MAHIDOL UNIVERSITY

Wisdom of the Land

[SCPY204]

Computer Programing

for Physicists

Class 05: 9 Feb 2017

Content: Program's input/output, introduction to Python programming

Instructor: Puwis Amatyakul

2017

“Celebrating Maka Bucha Day”

[on 11 Feb]

Today's Goals

Part I: Review, Q&A

Part II: Introduction to Python

Part III: Again! Exercises

Part IV: File I/O

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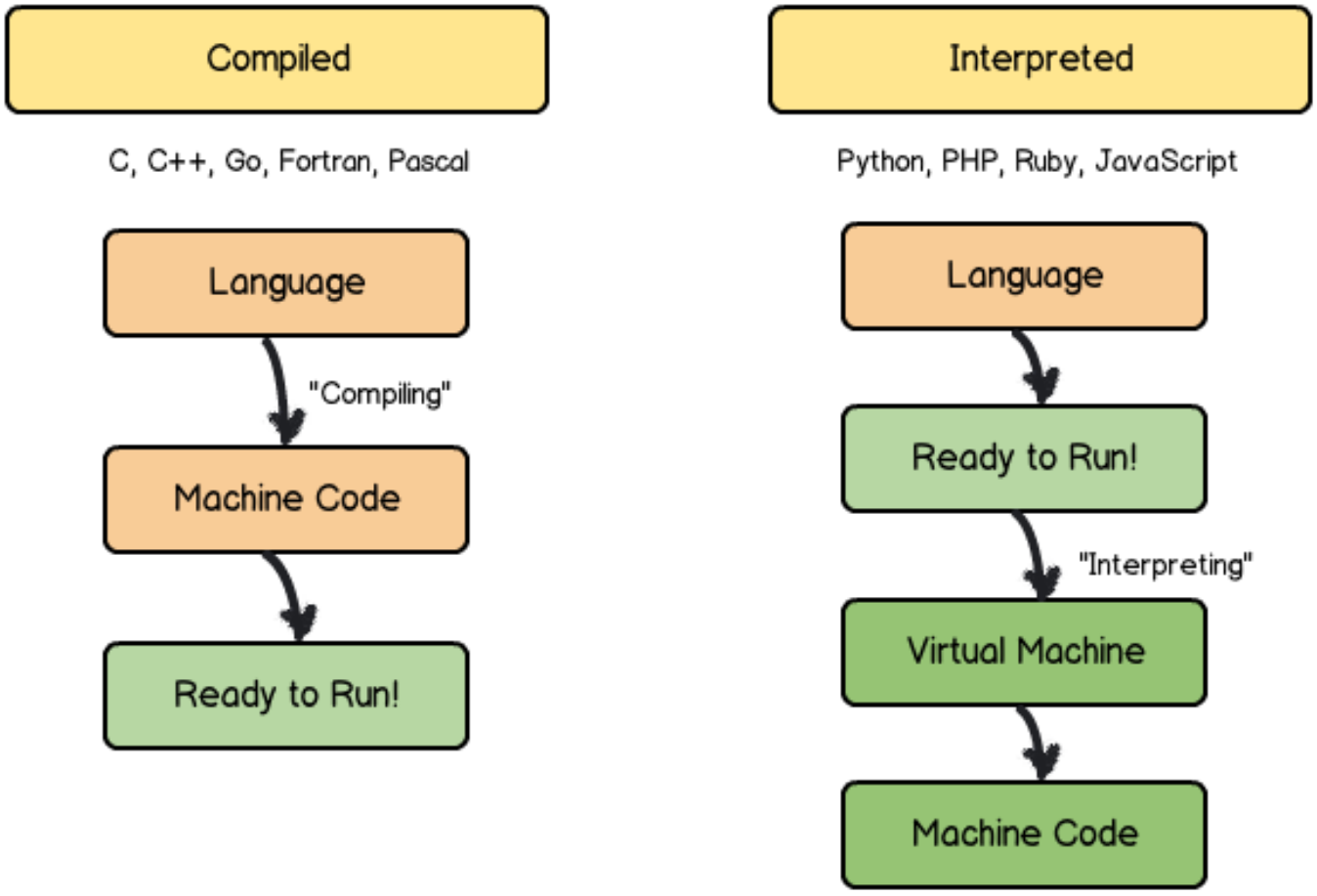
Python: Introduction

About Python

- Python is a high-level programming language created by Guido van Rossum.
- First released in 1991.
- It can be classified as an interpreted language used for general-purpose programming.
- Python emphasizes its code readability by using **whitespace indentation** to delimit code blocks rather than **curly braces** or **keywords**).

Guido van Rossum
Dutch programmer

Compiled VS Interpreted Language



Python: Introduction

Compiled VS Interpreted Language

Compiled		Interpreted	
PROS	CONS	PROS	CONS
ready to run	**not** cross platform	cross-platform	interpreter required
often **faster**	inflexible	simpler to test	often **slower**
source code is **private**	extra step	easier to debug	source code is **public**

Python: Introduction

Code blocks

```
1  #!/usr/bin/python
2
3  print "Hello, World!";
4
```

"Hello, World!" program in Python

```
1  #include <stdio.h>
2
3  int main()
4  {
5     printf("Hello, World! \n");
6     return 0;
7  }
8
```

"Hello, World!" program in C

Python: Introduction

➔ Comparison with other languages (1)

Matrix multiplication test: $\mathbf{C} = \mathbf{AB}$

Language	Option	n=1500	n=1750	n=2000
Python	intrinsic	0.49	0.80	0.95
Python + Numba (loops)		3.6	6.28	13.4
Matlab	intrinsic	0.77	1.02	0.99
Fortran	gfortran (matmul)	1.58	2.52	4.34
	gfortran -O3 (matmul)	1.28	2.05	3.68
	ifort (loop)	1.55	2.01	4.48
	ifort -O3 (loop)	0.51	0.81	1.24
	ifort -O3 (matmul)	0.52	0.82	1.25
	ifort (DGEMM)	0.19	0.23	0.33
C	gcc (loop)	13.33	21.18	31.77
	gcc -Ofast (loop)	1.34	2.35	4.30
	icc (loop)	1.25	2.19	3.99
	icc -Ofast (loop)	1.23	1.72	2.62

Source: https://modelingguru.nasa.gov/docs/DOC-2625

Python: Introduction

➔ Comparison with other languages (2)

Solving 2-D Laplace's equation : $\boldsymbol{u_{xx} + u_{yy} = 0}$

Language	Option	n=100	n=150	n=200
Python		144.54	715.96	2196.97
Python + Numba		1.23	5.37	16.34
Matlab		5.06	12.50	23.40
Fortran	gfortran	1.21	5.56	15.64
	gfortran -O3	0.668	3.072	8.897
	ifort	0.38	2.15	6.10
	ifort -O3	0.536	2.46	7.15
C	gcc	0.51	2.47	7.85
	gcc -Ofast	0.21	1.04	3.18
	icc	0.45	2.23	6.78
	icc -Ofast	0.32	1.60	4.87

Source: https://modelingguru.nasa.gov/docs/DOC-2625

Python: Basic

- ➔ **Syntax**
- ➔ **Data type**
- ➔ **Operation**
- ➔ **Control flows**
- ➔ **Function**
- ➔ **Sequence** (array)

Python: Basic

➔ Syntax

Identifier (naming)

- An identifier starts with a letter A to Z or a to z or an underscore (_) followed by zero or more letters, underscores and digits (0 to 9).

Statement

- Semicolon (;) is not needed to end a statement. It can be used to omit display output and also for multiple statements on a single line.

```
x = 2.5; y = 4.5; z = 45
d = x/y
```

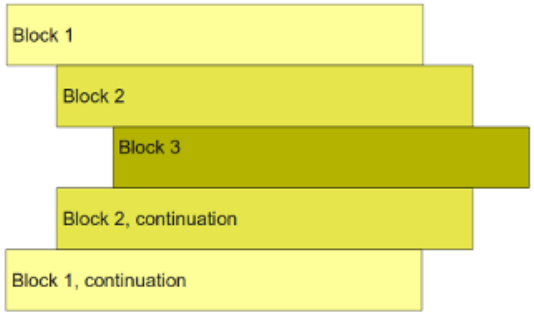
Python: Basic

➔ Syntax

Lines and Indentation

- Blocks of code are denoted by line indentation
- The number of spaces in the indentation is variable, but all statements within the block must be indented the same amount.

```
if True:
    print "Answer"
    print "True"
else:
    print "Answer"
  print "False" XXXXXXXX
```



This is very important!

Python: Basic

➔ Syntax

Multi-Line Statements

Python allow multiline coding for both assignment and operation statement.

For example,

```
total = item_one + \
        item_two + \
         item_three
```

and,

```
days = ['Monday', 'Tuesday', 'Wednesday',
         'Thursday', 'Friday']
```

Python: Basic

➔ Syntax

Comment

'**#**' will be used for commenting. All characters after the # and up to the end of the physical line are part of the comment.

```
x = 2.5 # comments
y = 4.5
```

Input and Output

Waiting for user input (keyboard)

```
input_str = raw_input("Enter input string:")
```

Display output

```
print( "Input = ",input_str,"\n") # Python 3
```

See: http://sebastianraschka.com/Articles/2014_python_2_3_key_diff.html

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Python: Exercise

➔ Ex 1:

Giving a series **s** = {-1,4,-9,16,-25, … }.

1) Can you find a formula of this series?
2) Write a Python program to sum the first 20 terms.
3) Write a program to find how many percent of the first 100 term that |s| < 1000.

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* I/O == input and output

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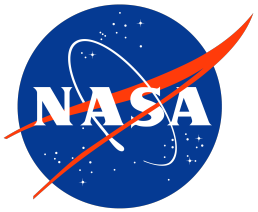
Something Interesting

Interesting Stuffs



NASA modeling Guru
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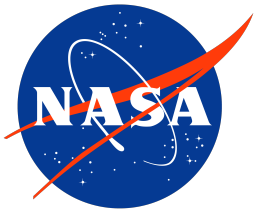
Interesting Stuffs



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