Python

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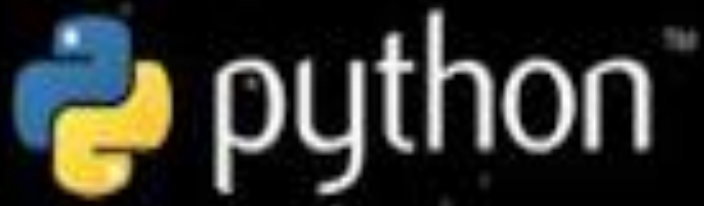
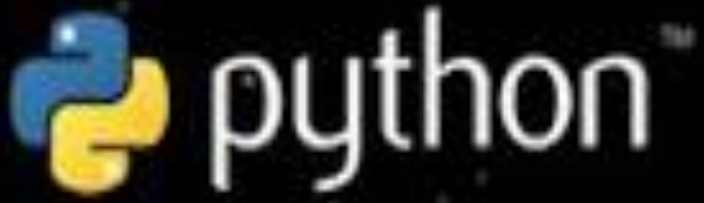


Overview

- Fast, dynamically-typed, and extensible scripting language
- Multi-paradigmed: Object-Oriented, Functional, Procedural, Imperative
- Commonly used for:
  - Scientific Computing
  - Automating tasks
  - Working with databases
  - Web development
  - Game development
  - Text-processing
  - AI



History

- Designed by Guido Van Rossum in early 90's – Very young language
- Many features of Python were inspired by the interpreted language ABC
- Rossum wanted to fix some of ABC's issues while retaining some of it's useful features
  - Data manipulation
  - Simple and quickly increased programmer's productivity

History (Evolution)

- Python Version 1.0
  - Functional programming tools such as lambda, map, filter, and reduce
- Python Version 2.0
  - List comprehensions (borrowed from Haskell), garbage collection system, expansion of numerous modules, bug-fixes for popular libraries/modules
- Python Version 3.0
  - Rectified some fundamental design flaws
    - Print statement -> Print function
    - Basic math operations
    - Overhaul for iterators
    - _future_ module (allowed some necessary backwards-compatibility to Version 2.7)
- Currently on Version 3.5

Language Concepts

- Interactive shell built-in
  - Allows for quick testing of code snippets in isolation
- Requires careful attention of line spacing and indentation
  - Python uses indents instead of braces for classes, functions, control-structures
- Multiple statements on a single line
  - Can make code much cleaner if used appropriately
  - Popular among experienced programmers, known as “one-liners”
- Generators
  - Lazy evaluation
  - Computations over potentially huge sets of data without compromising memory

Language Concepts

- Example of using a generator:
- If we ran this test:

```
for x in fibon(1000000):
    print x,
```

- The entire list (100,000 items long) is created only one value at a time.

-Say we were looking for the 1,000th iteration…

- The list version would calculate the entire sequence but the generator could stop at our desired target

```
# function version
def fibon(n):
    a = b = 1
    result = []
    for i in xrange(n):
        result.append(a)
        a, b = b, a + b
    return result
```

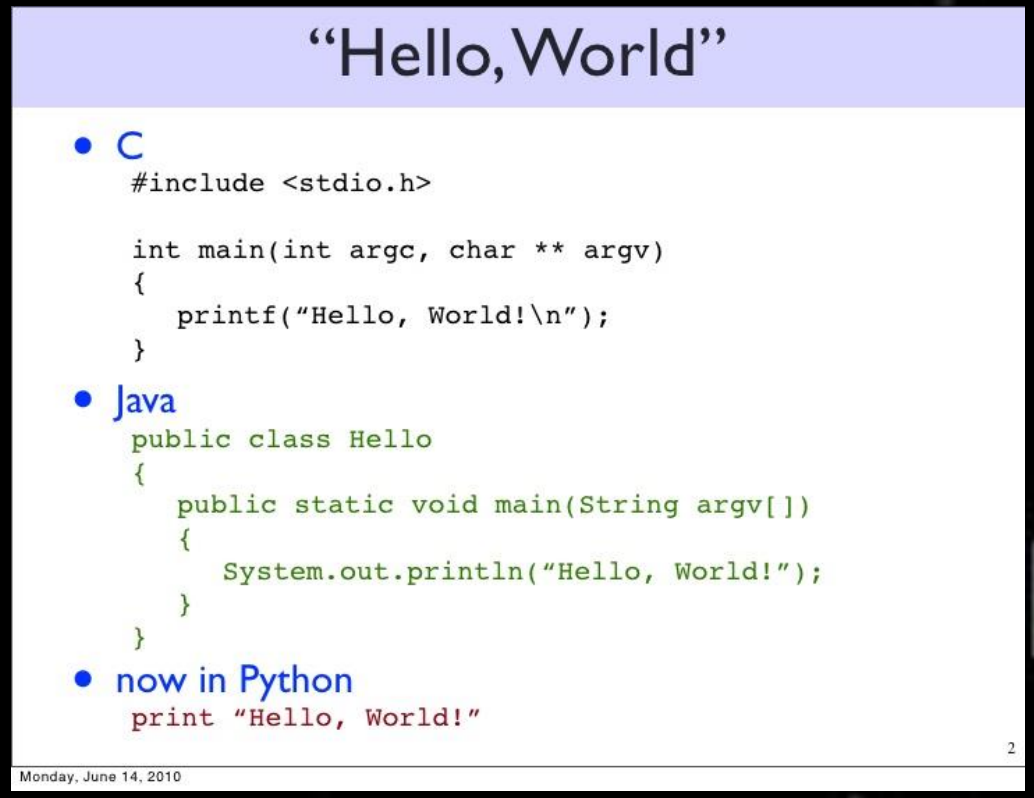
```
# generator version
def fibon(n):
    a = b = 1
    for i in xrange(n):
        yield a
        a, b = b, a + b
```

Language Concepts

- Python's compatibility with other languages
  - Tools/libraries that allow Python to integrate with other major languages
    - C/C++ with Pyrex/Cython
    - Java with Jython/Jpype
    - C#/.NET with IronPython
    - Fortran with F2PY
    - Prolog with PyLog
    - And many, many more
- Everything in Python is an object
  - Can be assigned to a variable or passed as an argument
    - "foo = Foo( )"
    - "foo = 10"
    - "foo = "Hello world!"
  - This is where "dynamically-typed" comes into play, although Python is still strongly-typed

Language Concepts

- Python is very high-level making it easy to read/write compared to other languages



- Use of "for-else" control statements
- Swapping values of variables dynamically
- Argument unpacking
  - See these in example program

- Assigning multiple values to a variable

```
Python 3.5.0 (v3.5.0:374f501f4567, Sep 13 2015, 02:16:59) [MSC v.1900 32 bit (Int
el)] on win32
Type "copyright", "credits" or "license()" for more information.
>>> temp = 1,2,3
>>> temp
(1, 2, 3)
>>> x,y,z = temp
>>> x
1
>>> y
2
>>> z
3
>>>
```

Example

presentationExample.py

```python
#for-else block:
def newControls(thisList):
    print("Input list =",thisList)
    for element in thisList:
        if element == "target":
            print(element,"= target")
            print("Search successful!")
            break
        elif element != "target":
            print(element,"!= target")

    else:
        print("Your target is not in this list!")

#Argument unpacking:
def splitThree(x,y,z):
    print(x)
    print(y)
    print(z)

def changeArgs(*args):
    args = list(args)
    args[0] = 'Hello'
    args[1] = 'awesome'
    splitThree(*args)
```

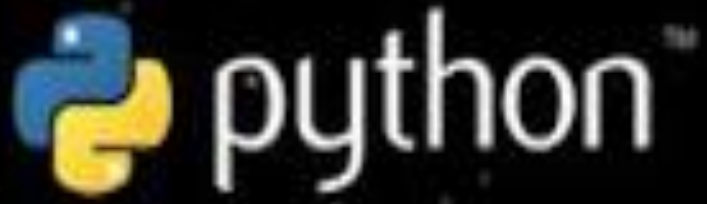
```python
#Assigning multiple values to a variable:
def multVals():
    print("Running 'temp = 1,2,3' assigns variable a tuple of three values")
    temp = 1,2,3
    print("Now, 'temp' =",temp)
    print("Running 'x,y,z = temp' dynamically assigns the values from temp to x,y, and z")
    x,y,z = temp
    print("Now, x =",x)
    print("Now, y =",y)
    print("Now, z =",z)

#Executing functions
print("Testing for-else block:")
newControls([24,"Python",[]])
print("")
newControls(["NOPE",.000001,"target"])
print("")
print("Testing argument unpacking:")
changeArgs('Goodbye','cruel','world!')
print("")
print("Testing assigning multiple values to a variable:")
multVals()
```

Example

```
Python 3.5.0 (v3.5.0:374f501f4567, Sep 13 2015, 02:16:59) [MSC v.1900 32 bit (Intel)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: C:\Python3.5\Python Files\presentationExample.py ==========
Testing for-else block:
Input list = [24, 'Python', []]
24 != target
Python != target
[] != target
Your target is not in this list!

Input list = ['NOPE', 1e-06, 'target']
NOPE != target
1e-06 != target
target = target
Search successful!

Testing argument unpacking:
Hello
awesome
world!

Testing assigning multiple values to a variable:
Running 'temp = 1,2,3' assigns variable a tuple of three values
Now, 'temp' = (1, 2, 3)
Running 'x,y,z = temp' dynamically assigns the values from temp to x,y, and z
Now, x = 1
Now, y = 2
Now, z = 3
>>> testString = "Testing Python's interactive shell"
>>> testString
"Testing Python's interactive shell"
>>> print(type(testString))
<class 'str'>
>>> testString == 3
False
>>>
```

Comparsions - C++

- Both object-oriented, imperative languages
- C++ compiled code to hardware native code language, but Python compiled to bytecode, executed by VM
- Usually code length of Python is 5 - 10 times shorter than equivalent C++ code.
- Python shines a s a glue language, used to combine components written in C++.



Comparsions - Java

- Usually code length is 3 - 5 times shorter than the equivalent Java code.
- Python can be used to prototype components into Java implementation.
- The components can be developed in Java and then use it in Python. It can combined to form applications in Python.