Python : Getting Started

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First Python program

- Let us execute programs in different modes of programming.
- Interactive Mode Programming:
  - Invoking the interpreter without passing a script file as a parameter brings up the following prompt:

```
rashmi@rashmi-dell:~$ python3
Python 3.4.3 (default, Oct 14 2015, 20:33:09)
[GCC 4.8.4] on linux
Type "help", "copyright", "credits" or "license" for
>>> print("Hello World...!!!")
Hello World...!!!
>>>
```

Script Mode Programming

- Invoking the interpreter with a script parameter begins execution of the script and continues until the script is finished. When the script is finished, the interpreter is no longer active.
- Let us write a simple Python program in a script. Python files have the extension .py. Type the following source code in a test.py file-

```
print ("Hello, Python!")
```

- Now, try to run this program as follows-

```
$ python test.py
```

Script Mode Programming

- Let us try another way to execute a Python script in Linux. Here is the modified test.py file-

```
#!/usr/bin/python3

print ("Hello, Python!")
```

- We assume that you have Python interpreter available in the /usr/bin directory. Now, try to run this program as follows-

```
$ chmod +x test.py # This is to make file executable
$./test.py
```

Python Identifiers

- A Python identifier is a name used to identify a variable, function, class, module or other object.
- 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).
- Python does not allow punctuation characters such as @, $, and % within identifiers.
- Python is a case sensitive programming language. Thus, `College` and `college` are two different identifiers in Python.

Python Identifiers – Naming Conventions

- Class names start with an uppercase letter. All other identifiers start with a lowercase letter.
- Starting an identifier with a single leading underscore indicates that the identifier is private.
- Starting an identifier with two leading underscores indicates a strong private identifier.
- If the identifier also ends with two trailing underscores, the identifier is a language-defined special name.

Keywords

- Keywords are the **reserved words** in Python.
- We cannot use a keyword as a variable name, function name or any other identifier. They are used to define the syntax and structure of the Python language.
- In Python, keywords are case sensitive.
  - All the keywords except True, False and None are in lowercase and they must be written as it is.
- There are 33 keywords in Python 3.7

Python keywords

False	class	finally	is	return
None	continue	for	lambda	try
True	def	from	nonlocal	while
and	del	global	not	with
as	elif	if	or	yield
assert	else	import	pass	
break	except	in	raise	

Declaring and using variables

```
>>> num1 = 45
>>> num2 = 56
>>> print(num1)
45
>>> num3 = 12.33
>>> print(num3)
12.33
>>> name = 'Tushar'
>>> print(name)
Tushar
```

Data types

- Numbers:
  - int
  - float
  - complex
- String
- Boolean
- List
- Tuple
- Set
- Dictionary

Integers

```
>>> num = 23
>>> type(num)
<class 'int'>
>>> num + 10
33
>>> num ** 100
1488619150636303939379155658659754231987119653801368686576988209222433278539331352152390143277346804233476592179447310859520222529876001
```

Integer length

- Try this:

```
>>> num ** 1000
```

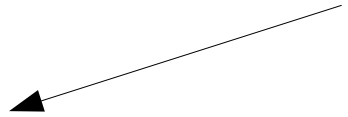
- This will generate a big number with 100s of digits.
- There is NO inherent limit to the integer to store in memory. It goes on using until we run out of memory.

Floating point numbers

```
>>> num = 59.33
>>> print(num)
59.33
>>> num = 5933e18
>>> print(num)
5.933e+21
>>> type(num)
<class 'float'>
>>> num = 12.9567255478
>>> num * 11.43
148.09537301135398
```

Floating point numbers

```
>>> num1 = 4.233e221
>>> num2 = 12.322E212
>>> num1 * num
inf
>>> 2.0 ** 1023
8.98846567431158e+307
>>> 2.1 ** 1023
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
  OverflowError: (34, 'Numerical result out of range')
```



Other number systems

- **Octal number system**

```
>>> num = 0o123
>>> print(num)
83
```

- **Hexadecimal number system**

```
>>> num = 0x123
>>> print(num)
291
```

- **Binary Number system**

```
>>> num = 0b101
>>> print(num)
5
```

Multiple assignment

```
>>> num1, num2, num3 = 12, 34, 55
>>> print(num1)
12
>>> print(num2)
34
>>> print(num3)
55
```

Multiple assignment

```
>>> num1 = num2 = num3 = 27
>>> print(num1)
27
>>> print(num2)
27
>>> print(num3)
27
```

Semicolon separator

```
>>> num1 = 12; num2 = 34; num3 = 31
>>> print(num2)
34
>>> num1 = 10; num1 = num1 + 2; print(num1)
12
```

Strings

- Strings can be declared in single or double quotes.

```
>>> name = 'Hello World'
>>> print(name)
Hello World
>>> name = "Hello World"
>>> print(name)
Hello World
>>> type(name)
<class 'str'>
```

Making combinations

```
>>> data = 'Learning "Python" is fun'
>>> print(data)
Learning "Python" is fun
>>> data = "Learning 'Python' is fun"
>>> print(data)
Learning 'Python' is fun
```

String concatenation

```
>>> first = 'Python'
>>> second = 'Programming'
>>> last = first + second
>>> print(last)
PythonProgramming
>>> print(first+second)
PythonProgramming
>>> print('Python'+'Programming')
PythonProgramming
```

Escape Sequences

\n	New Line
\t	Tab
\v	Vertical tab
\r	Carriage Return
\b	Backspace
\a	Audio bell
\\	Single slash

Using escape sequences

```
>>> print('Hello\nWorld')
Hello
World
>>> print('Hello\bWorld')
HellWorld
>>> print('Hello\vWorld')
Hello
     World
>>> print('Hello\rWorld')
World
>>> print('Hello\\World')
Hello\World
```

Comment

- Python Syntax ‘Comments’ let you store tags at the right places in the code.
- You can use them to explain complex sections of code. The interpreter ignores comments.
- Declare a comment using an octothorpe / hash (#).

```
# This is a comment
>>> num = 34     #Variable declared
```

- Python does not support general multiline comments like Java or C++.

Docstring

- A docstring is a documentation string. Like a comment, this Python Syntax is used to explain code.
- But unlike comments, they are more specific. Also, they are retained at runtime.
- This way, the programmer can inspect them at runtime. Delimit a docstring using three double or single quotes.

Multi-line string

```
>>> line = '''Hello
... Welcome to MITU
... Pune'''
>>> print(line)
Hello
Welcome to MITU
Pune
```

Multi-line comment

```
'''This is my first program
Date: 15/05/2019 '''
num1 = 45
num2 = 55
result = 45 + 55
print(result)
```

Common string functions

- `title()`
- `upper()`
- `lower()`
- `swapcase()`
- `isalpha()`
- `isdigit()`
- `islower()`
- `isupper()`
- `istitle()`
- `split()`
- `strip()`
- `lstrip()`
- `rstrip()`
- `find()`
- `startswith()`
- `endswith()`
- `replace()`

Using string functions

```
>>> data = 'hello'
>>> data.upper()
'HELLO'
>>> data.isalpha()
True
>>> data.split()
['hello']
>>> data.startswith('he')
True
>>> data.replace('e','a')
'hallo'
```

The Unicode strings

```
>>> s = u'\u0937'
>>> print(s)
ष
>>> s = u'\u0567'
>>> print(s)
է
s = u'\u0756'
>>> print(s)
ݖ
```

The dir( ) function

- The dir() function returns all properties and methods of the specified object, without the values.
- This function will return all the properties and methods, even built-in properties which are default for all object.
- If the object has __dir__() method, the method will be called and must return the list of attributes.
- If the object doesn't have __dir__() method, this method tries to find information from the __dict__ attribute (if defined), and from type object. In this case, the list returned from dir() may not be complete.

Using dir and help

- How to use dir( ) ?
  - `>>> data = 'hello'`
  - `>>> dir(data)`
- How to see the help of functions ?
  - `>>> help(data.upper)# Object function`
  - `>>> help(len)  # basic function`
- You can apply the dir() and help() function to all kind of variables and objects.

The print function

- The print() function prints the given object to the standard output device (screen) or to the text stream file.
- The full syntax of print() is:
  - `print(*objects, sep=' ', end='\n')`
    - objects - object to the printed. * indicates that there may be more than one object
    - sep - objects are separated by sep. Default value: ''
    - end - end is printed at last

Using print( )

```
>>> name = 'Tushar'
>>> age = 34
>>> print('My name is',name,'and age is',age)
My name is Tushar and age is 34
>>> print('My name is %s and age is %d' %
(name,age))   # Formatted print
My name is Tushar and age is 34
>>> print('My name is {} and age is
{}' .format(name,age))  #Using .format
My name is Tushar and age is 34
```

Print options

```
>>> print('My name is',name)
My name is Tushar
>>> print('My name is',name,end='\n\n')
My name is Tushar

>>> print(name,age)
Tushar 34
>>> print(name,age,sep='\t')
Tushar 34
>>> print(name,age,sep='\n')
Tushar
34
```

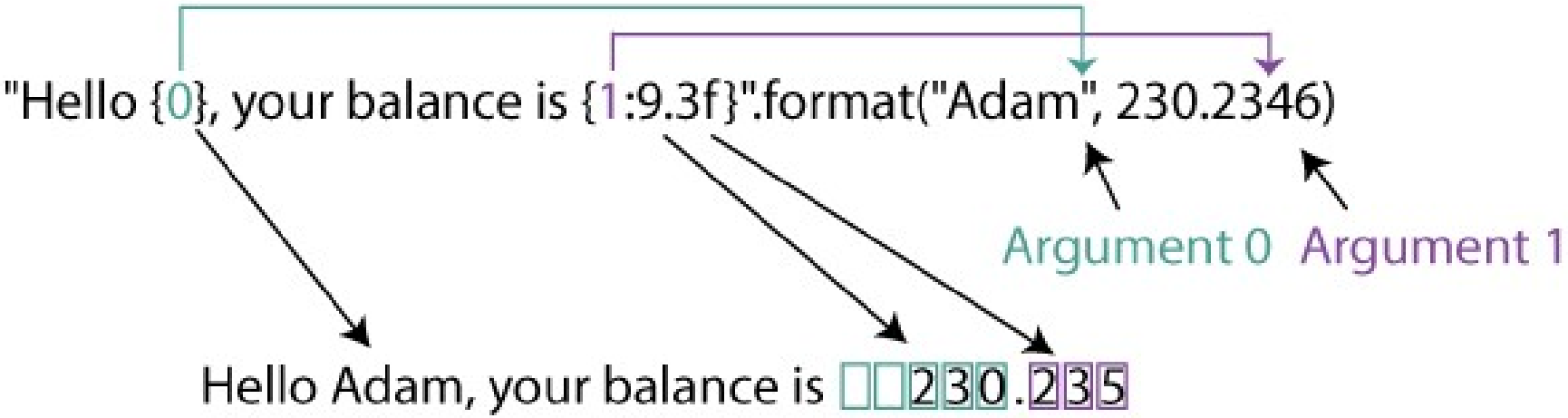
The format( )

- The string format() method formats the given string into a nicer output in Python.
- The syntax of format() method is:
  - `template.format(p0, p1, ..., k0=v0, k1=v1, ...)`
- Here, p0, p1,... are positional arguments and, k0, k1,... are keyword arguments with values v0, v1,... respectively.
- And, template is a mixture of format codes with placeholders for the arguments.

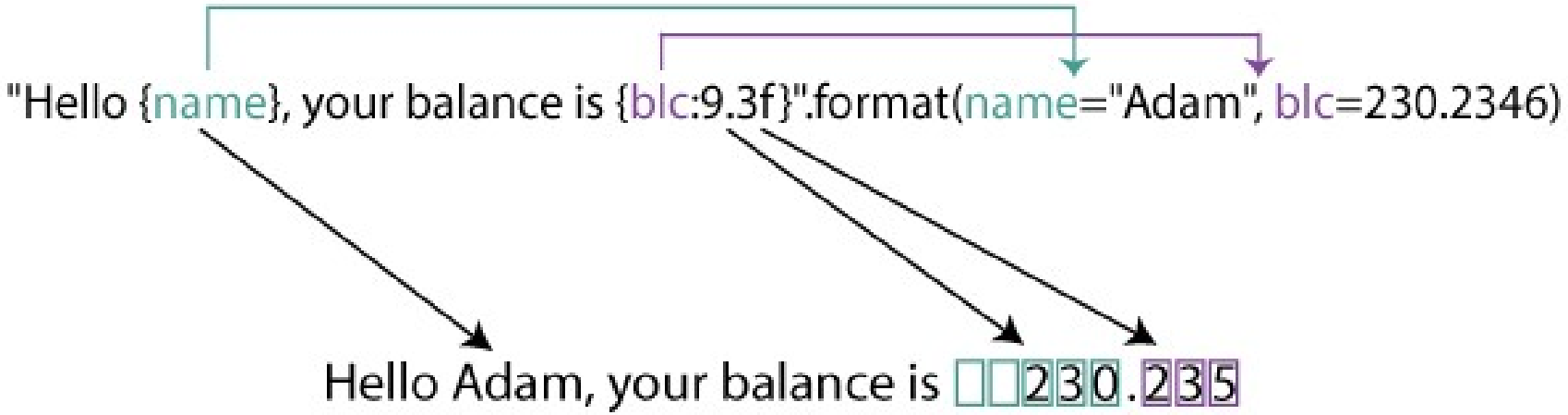
The format( ) parameters

- String format() Parameters
  - format() method takes any number of parameters. But, is divided into two types of parameters:
  - Positional parameters - list of parameters that can be accessed with index of parameter inside curly braces {index}
  - Keyword parameters - list of parameters of type key=value, that can be accessed with key of parameter inside curly braces {key}

Positional arguments



Keyword arguments



Using format( )

name = 'Tushar'

age = 34

- # default arguments

  print("Hello { }, your age is { }.".format(name,age))

- # positional arguments

  print("Hello {0}, your age is {1}.".format(name,age))

- # keyword arguments

  print("Hello {x}, your age is {y}.".format(x=name, y=age))

- # mixed arguments

  print("Hello {0}, your age is {y}.".format(name, y=age))

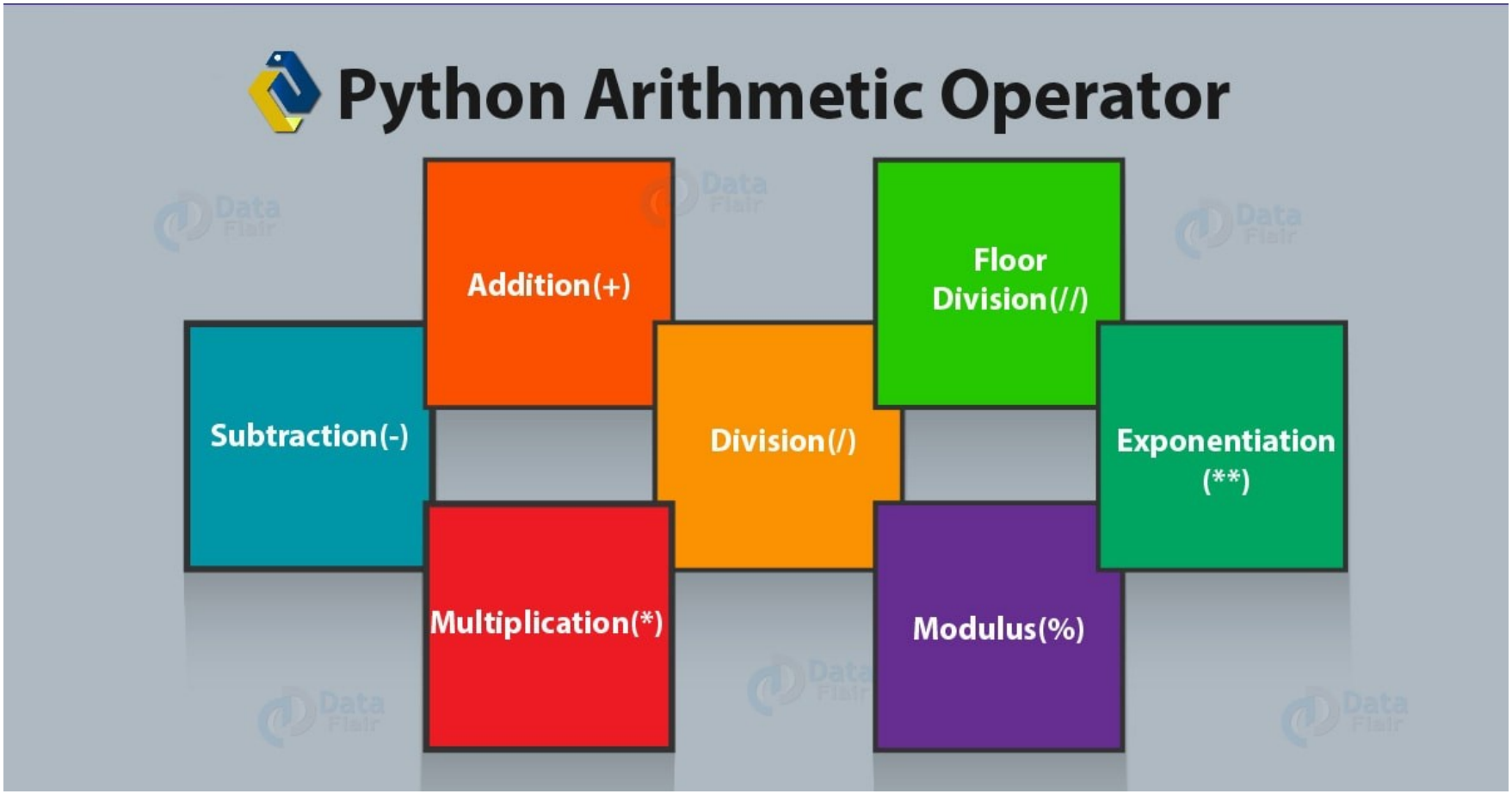
Format specifiers

- %s – String (or any object with a string representation, like numbers)
- %d – Integers
- %f – Floating point numbers
- %.<number of digits>f – Floating point numbers with a fixed amount of digits to the right of the dot.
- %x/%X – Integers in hex representation (lowercase/ uppercase)
- %o – Integers in octal representation

Operators


Python
Operators
Arithmetic Operators
Relational Operators
Assignment Operators
Logical Operators
Bitwise Operators
Membership Operators
Identity Operators

Arithmetic Operators



Arithmetic operators

```
>>> num1 = 23; num2 = 11
>>> result = num1 + num2
>>> result
34
>>> num1 - num2
12
>>> num1 * num2
253
>>> num1 / num2
2.090909090909091
>>> num1 // num2
2
>>> num1 % num2
1
```

Arithmetic operators on strings

- The multiplication operator can be used on strings too.

```
>>> name = 'Tushar'
>>> name * 5
'TusharTusharTusharTusharTusharTushar'
```

Relational operators

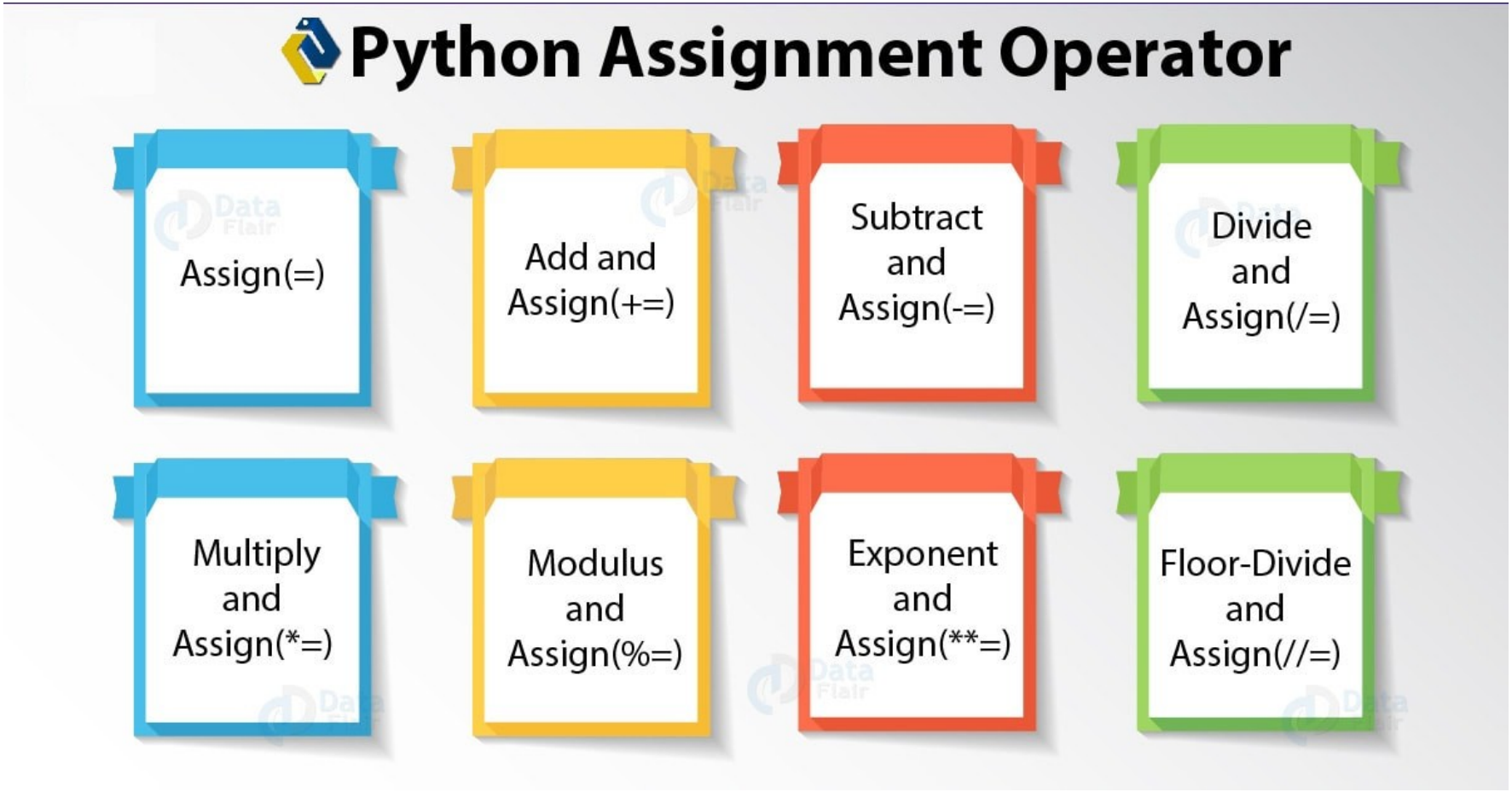
Relational operators

```
>>> num1 > num2
True
>>> num1 <= num2
False
>>> num1 == num2
False
>>> num1 != num2
True
```

Relational operators on strings

```
>>> 'Abc' != 'AbC'
True
>>> 'Abc' == 'AbC'
False
>>> 'Abc' < 'AbC'
False
>>> 'Abc' < 'AbCdef'
False
```

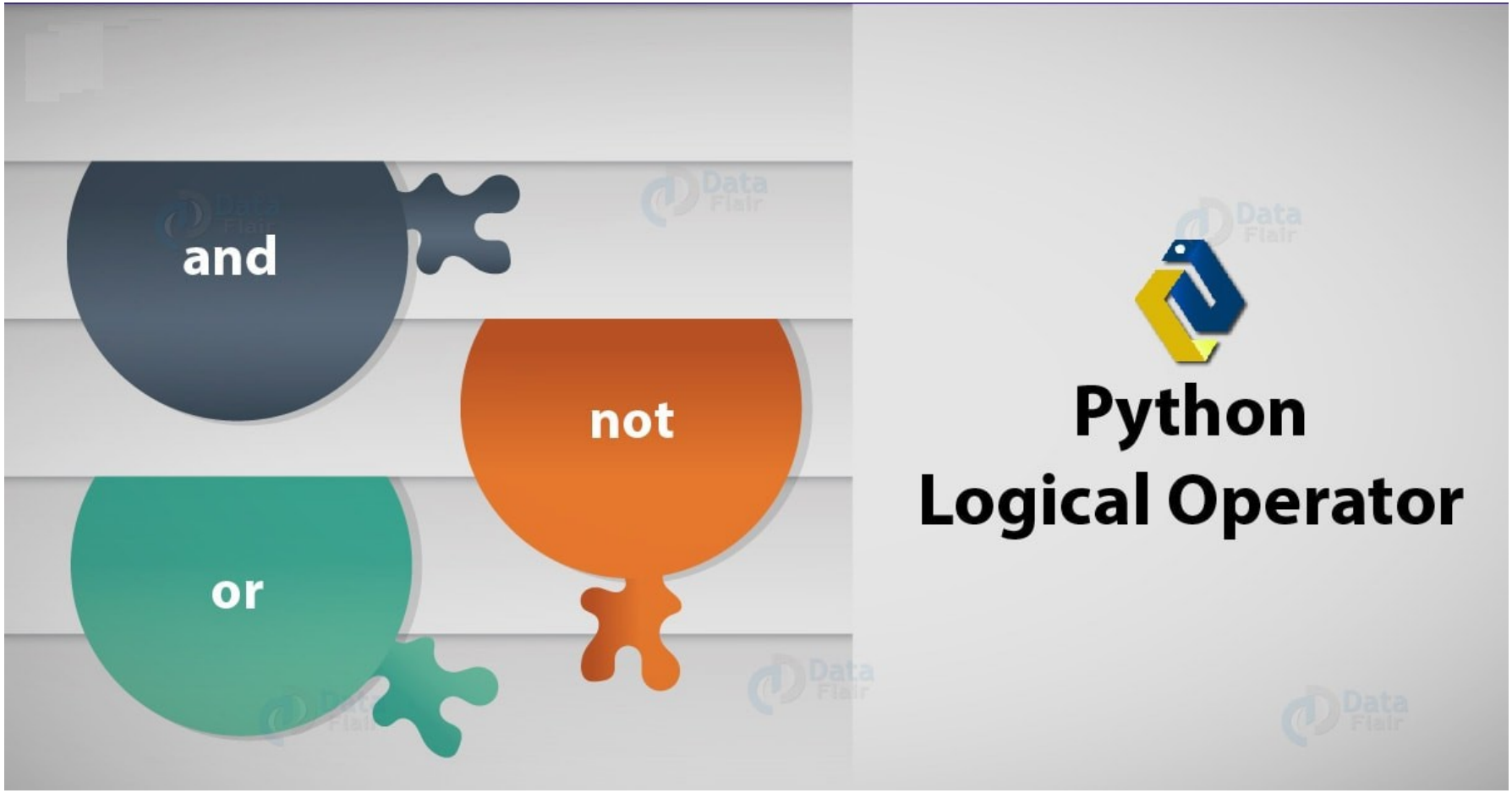
Assignment operators



Assignment operators

```
>>> print(num1)
25
>>> num1 += 2
>>> print(num1)
27
>>> num1 *= 2
>>> print(num1)
54
>>> num1 /= 2
>>> print(num1)
27.0
```

Logical operators



Logical operators

```
>>> num1 > num2 and num1 < 100
True
>>> num1 > 100 or num1 == num2
False
>>> not num1 < 100
False
```

Membership operators

- These operators test whether a value is a member of a sequence. The sequence may be a list, a string, or a tuple. We have two membership python operators- ‘in’ and ‘not in’.
  - `in`
    - This checks if a value is a member of a sequence.
  - `not in`
    - Unlike ‘in’, ‘not in’ checks if a value is not a member of a sequence.

Membership operators

```
>>> x = 10
>>> x in [34,10,32,17]
True
>>> 15 in [34,10,32,17]
False
>>> 15 not in [34,10,32,17]
True
>>> 'kar' in 'Tendulkar'
True
```

Identity operators

- These operators test if the two operands share an identity. We have two identity operators- ‘is’ and ‘is not’.
  - `is`
    - If two operands have the same identity, it returns True.
  - `is not`
    - If two operands have the different identity, it returns True.

Identity operators

```
>>> 2 is 2
True
>>> 2 is '2'
False
>>> 20 is 20.0
False
>>> 20 is not 20.0
True
>>> 2000.0 is 2e3
True
```

Bitwise operators

Bitwise operators

```
>>> x = 19; y = 34
>>> x & y
2
>>> x | y
51
>>> x ^ y
49
>>> y << 2
136
>>> ~x
-20
```

Operators Precedence

Operator	Description
**	Exponentiation (raise to the power)
~ + -	Complement, unary plus and minus (method names for the last two are +@ and -@)
* / % //	Multiply, divide, modulo and floor division
+ -	Addition and subtraction
>> <<	Right and left bitwise shift
&	Bitwise 'AND'
^ |	Bitwise exclusive `OR' and regular `OR'
<= < > >=	Comparison operators
<> == !=	Equality operators
= %= /= //= -= += *= **=	Assignment operators
is is not	Identity operators
in not in	Membership operators
not or and	Logical operators

Two more types

- Complex

```
>>> num = 2.3 + 4.5j
>>> print(num)
(2.3+4.5j)
>>> type(num)
<class 'complex'>
```

- Boolean

```
>>> num = True
>>> print(num)
True
>>> type(num)
<class 'bool'>
```

Special type: None

- The null keyword is commonly used in many programming languages, such as Java, C++, C# and Javascript. It is a value that is assigned to a variable.
- The equivalent of the null keyword in Python is **None**. It was designed this way for two reasons:
  - Many would argue that the word "null" is somewhat esoteric. It's not exactly the most friendliest word to programming novices. Also, "None" refers exactly to the intended functionality - it is *nothing*, and has no behavior
  - In most object-oriented languages, the naming of objects tend to use camel-case syntax. eg. ThisIsMyObject. As you'll see soon, Python's None type is an object, and behaves as one.

Basic use

```
>>> num = None
>>> print(num)
None
>>> num
>>> type(num)
<class 'NoneType'>
```

Type conversion

- The process of converting the value of one data type (integer, string, float, etc.) to another data type is called type conversion. Python has two types of type conversion.
  - Implicit Type Conversion
  - Explicit Type Conversion
- Implicit Type Conversion:
  - In Implicit type conversion, Python automatically converts one data type to another data type. This process doesn't need any user involvement.

Type conversion

```
>>> num1 = 45          #int
>>> num2 = 56.23       #float
>>> result = num1 + num2
>>> print(result)      #float
101.22999999999999
```

Explicit type conversion

- In Explicit Type Conversion, users convert the data type of an object to required data type. We use the predefined functions like int(), float(), str(), etc to perform explicit type conversion.
- This type conversion is also called typecasting because the user casts (change) the data type of the objects.
- Syntax :

```
(required_datatype)(expression)
```

- Typecasting can be done by assigning the required data type function to the expression.

Explicit type conversion

```
>>> num1 = 45
>>> num2 = 56.23
>>> result = num1 + int(num2)
>>> print(result)
101
```

Type casting on strings

```
>>> num = '178'
>>> num * 3
'178178178'
>>> int(num) * 3
534
>>> num = 123
>>> s = 'hello' + str(num)
>>> s
'hello123'
```

Compatibility code

- Many interpreter based languages are having similar kind of syntax. Check the below code. We can run this code by three different kinds of interpreters i.e. Python, R and Ruby.

add.py

```
# Addition
num1 = 45
num2 = 55
result = 45 + 55
print(result)
```

Output

```
mitu@skillologies:~$ python add.py
100
mitu@skillologies:~$ Rscript add.py
[1] 100
mitu@skillologies:~$ ruby add.py
100mitu@skillologies:~$
```

Taking user input

- The input( ) function is used to read the values from keyboard. It prints the string and reads a string from keyboard which then will be stored in a variable.
- Example:
  - `s = input('Enter your name:')`
  - `num = int(input('Enter a number:'))`
  - `marks = float(input('Enter marks:'))`

Sample code:

```
# Addition
num1 = int(input('Enter first:'))
num2 = int(input('Enter second:'))
result = num1 + num2
print('Addition is', result)
```

```
mitu@skillologies:~$ python3 add.py
Enter first:12
Enter second:23
Addition is 35
```

Exercises

- Write a program to read Celsius temperature and print equivalent Fahrenheit temperate on screen.
- Read radius of the circle from user and find the area and perimeter of it.
- Read the amount and percentage of interest from the keyboard and find final amount after adding interest in original amount.
- Write a program to read distance value in meters and convert it into centimeters, inches, and yards.

Thank you

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