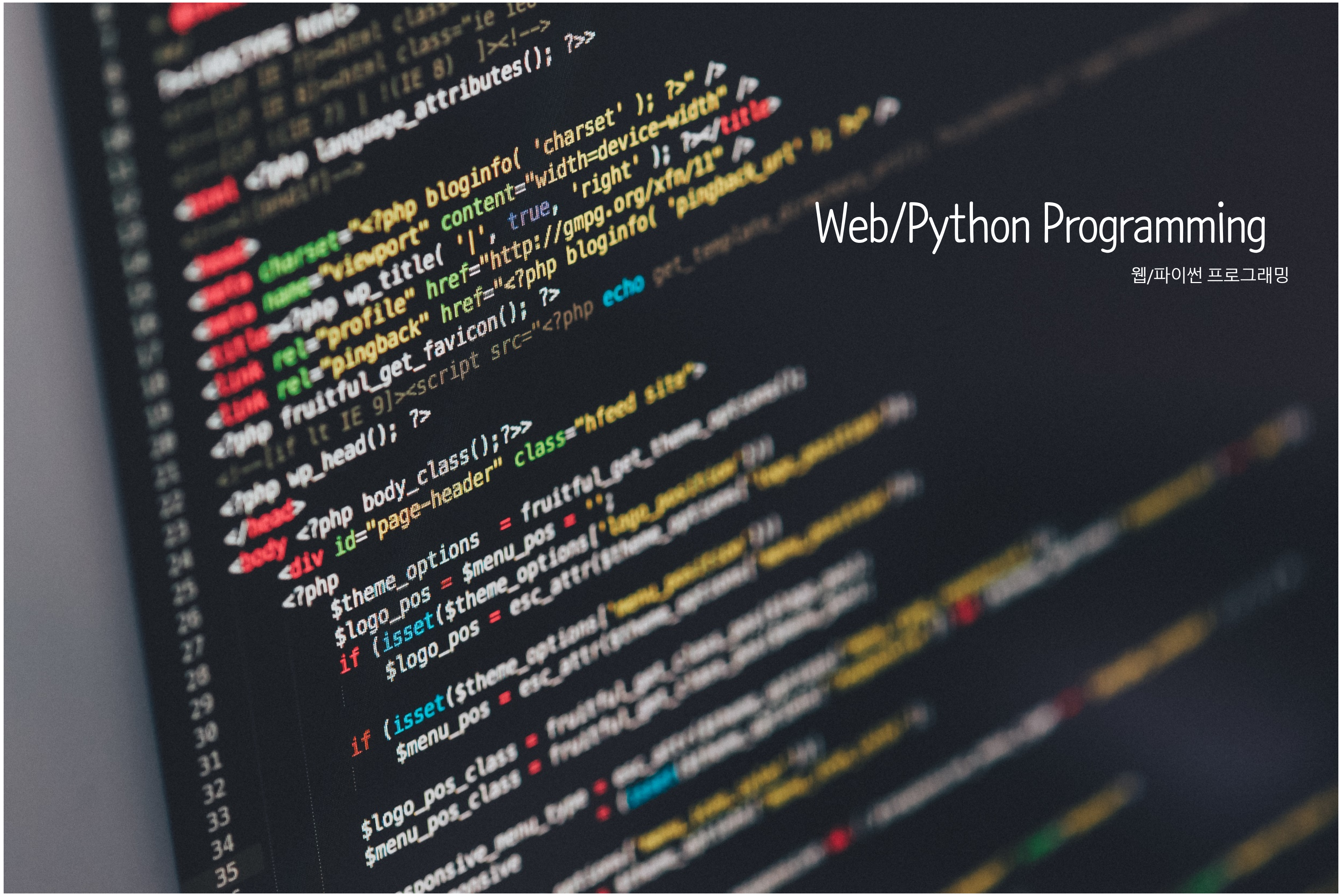


Web/Python Programming

웹/파이썬 프로그래밍

Today

- File I/O continued

Help on file method?

```
import io
help(io.TextIOBase.read)
```

How to get data?

```
if age < 45:
    if bmi < 22.0:
        risk = 'low'
    else:
        risk = 'medium'
else:
    if bmi < 22.0:
        risk = 'medium'
    else:
        risk = 'high'
```

$$\text{Body Mass Index (bmi)} = \frac{\text{weight (kg)}}{\left(\text{height (m)}\right)^2}$$

Name: Mike
Age: 24
Height: 172
Weight: 72

Name: Jane
Age: 51
Height: 160
Weight: 60

Name: Jason

Mike, 24, 172, 72
Jane, 51, 160, 60
Jason, 35, 180, 80
…

Mike, Jane, Jason;
24, 51, 35;
172, 160, 180;
72, 60, 80;
…

Mike 24 172 72; Jane 51 160 60; Jason 35 180 80;
…

What kind of files are there?

- Text files
- Music files
- Videos
- Word processor (docx, hwp)
- Presentation documents (ppt)
- Spread sheets (excel)
- pdf

- Text files only contain characters
- Other file formats include formatting information that is specific to that particular file format
- Ex) You cannot open a ppt file using notepad
- Ex) Check the size of an empty file of various format

Text files

- Take up little disk space
- Easy to process
- Only letters in a file

- .py file is a text file
- With a particular syntax
- Python interpreter can read Python text files and follow the instructions

- Web browsers read and process HTML files
- Spreadsheets read and process comma-separated value files
- Calendar programs read and process calendar data files
- Other programming language applications read and process files written with a particular programming language syntax

Opening a file

- Python assumes that the file you want to read is in the same directory as the current program

```
First line of text
Second line of text
Third line of text
```

1) Make a directory, `file_examples`
2) Open Notepad and type the following:
3) Save this file in your `file_examples` directory as `file_example.txt`
4) In IDLE, select File-> New Window and type this program:
5) Save this as `file_reader.py`

   in `file_examples` directory
6) Run

```
file = open('file_example.txt','r')
contents = file.read()
print(contents)
file.close()
```

Opening a file

file name

file mode

```
file = open('file_example.txt','r')
contents = file.read()
print(contents)
file.close()
```

file cursor

```
First line of text
Second line of text
Third line of text
```

- Built-in function `open` opens a file and returns an object that knows…
  - How to get information from the file
  - How much you've read
  - Which part of the file you're about to read next

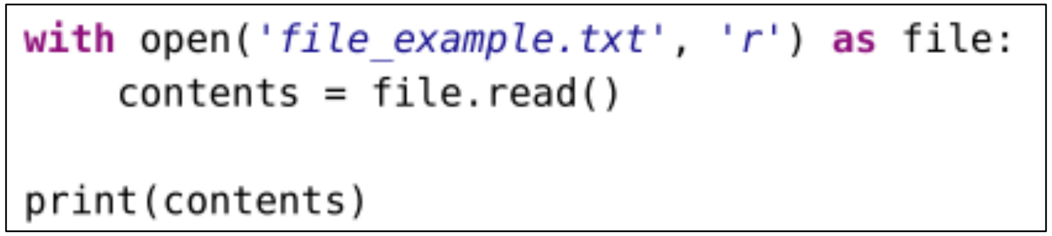
A file cursor is a marker that keeps track of the current location in the file.

The file cursor is initially at the beginning of the file.

As we read or write data, it moves to the end of what we just read or wrote.

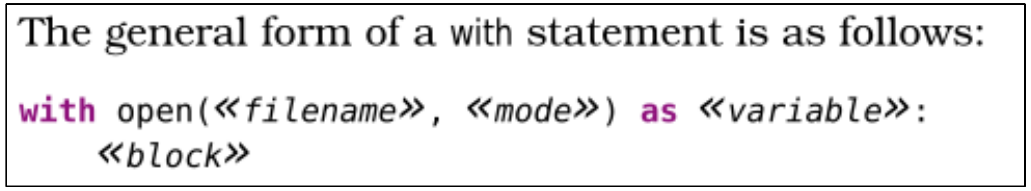
The with statement

```
file = open(‘file_example.txt’,’r’)
contents = file.read()
print(contents)
file.close()
```



```
with open('file_example.txt', 'r') as file:
    contents = file.read()

print(contents)
```



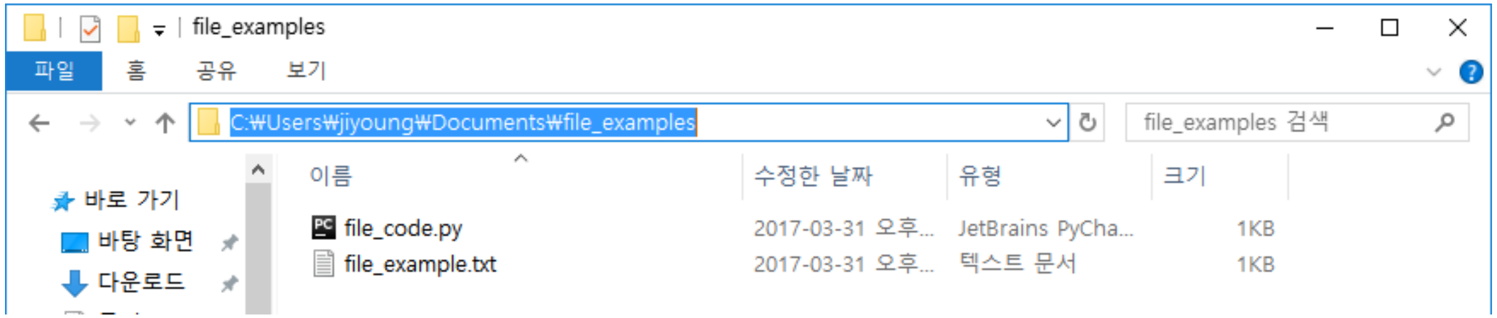
The general form of a with statement is as follows:

```
with open(«filename», «mode») as «variable»:
    «block»
```

- Automatically closes a file when the end of the block is reached
- Not recommended

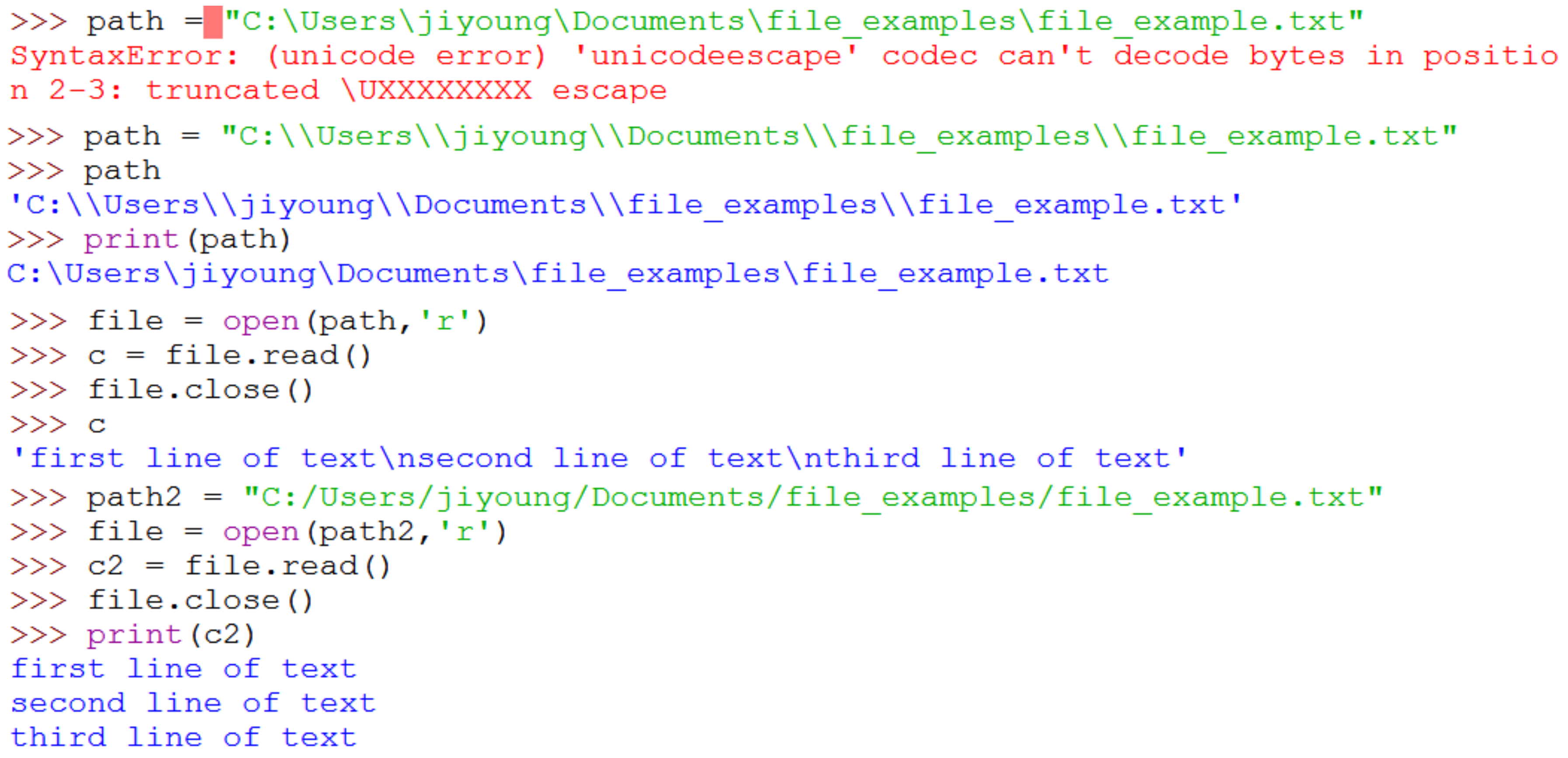
How files are organized in your computer

- A file path specifies a location in your computer's file system.
- File path for file_example.txt:
  C:\Users\jiyoung\Documents\file_examples\file_example.txt



이름	수정한 날짜	유형	크기
file_code.py	2017-03-31 오후...	JetBrains PyCha...	1KB
file_example.txt	2017-03-31 오후...	텍스트 문서	1KB

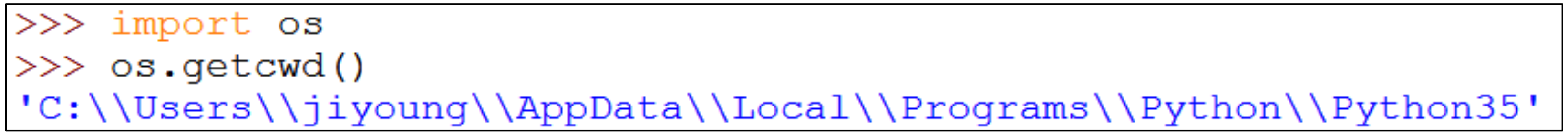
How files are organized in your computer



```
>>> path = "C:\Users\jiyoung\Documents\file_examples\file_example.txt"
SyntaxError: (unicode error) 'unicodeescape' codec can't decode bytes in positio
n 2-3: truncated \UXXXXXXXX escape
>>> path = "C:\\Users\\jiyoung\\Documents\\file_examples\\file_example.txt"
>>> path
'C:\\Users\\jiyoung\\Documents\\file_examples\\file_example.txt'
>>> print(path)
C:\Users\jiyoung\Documents\file_examples\file_example.txt
>>> file = open(path,'r')
>>> c = file.read()
>>> file.close()
>>> c
'first line of text\nsecond line of text\nthird line of text'
>>> path2 = "C:/Users/jiyoung/Documents/file_examples/file_example.txt"
>>> file = open(path2,'r')
>>> c2 = file.read()
>>> file.close()
>>> print(c2)
first line of text
second line of text
third line of text
```

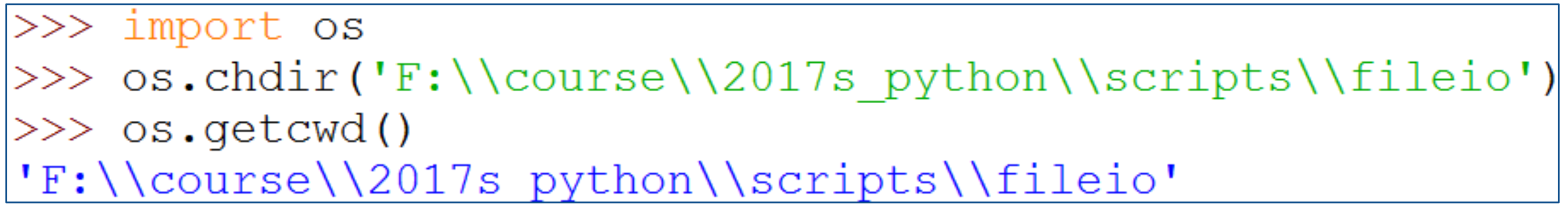
Specifying which file you want

- Current working directory
- The directory where Python looks for files
- The directory where the current program (.py file) is saved



```
>>> import os
>>> os.getcwd()
'C:\\Users\\jiyoung\\AppData\\Local\\Programs\\Python\\Python35'
```

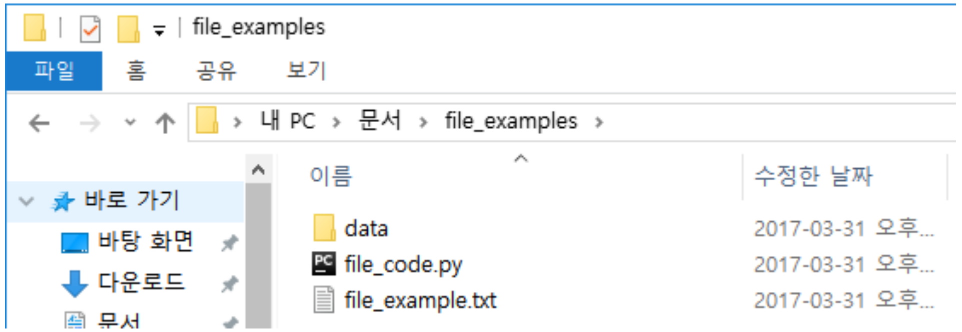
- An absolute path starts at the root directory of the file system



```
>>> import os
>>> os.chdir('F:\\course\\2017s_python\\scripts\\fileio')
>>> os.getcwd()
'F:\\course\\2017s_python\\scripts\\fileio'
```

Specifying which file you want

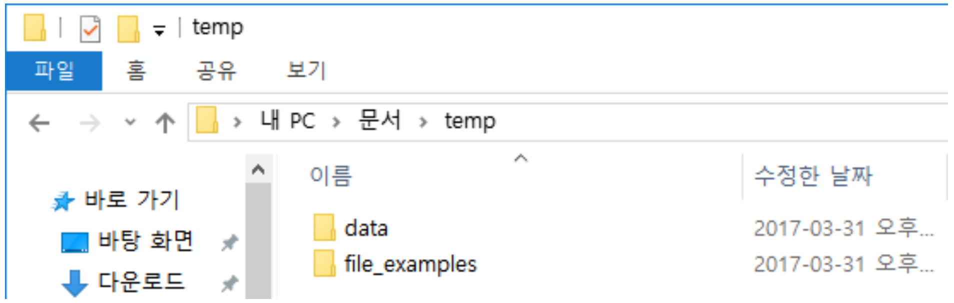
```
file = open(‘file_example.txt’,’r’)
contents = file.read()
print(contents)
file.close()
```



이름	수정한 날짜
data	2017-03-31 오후...
file_code.py	2017-03-31 오후...
file_example.txt	2017-03-31 오후...

```
file = open(‘data/data1.txt’,’r’)
```

```
file = open(‘../data/data1.txt’,’r’)
```



이름	수정한 날짜
data	2017-03-31 오후...
file_examples	2017-03-31 오후...

```
file = open(‘../../../data/data1.txt’,’r’)
```

Relative path is relative to the current working directory

Techniques for reading files

- read

```
file = open('file_example.txt','r')
contents = file.read()
file.close()
print(contents)

file = open('file_example.txt','r')
first_ten_characters = file.read(10)
the_rest = file.read()
file.close()
print("first:",first_ten_characters)
print("the rest:",the_rest)
```

- readlines

```
file = open('file_example.txt','r')
contents = file.readlines()
file.close()
print(contents)
```

readlines

```
file = open('planets.txt','r')
planets = file.readlines()
file.close()
```

planets.txt
Mercury Venus Earth Mars

```
==== RESTART: C:\Users\jiyoung\Documents\temp\
file_examples\file_code.py ====
>>> planets
['Mercury\n', 'Venus\n', 'Earth\n', 'Mars\n']


>>> for p in planets:
        print(p.strip())


Mercury
Venus
Earth
Mars
```

```
>>> for p in reversed(planets):
        print(p.strip())


Mars
Earth
Venus
Mercury
>>> for p in sorted(planets):
        print(p.strip())


Earth
Mars
Mercury
Venus
```

for line in file

```
file = open(‘planets.txt’,’r’)
for line in file:
    print(len(line))
file.close()
```

planets.txt
Mercury Venus Earth Mars

```
==== RESTART: C:\Users\jiyoung\Documents\temp\
file_examples\file_code.py ====
8
6
6
5
```

```
file = open(‘planets.txt’,’r’)
for line in file:
    print(len(line.strip()))
file.close()
```

```
==== RESTART: C:\Users\jiyoung\Documents\temp\
file_examples\file_code.py ====
7
5
5
4
```

Skipping the header

```
Skip the first line in the file
Skip over the comment lines
For each of the remaining lines:
    Process the data on that line
```

```
Skip the first line in the file
Find and process the first line of data
For each of the remaining lines:
    Process the data on that line
```

readline

```
hopedale.txt
Coloured fox fur production, HOPEDALE, Labrador, 1834-1842
#Source: C. Elton (1942) "Voles, Mice and Lemmings", Oxford Univ. Press
#Table 17, p.265--266
22
29
2
16
12
35
8
83
166
```

```python
hopedale_file = open('hopedale.txt', 'r')

hopedale_file.readline()  # header

data = hopedale_file.readline().strip()
while data.startswith('#'):
    data = hopedale_file.readline().strip()


for data in hopedale_file:
    print(data)

hopedale_file.close()
```

readline

```
hopedale.txt
Coloured fox fur production, HOPEDALE, Labrador, 1834-1842
#Source: C. Elton (1942) "Voles, Mice and Lemmings", Oxford Univ. Press
#Table 17, p.265--266
22
29
2
16
12
35
8
83
166
```

```python
hopedale_file = open('hopedale.txt', 'r')

hopedale_file.readline()  # header

data = hopedale_file.readline().strip()
while data.startswith('#'):
    data = hopedale_file.readline().strip()


total_pelts = int(data)

for data in hopedale_file:
    total_pelts = total_pelts + int(data.strip())

hopedale_file.close()

print("Total number of pelts:", total_pelts)
```

Local file

```
hopedale.txt
```

```
Coloured fox fur production, HOPEDALE, Labrador, 1834-1842
#Source: C. Elton (1942) "Voles, Mice and Lemmings", Oxford Univ. Press
#Table 17, p.265--266
22
29
2
16
12
35
8
83
166
```

```python
hopedale_file = open('hopedale.txt', 'r')

line = hopedale_file.readline()   # header
```

```
>>> type(hopedale_file)
<class '_io.TextIOWrapper'>
>>> type(line)
<class 'str'>
```

Files over the internet

http://robjhyndman.com/tsdldata/ecology1/hopedale.dat

```python
import urllib.request
url = 'http://robjhyndman.com/tsdldata/ecology1/hopedale.dat'
webpage = urllib.request.urlopen(url)
line = webpage.readline()
line = line.strip()
line = line.decode('utf-8')
print(line)
```

```python
import urllib.request
url = 'http://robjhyndman.com/tsdldata/ecology1/hopedale.dat'
webpage = urllib.request.urlopen(url)
for line in webpage:
    line = line.strip()
    line = line.decode('utf-8')
    print(line)
webpage.close()
```

```
>>> type(webpage)
<class 'http.client.HTTPResponse'>
>>> type(line)
<class 'bytes'>
```

```
Coloured fox fur production, HOPEDALE, Labrado
r,, 1834-1925
```

Writing files

```
outfile = open('topics.txt','w')
outfile.write('Computer Science')
outfile.close()

outfile = open('topics.txt','w')
word = outfile.write('Computer Science')
outfile.close()

outfile = open('topics.txt','a')
outfile.write('Software Engineering')
outfile.close()
```

```
Computer ScienceSoftware
Engineering
```

Reading and writing files

total.py

```
def sum_number_pairs(input_file, output_filename):

    """(file open for reading, str) -> NoneType

    Read the data from input_file, which contains two floats
    per line separated by a space. Open file named output_file
    and, for each line in input_file, write a line to the output
    file that contains the two floats from the corresponding
    line of input_file plus a space and the sum of the two floats.
    """
    output_file = open(output_filename,'w')
    for number_pair in input_file:
        number_pair = number_pair.strip()
        operands = number_pair.split()
        total = float(operands[0])+ float(operands[1])
        new_line = '{0} {1}\n'.format(number_pair, total)
        output_file.write(new_line)
    output_file.close()
```

number_pairs.txt

```
1.3 3.4

2 4.2

-1 1
```

out.txt

```
1.3 3.4 4.7

2 4.2 6.2

-1 1 0.0
```

```
>>> import total
>>> total.sum_number_pairs(open('number_pairs.txt','r'),'out.txt')
```

Summary

- When files are opened and read, their contents are commonly stored in lists of strings.
- Data stored in files is usually formatted in one of a small number of ways, from one value per line to multiline records with explicit end-of-record markers. Each format can be processed in a stereotypical way.
- Data processing programs should be broken into input, processing, and output stages so that each can be reused independently.
- Files can be read (content retrieved), written to (content replaced), and added to (new content appended). When a file is opened in writing mode and it doesn’t exist, a new file is created.

Summary 2

- Data files come in many different formats, so custom code is often required, but we can reuse as much as possible by writing helper functions
- To make the functions usable by different types of readers, the reader (for a file or web page) is opened outside the function, passed as an argument to the function, and then closed outside the function.