Python Programming Fundamental

L01 - S05

Introduction

- Python 3.0, released in December 2008, was a major upgrade from the Python 2.x series and introduced several changes that were not backward compatible. The purpose was to rectify fundamental design flaws and inconsistencies in the language. Despite the intention to move the community forward with Python 3, many developers continued to use Python 2.7 due to the vast amount of existing code written in Python 2.x.
- To ease the transition and encourage adoption of Python 3, many features introduced in Python 3 were backported to Python 2.7, which was the last release of the Python 2.x series. This made it possible for developers to write code that was compatible with both versions, facilitating a smoother migration.

Introduction

Python Character Set

A set of valid characters recognized by python. Python uses the traditional ASCII character set. The latest version recognizes the Unicode character set.

The ASCII (American Standard Code for Information Interchange) character set is a subset of the Unicode character set

Letters :– A-Z,a-z

Digits :– 0-9

Special symbols :– Special symbol available over keyboard

White spaces:– blank space,tab,carriage return,new line, form feed

Token

Smallest individual unit in a program is known as token.

1. **Keywords**
2. **Identifiers**
3. **Literals**
4. **Operators**
5. **punctuators**

Keywords

Reserve word of the compiler/interpreter which can't be used as identifier.

and	exec	not
as	finally	or
assert	for	pass
break	from	print
class	global	raise
continue	if	return
def	import	try
del	in	while
elif	is	with
else	lambda	yield
except		

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 special characters

* Python is a case sensitive programming language.

* Identifier must not be a keyword of Python.

Thus, **Rollnumber** and rollnumber are two different identifiers in Python.

Some valid identifiers : Mybook, file123, z2td, date_2, _no

Some invalid identifier : 2rno,break,my.book,data-cs

Identifiers-continue

Some additional naming conventions

1. Class names start with an uppercase letter. All other identifiers start with a lowercase letter.

2. Starting an identifier with a single leading underscore indicates that the identifier is private.

3. Starting an identifier with two leading underscores indicates a strong private identifier.

4. If the identifier also ends with two trailing underscores, the identifier is a language-defined special name.

Literals

Literals in Python can be defined as number, text, or other data that represent values to be stored in variables.

Example of String Literals in Python
name = ‘Johni’ , fname =“johny”

Example of Integer Literals in Python(numeric literal)
age = 22

Example of Float Literals in Python(numeric literal)
height = 6.2

Example of Special Literals in Python
name = None

Literals

Escape sequence

Escape Sequence	Description
****	Backslash (\)
\'	Single quote (')
\"	Double quote (")
\a	ASCII Bell (BEL)
\b	ASCII Backspace (BS)
\f	ASCII Formfeed (FF)
\n	ASCII Linefeed (LF)
\r	ASCII Carriage Return (CR)
\t	ASCII Horizontal Tab (TAB)
\v	ASCII Vertical Tab (VT)
\ooo	Character with octal value ooo
\xhh	Character with hex value hh

Operators

Operators can be defined as symbols that are used to perform operations on operands.

Types of Operators

1. Arithmetic Operators.
2. Relational Operators.
3. Assignment Operators.
4. Logical Operators.
5. Bitwise Operators
6. Membership Operators
7. Identity Operators

Operators continue

1. Arithmetic Operators

Arithmetic Operators are used to perform arithmetic operations like addition, multiplication, division etc.

Operators	Description	Example
+	perform addition of two number	a+b
-	perform subtraction of two number	a-b
/	perform division of two number	a/b
*	perform multiplication of two number	a*b
%	Modulus = returns remainder	a%b
//	Floor Division = remove digits after the decimal point	a//b
**	Exponent = perform raise to power	a**b

Operators continue

2. Relational Operators

Relational Operators are used to compare the values.

Operators	Description	Example
==	Equal to, return true if a equals to b	a == b
!=	Not equal, return true if a is not equals to b	a != b
>	Greater than, return true if a is greater than b	a > b
>=	Greater than or equal to , return true if a is greater than b or a is equals to b	a >= b
<	Less than, return true if a is less than b	a < b
<=	Less than or equal to , return true if a is less than b or a is equals to b	a <= b

Operators continue

3. Assignment Operators
Used to assign values to the variables.

Operators	Description	Example
=	Assigns values from right side operands to left side operand	a=b
+=	Add 2 numbers and assigns the result to left operand.	a = a+b
/=	Divides 2 numbers and assigns the result to left operand.	a = a/b
*=	Multiply 2 numbers and assigns the result to left operand.	a = a*b
-=	Subtracts 2 numbers and assigns the result to left operand.	a = a-b
%=	modulus 2 numbers and assigns the result to left operand.	a = a%b
//=	Perform floor division on 2 numbers and assigns the result to left operand.	a = a//b
**=	calculate power on operators and assigns the result to left operand.	a = a**b

Operators continue

4. Logical Operators

Logical Operators are used to perform logical operations on the given two variables or values.

Operators	Description	Example
and	return true if both condition are true	x and y
or	return true if either or both condition are true	x or y
not	reverse the condition	not(a>b)

```
a=30
b=20
if(a==30 and b==20):
   print('hello')
```

Output :-

hello

Operators continue

6. Membership Operators

The membership operators in Python are used to validate whether a value is found within a sequence such as such as strings, lists, or tuples.

Operators	Description	Example
in	return true if value exists in the sequence, else false.	a in list
not in	return true if value does not exists in the sequence, else false.	a not in list

E.g.

```
a = 22
list = [22,99,27,31]
In_Ans = a in list
NotIn_Ans = a not in list
print(In_Ans)
print(NotIn_Ans)
```

Output :-

```
True
False
```

Operators continue

7. Identity Operators
Identity operators in Python compare the memory locations of two objects.

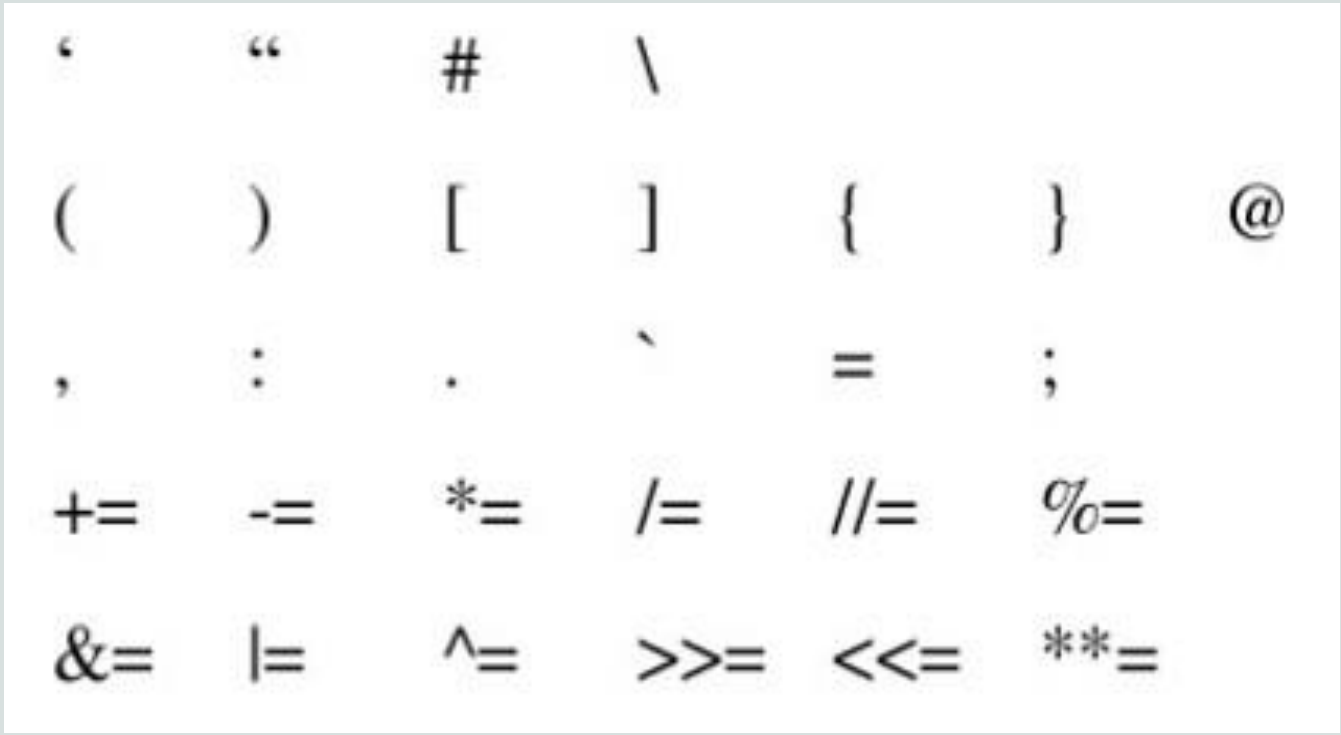
Operators	Description	Example
is	returns true if two variables point the same object, else false	a is b
is not	returns true if two variables point the different object, else false	a is not b

```
a = 37 b=34
if (a is b):
print('both a and b has same identity') else:
print('a and b has different identity')
```

Output:
both a and b has different identity

Punctuators

Used to implement the grammatical and structure of a Syntax.Following are the python punctuators.



Barebone of a python program

```
#function definition
def keyArgFunc(empname, emprole):
        print ("Emp Name: ", empname)
        print ("Emp Role: ", emprole)
        return;
A = 20
print("Calling in proper sequence")
keyArgFunc(empname = "Nick",emprole = "Manager" )
print("Calling in opposite sequence")
keyArgFunc(emprole = "Manager",empname = "Nick")
```

comment

Function

indentation

expression

statements

A python program contain the following components

a. Expression
b. Statement
c. Comments
d. Function
e. Block &n indentation

Barebone of a python program

a. Expression : - which is evaluated and produce result. E.g. (20 + 4) / 4
b. Statement :- instruction that does something.

```
e.g
a = 20
print("Calling in proper sequence")
```

c. Comments : which is readable for programmer but ignored by python interpreter

i. Single line comment: Which begins with # sign.
ii. Multi line comment (docstring): either write multiple line beginning with # sign or use triple quoted multiple line. E.g.

```
'''this is my
  first
 python multiline comment
'''
```

d. Function

a code that has some name and it can be reused.e.g. **keyArgFunc** in above program

d. Block & indentation : group of statements is block.indentation at same level create a block.e.g. all 3 statement of **keyArgFunc function**

Variables

- Variable is a name given to a memory location. A variable can consider as a container which holds value. Python is a type infer language that means you don't need to specify the datatype of variable.Python automatically get variable datatype depending upon the value assigned to the variable.
- **Assigning Values To Variable**
- name = 'python' # String Data Type
- **sum** = None # **a variable without value**

```
a = 23      # Integer
b = 6.2     # Float
sum = a + b
print (sum)
```

Multiple Assignment: assign a single value to many variables a = b = c = 1 # single value to multiple variable

a,b = 1,2 # multiple value to multiple variable a,b = b,a # value of a and b is swaped

Variables

Variable Scope And Lifetime in Python Program

1. Local Variable

```
def fun():
        x=8
        print(x)

fun()
print(x) #error will be shown
```

2. Global Variable

```
x = 8
def fun():
        print(x) # Calling variable ‘x’ inside fun()

fun()
print(x) # Calling variable ‘x’ outside fun()
```

Dynamic typing

Data type of a variable depend/change upon the value assigned to a variable on each next statement.

```
X = 25              # integer type
X = “python”        # x variable data type change to string on just next line
```

Now programmer should be aware that not to write like this:

```
Y = X / 5  # error !! String cannot be devided
```

Input and Output

print() Function In Python is used to print output on the screen.

Syntax of Print Function

print(expression/variable)
e.g. print
(122)

Output :-

122

print('hello India')

Output :-

hello India

print('Computer','Science') print('Compute
r','Science',sep=' &
') print('Computer','Science', sep=' & ',
end='.')

Output :-

Computer Science
Computer & Science

Input and Output

```
var1=‘Computer Science'
var2=‘Informatics Practices'
print(var1,' and ',var2,' )
```

Output :-

Computer Science and Informatics Practices

raw_input() Function In Python allows a user to give input to a program from a keyboard but in the form of string.

NOTE : raw_input() function is deprecated in python 3

e.g.

```
age = int(raw_input(‘enter your age’))
percentage = float(raw_input(‘enter percentage’))
```

input() Function In Python allows a user to give input to a program from a keyboard but returns the value accordingly.

e.g.

```
age = int(input(‘enter your age’))
C = age+2 #will not produce any error
```

NOTE : input() function always enter string value in python 3.so on need int(),float() function can be used for data conversion.

Python Data Types

Numeric Data Types

Numeric Data Types in Python are used to represent numbers, including integers and floating-point numbers, allowing for mathematical operations to be performed on them.

Sequence Data Types

Sequence Data Types in Python are used to store a collection of items in a specific order, such as lists, tuples, and strings.

Mapping Data Types

Mapping data types in Python refer to objects that store key-value pairs, allowing for efficient retrieval and manipulation of data within a program.

Set Data Types

In Python, set data types are unordered collections of unique elements that can be modified using methods like add(), remove(), and update().

Python - Data Types

- Numeric - int, float, complex
- String - str
- Sequence - list, tuple, range
- Binary - bytes, bytearray, memoryview
- Mapping - dict
- Boolean - bool
- Set - set, frozenset
- None - NoneType

Python Numeric Data Type

int	long	float	complex
10	51924361L	0.0	3.14j
100	-0x19323L	15.20	45.j
-786	0122L	-21.9	9.322e-36j
080	0xDEFABC ECBDAECB FBAEl	32.3+e18	.876j
-0490	535633629 843L	-90.	-.6545+0J
-0x260	- 052318172 735L	-32.54e100	3e+26J
0x69	- 472188529 8529L	70.2-E12	4.53e-7j

Python String Data Type

- Python Strings are identified as a contiguous set of characters represented in the quotation marks.
- Python allows for either pairs of single or double quotes.
- Subsets of strings can be taken using the slice operator ([ ] and [:]) with indexes starting at 0 in the beginning of the string and working their way from -1 at the end.

Practice

```
str = 'Hello World!'

print (str)          # Prints complete string
print (str[0])       # Prints first character of the string
print (str[2:5])     # Prints characters starting from 3rd to 5th
print (str[2:])      # Prints string starting from 3rd character
print (str * 2)      # Prints string two times
print (str + "TEST") # Prints concatenated string
```

Edit & Run

Python List Data Type

- A Python list contains items separated by commas and enclosed within square brackets ([]).
- To some extent, Python lists are similar to arrays in C.
- One difference between them is that all the items belonging to a Python list can be of different data type where as C array can store elements related to a particular data type.

Practice - list

Edit & Run

```
list = [ 'abcd', 786 , 2.23, 'john', 70.2 ]
tinylist = [123, 'john']

print (list)            # Prints complete list
print (list[0])         # Prints first element of the list
print (list[1:3])       # Prints elements starting from 2nd till 3rd
print (list[2:])        # Prints elements starting from 3rd element
print (tinylist * 2)    # Prints list two times
print (list + tinylist) # Prints concatenated lists
```

Practice - list

```python
# Create a list of integers
numbers = [1, 2, 3, 4, 5]
print(numbers)

# Create a list of strings
fruits = ["apple", "banana", "cherry"]
print(fruits)

# Create a mixed list
mixed = [1, "apple", 3.14, True]
print(mixed)

# Accessing elements by index
fruits = ["apple", "banana", "cherry"]
print(fruits[0])  # Output: apple
print(fruits[1])  # Output: banana
print(fruits[2])  # Output: cherry

# Negative indexing
print(fruits[-1])  # Output: cherry
print(fruits[-2])  # Output: banana

# Changing an element
fruits = ["apple", "banana", "cherry"]
fruits[1] = "blueberry"
print(fruits)  # Output: ['apple', 'blueberry', 'cherry']

# Using append() to add an element at the end
fruits = ["apple", "banana", "cherry"]
fruits.append("date")
print(fruits)  # Output: ['apple', 'banana', 'cherry', 'date']

# Using insert() to add an element at a specific position
fruits.insert(1, "blueberry")
print(fruits)  # Output: ['apple', 'blueberry', 'banana', 'cherry', 'date']
```

Python Tuple Data Type

- A Python tuple consists of a number of values separated by commas. Unlike lists, however, tuples are enclosed within parentheses.

```
my_tuple = (1, 2, 3, 'apple', 'banana')
```

```python
# Accessing elements
print(my_tuple[0])        # Output: 1
print(my_tuple[3])        # Output: 'apple'

# Slicing
print(my_tuple[1:4])      # Output: (2, 3, 'apple')

# Nested tuples
nested_tuple = (1, 2, ('apple', 'banana'), 3)
print(nested_tuple[2])    # Output: ('apple', 'banana')
print(nested_tuple[2][0])# Output: 'apple'
```