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Advanced Programming in Python

LECTURE 2

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Previously On...

Previously on...

Inmutable Types:

Boolean:

```
True, False, and, or, not...
```

Numeric:

```
n_int = 1
n_float = 1.1
n_complex = 1 + 1j
```

Strings:

```
str = "Hello"
str = 'Hello'
```

Mutable Types:

Lists (0 based indexing):

```
lst = [1,2,3,4]
lst.append(), lst.clear()
```

Dictionary:

```
dct = {"apple": 1, "orange": 2}
dct.update({"pineapple":3})
```

Python Org, April 2022, https://docs.python.org/3/library/stdtypes.html (Accessed: 20-04-2022)

Previously on...

Inmutable Types:

Tuples:

```
tpl = (1,2,3,4)
```

Ranges:

```
rng = range(0,10) -> [0..10)
```

Frozenset:

```
st = frozenset([1,2,3,4])
```

Mutable Types:

Set:

```
st = set([1,2,4,4]) -> (1,2,4)
st.add(5), st.remove(4)
```

List as stack:

```
lst.pop(), lst.append(1)
```

Python Org, April 2022, https://docs.python.org/3/library/stdtypes.html (Accessed: 20-04-2022)

Previously on...

Bare minimum requirements of a program?

- Import libraries:
```
import sys
```
- Functions:
```
def function(param1):
```
- Main entry point :
```
if __name__ == "__main__":
```

Previously on...

Branching

```
def some_function(a):
    if a == 1:
        s = "Hello"
    elif a == 2:
        s = "Bye"
    else:
        s = "End"
```

Looping

```
while condition:
    pass

for elem in sequence:
    pass
```

Pythonic way

```
sequence = [7,8,9,10,11,12]
elem = [n for n in sequence]
```

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Introduction

Specs, OOP and more...

Outline

Previously on...

Introduction

Specifications

Development Setup

Object Oriented Programming.

Architecture.

Live Demo.

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Specifications

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Specifications

Conceptual Specifications

Scope of the project

Functionality

Constraints

Cost:

- Personel
- Infrastructure

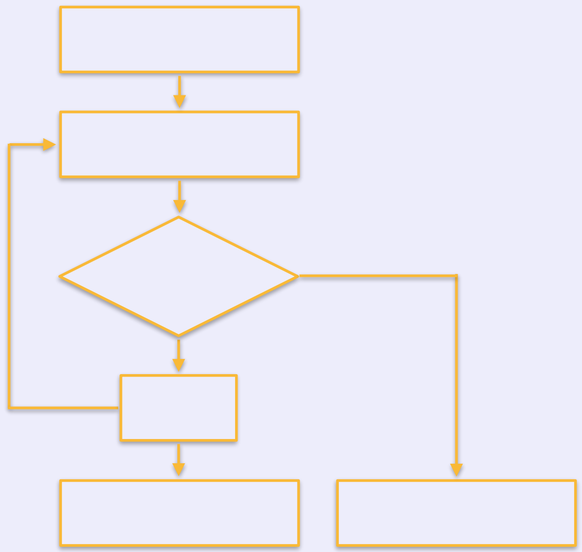
Technical Specifications

Code specification

- Requirements
- Min version
- ...

Fault tolerance

Reusability



Example

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Development Setup

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Development Setup

IDE

- Visual Studio Code
- Extensions:
  - Python
  - GitLens

Minimum Requirements

- Python 3.8
- Virtual environment

```
python3 -m virtualenv -p python3 ./env

source env/bin/activate
```

- Install libraries

```
python3 -m pip install <package>
```

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Object Oriented Programming

With Demos...

Object Oriented Programming

Variables

Encapsulation

Class

Namespaces

Methods

Objects

OOP: Classes

```
class Fruit:
    def __init__(self, size: int, name: str) -> None:
        print("init {}".format(id(self)))
        self.size = size
        self.name = name

if __name__ == "__main__":
    c1 = Fruit(10, "orange")
    c2 = Fruit(5, 'apple')
```

OOP: Methods

```
class Fruit:
    def __init__(self, size: int, name: str) -> None:
        self.size = size
        self.name = name

    def set_size(self, size: int = 10) -> None:
        self.size = size

if __name__ == "__main__":
    c1 = Fruit(10, "orange")
    c1.set_size(15)
```

OOP: Objects

```
class Fruit:
    def __init__(self, size: int, name: str) -> None:
        self.size = size
        self.name = name

    def set_size(self, size: int = 10) -> None:
        self.size = size

if __name__ == "__main__":
    c1 = Fruit(10, "orange")
    c1.name = "pineapple"
    c1.set_size(15)
```

OOP: Namespace

- Namespaces lets us uniquely identify each variable and object within our program.

- Namespaces provide the mapping between the names (functions and objects) to the actual instance/reference.

- As an example, when we instantiate a class, we create a new namespace for that class.

OOP: Encapsulation or scope

```
class Fruit:
    color = 'orange' # no mutable
    attributes = [] # mutable -> this is a problem!
    def __init__(self, size: int, name: str) -> None:
        ...
        self.name = name
        self.__other = [] # private variable

if __name__ == "__main__":
    c1 = Fruit(10, "orange")
    c2 = Fruit(5, 'apple')
    c2.color = 'green'
    c2.attributes.append('something')
```

OOP: Inheritance

```
class Computer:
    def __init__(self, ram: int = 8, cpu_core: int=8) -> None:
        self.ram = ram
        self.cpu_core = cpu_core

class Laptop(Computer):
    def __init__(self, screen: int=15, usb: int=2):
        self.screen = screen
        self.usb = usb

if __name__ == "__main__":
    l = Laptop()
    l.ram = 16
```

OOP: lambda functions

```
def sort_even(number):
    return (number%2)

ll = [1,2,3,4,5,6]
ll.sort(key=sort_even)

# [2, 4, 6, 1, 3, 5]
```

Anonymous Function

```
ll = [1,2,3,4,5,6]
ll.sort(key=lambda val: (val%2))

# [2, 4, 6, 1, 3, 5]
```

OOP: Dataclasses

```
from dataclasses import dataclass

@dataclass
class person:
    name: str
    surname: str
    age: int
    height: int

if __name__ == "__main__":
    p1 = person("John", "Doe", 30, 180)
```

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Architecture

Technical definition & Execution model

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LIVE DEMO

Bibliography

Python Tutorial: Classes, April 2022, https://docs.python.org/3/tutorial/classes.html (Accessed: 20-04-2022)

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Python Docs: Lambdas, April 2022, https://docs.python.org/3/reference/expressions.html?highlight=lambda (Accessed: 20-04-2022)

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