PYTHON PROGRAMMING

AARHUS
UNIVERSITY
DEPARTMENT OF CIVIL AND ARCHITECTURAL ENGINEERING

ADVANCED TECHNOLOGY IN CONSTRUCTION
13 JANUARY 2022

KARSTEN WINTHER JOHANSEN
PHD-STUDENT

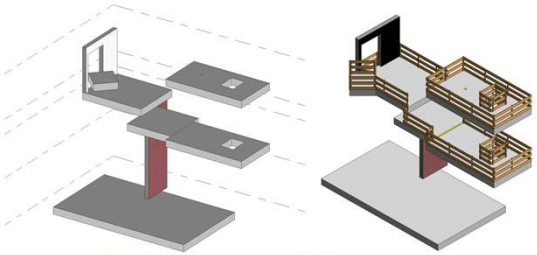
SHORT INTRODUCTION

Karsten Winther Johansen

- From Denmark
- Background
  - Electrician 2013
  - Bachelor in electronics 2018
  - Master in computer engineering 2021
  - Currently doing PhD study

Research topic is safety in construction

- Automated approach to do
  - Prevention through design/planning
  - (expectedly) Inspection of protective equipment



YOUR TURN

What is your name?

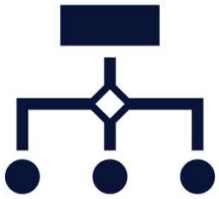
Where are you from?

What is your background?

Have you been exposed to sensor data analysis?

Have you been exposed to programming of any kind?

AGENDA



Basics of Python

Variables

Loops

Plotting

Sensor data in Python

Loading data (pandas)

Basic data analysis

Data filtering

In area analysis

Proximity analysis

OBJECTIVES OF LECTURE

Familiarize yourselves with programming for data analysis

- Experience how programming can be useful for real data
- Experience the benefits compared to excel
- Experience the fact that when a script has been created it can be used for analysis future similar datasets

Analysis and reporting can be automated

Familiarize yourselves with the basic functionality of Python

BASICS OF PYTHON – VARIABLES

In python variables are created when first assigned

- And are all created the same way

Built in types in python

Text Type:	`str`
Numeric Types:	`int`, `float`, `complex`
Sequence Types:	`list`, `tuple`, `range`
Mapping Type:	`dict`
Set Types:	`set`, `frozenset`
Boolean Type:	`bool`

```
# text type
my_string = "string"
# numeric types
my_int = 5
my_float = 5.5
my_complex = 2+3j
# sequence types
my_list = [5,5,5,5]
my_tuple = (4,4,4,4)
my_range = range(0,10)
# mapping
my_dict = {
    "dict_val_1":1,
    "dict_val_2":2
}
# set types
my_set = set(my_list)
my_frozenset = frozenset(my_set)

# boolean type
my_boolean = True
```

BASICS OF PYTHON – LOOPS

For loop

```
my_range = range(5)
for i in my_range:
    print(i)
```

What does this print?

Foreach

```
my_list = [5,5,5,5]
for element in my_list:
    print(element)
```

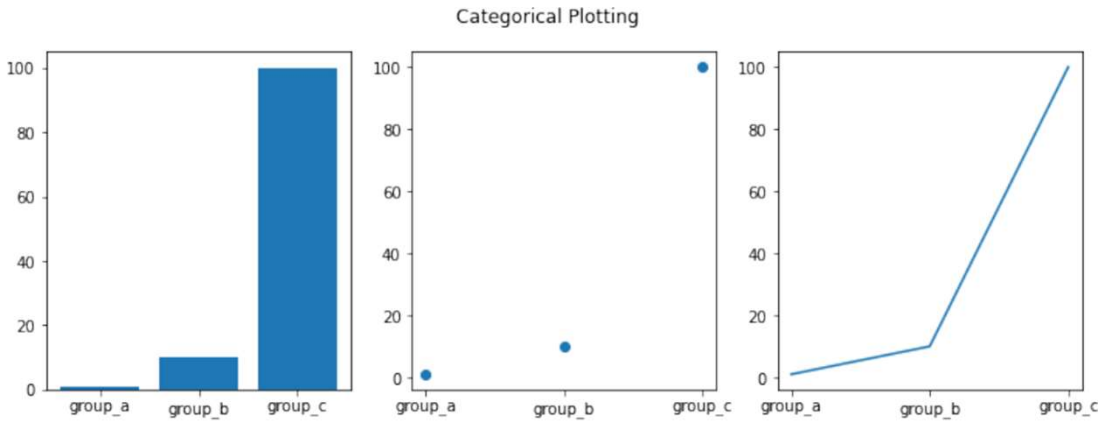
What does this print?

```
my_mixed_list = [my_string, my_int, my_float, my_complex, my_list, my_tuple, my_range, my_dict, my_boolean]
print(my_mixed_list)
for element in my_mixed_list:
    print(f"{type(element)} = {element}")
```

```
['string', 5, 5.5, (2+3j), [5, 5, 5, 5], (4, 4, 4, 4), range(0, 5), {'dict_val_1': 1, 'dict_val_2': 2}, True]

<class 'str'> = string
<class 'int'> = 5
<class 'float'> = 5.5
<class 'complex'> = (2+3j)
<class 'list'> = [5, 5, 5, 5]
<class 'tuple'> = (4, 4, 4, 4)
<class 'range'> = range(0, 5)
<class 'dict'> = {'dict_val_1': 1, 'dict_val_2': 2}
<class 'bool'> = True
```

BASICS OF PYTHON – MATPLOTLIB

```
import matplotlib.pyplot as plt
names = ['group_a', 'group_b', 'group_c']
values = [1, 10, 100]

figure = plt.figure(figsize=(9, 3))

ax1 = figure.add_subplot(131)
ax1.bar(names, values)
ax2 = figure.add_subplot(132)
ax2.scatter(names, values)
ax3 = figure.add_subplot(133)
ax3.plot(names, values)
figure.suptitle('Categorical Plotting')
```



https://matplotlib.org/stable/tutorials/introductory/pyplot.html

INTRODUCTION OF RUNNABLE CODE

If you have not yet installed python, VS-code, and Ipython Kernel, please do so.

- This can be done following the guide called “Python installation guide.pdf”

Please open “04.01-Python-Basics.ipynb” to review some of the variable assignment mentioned in previous slides

- You should try and follow the code, and read the comments between (the text between code is called Markdown, and is very useful for documentation)
- Go through the file with a **guess** and **check** approach, where you **guess**, what the individual lines will produce and **check** if you were right

Please open “04.02-Python-Conditionals-and-Libraries.ipynb”, which is concerning conditionals, importing libraries and functions.

- Walk through the file in the same guess and check approach as previous file.

ASSIGNMENT

Now that the basics are in place open the file called “04.03-RTLS_Lecture Assignment.ipynb” and embrace your inner programmer!

- The start of the file is introducing some concepts for the assignment, including
  - Data format, data loading, simple duration analysis.
- Gradually you will be tasked to fill in the blanks, where you as a programmer will have to perform the requested operations
- The tasks are designed in a way, where you will be able to reuse parts and continuously extend the functionality.
- See how far you can get and let me know if any trouble arises

Karsten Winther Johansen, kwj@cae.au.dk


AARHUS
UNIVERSITY