Lecture 8: Files

Morten Rieger Hannemose, Vedrana Andersen Dahl

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Today's lecture

1. Files (20 min)
2. String formatting (10 min)
3. Plotting, sneak peek (10 min)

   (No coding example today)

Practical information

- Mid-term exam (test); Roughly corresponding to half an exam.
- (By the end of the course we will have a test of DE system.)
- Nicolai og Hans Henrik: *Programing for all* DTU 116/81 Saturday 28/10, from 9:00

Course overview

Weeks 1-7

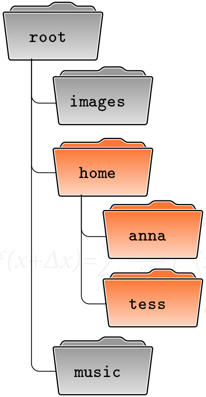
- Data types: `int`, `float`, `str`, `list`, `dict`, `tuple`
- Functions: void, fruitful, arguments, return types
- Flow control: conditions, loops
- In connection with sequences (string, list, tuple): indexing
- In connection with lists and strings: methods
- Problem solving
- Coding: testing, debugging

Weeks 8-13

- Files: reading and writing (today!)
- Object-oriented programming (2 weeks)
- Numpy, matplotlib, and other useful modules
- Efficiency and style
- The goodies
- Wrapping up

Files, folders, and paths

- Information on computers is stored in files.
- File: data treated as an entity, identified by filename (a string), usually ended by an extension.
- Path: a string that describes where the file is stored in a hierarchical system of folders.



Today:

- We can read and write files from Python.
- Focus on text files and csv-files (which are also text files)
- Exercises: examples of how an otherwise tedious task may be solved using programming, e.g. searching in many or large files.

Filenames and paths are strings

```python
import os

print(f'CWD: {os.getcwd()}')
print(os.listdir())

filename = os.path.join(os.getcwd(), 'new_file.txt')
print(filename)

if os.path.isfile(filename):
    print(f'File {filename} exists')
```

- Current working directory.
- Relative and absolute paths.
  - Relative: relates to cwd. Uses `..` to move one level up.
  - Absolute: starts with root directory.
- Dependency on the operative system.
  - Windows: `C:\Users\Vand\Desktop\course`
  - Unix-based (inc. macOS): `/Users/vand/Desktop/course`
- Module `os` – operating system interfaces.

Reading and writing text files

```python
with open('my_file.txt', 'w') as f:
    f.write('This is a new file\n')
    f.write('with two lines\n')

with open('my_file.txt') as f:
    lines = f.readlines()

print(lines)
```

- Function `open` opens a file and returns a file object.
- Statement `with` handles unexpected situations. No need to close a file.
- Reading methods: `read()`, `readline()`, `readlines()`
- Writing methods: `write()`, `writelines()`
- An escape character: backslash \ followed by a character. Most importantly: `\n`.
- Book Section 14.10, `repr()`: a printable representation
- Other readers and writers, for example, provided by `csv` module.

String formatting

```python
a = 17

print(a, '/3 =', a/3)
print(str(a) + '/3 = ' + str(a/3))

print(f'{a}/3 = {a/3}')  # using f-string
print(f'{a}/3 = {a/3:0.3}')  # custom format

print(f'{a=}')  # useful for debugging

bike_code = 217
bike_code_str = f'{bike_code:04}'
print(bike_code_str)
```

- Section 14.3 in the book: Format operator % (old string formatting)
- New string formatting (Python>3.6): f-strings
  - Prefixed with 'f' or 'F'
  - Replacement fields delimited by curly braces , evaluated at run time.

Simple plotting

```python
import matplotlib.pyplot as plt
import random

nr_points = 1000
x_values = list(range(nr_points))
y_values = [0]
for i in range(1, nr_points):
    y_values.append(y_values[-1] + random.randint(0, 10) - 5)

plt.plot(x_values, y_values)
plt.show()
```

- Matplotlib: Visualization with Python
- Things get slightly complicated and depend on how Python is used: your personal settings, operative system, Python interpreter... Therefore, Matplotlib has different backends.
- In week 11 we, focus on plotting.
- Goal for now: Generate a simple plot.
- To learn more: `https://matplotlib.org/stable/users/explain/quick_start.html`

Additional code shown during lecture

backslash.py

```python
print('ja\nnej')
print('ABCDEFG\b\b\b\b\b--')
print('ABCDEFG\r---')
```

writing_text.py

```python
f = open('test.txt', 'w')
f.write('I am writing to a file!\n')
f.close()
```

This is an example of writing a file without `with` statement. It is advisable to use `with` statement when writing and reading files.