Python - Variables

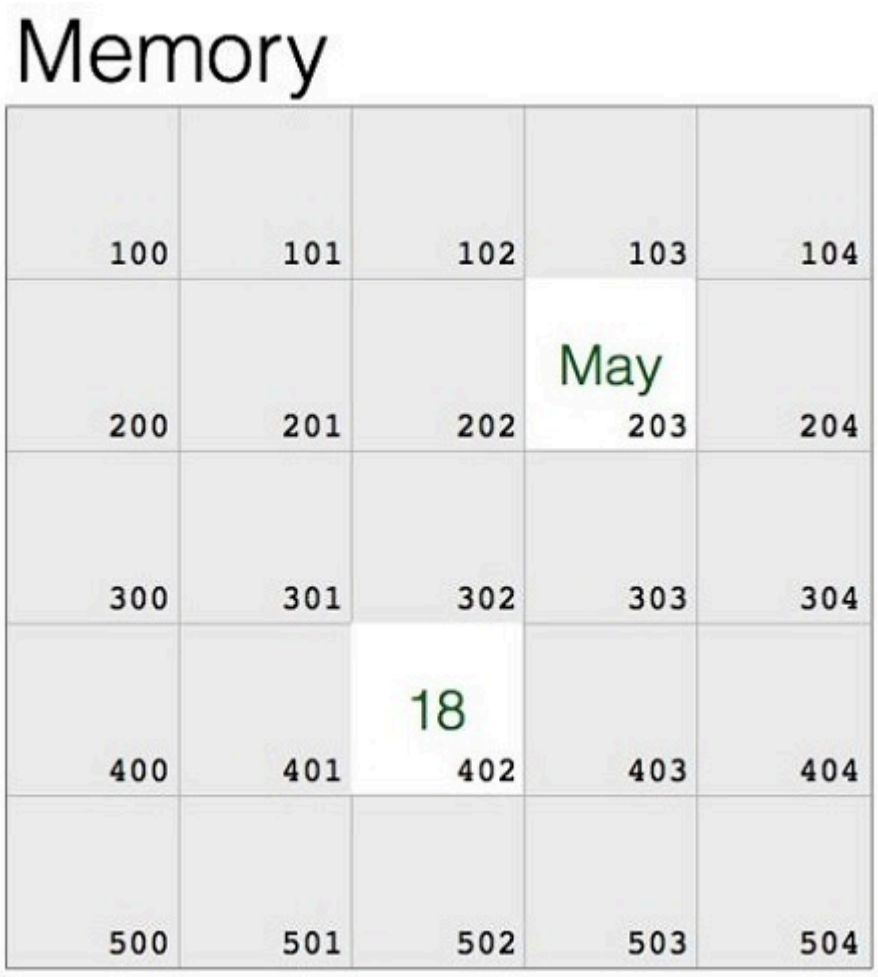
Python Variables

Python variables are the reserved memory locations used to store values with in a Python Program. This means that when you create a variable you reserve some space in the memory.

Based on the data type of a variable, Python interpreter allocates memory and decides what can be stored in the reserved memory. Therefore, by assigning different data types to Python variables, you can store integers, decimals or characters in these variables.

Memory Addresses

Data items belonging to different data types are stored in computer's memory. Computer's memory locations are having a number or address, internally represented in binary form. Data is also stored in binary form as the computer works on the principle of binary representation. In the following diagram, a string **May** and a number **18** is shown as stored in memory locations.



If you know the assembly language, you will covert these data items and the memory address, and give a machine language instruction. However, it is not easy for everybody. Language translator such as Python interpreter performs this type of conversion. It stores the object in a randomly chosen memory location. Python's built-in **id()** function returns the address where the object is stored.

```
>>> "May"
May
>>> id("May")
2167264641264

>>> 18
18
>>> id(18)
140714055169352
```

Once the data is stored in the memory, it should be accessed repeatedly for performing a certain process. Obviously, fetching the data from its ID is cumbersome. High level languages like Python make it possible to give a suitable alias or a label to refer to the memory location.

In the above example, let us label the location of May as month, and location in which 18 is stored as age. Python uses the assignment operator (=) to bind an object with the label.

```
>>> month="May"
>>> age=18
```

The data object (May) and its name (month) have the same id(). The id() of 18 and age are also same.

```
>>> id(month)
2167264641264
>>> id(age)
140714055169352
```

The label is an identifier. It is usually called as a variable. A Python variable is a symbolic name that is a reference or pointer to an object.

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Creating Python Variables

Python variables do not need explicit declaration to reserve memory space or you can say to create a variable. A Python variable is created automatically when you assign a value to it. The equal sign (=) is used to assign values to variables.

The operand to the left of the = operator is the name of the variable and the operand to the right of the = operator is the value stored in the variable. For example –

Example to Create Python Variables

This example creates different types (an integer, a float, and a string) of variables.

```
counter = 100          # Creates an integer variable
miles   = 1000.0       # Creates a floating point variable
name    = "Zara Ali"   # Creates a string variable
```

Printing Python Variables

Once we create a Python variable and assign a value to it, we can print it using **print()** function. Following is the extension of previous example and shows how to print different variables in Python:

Example to Print Python Variables

This example prints variables.

</> Open Compiler

```
counter = 100          # Creates an integer variable
miles   = 1000.0       # Creates a floating point variable
name    = "Zara Ali"   # Creates a string variable

print (counter)
print (miles)
print (name)
```

Here, 100, 1000.0 and "Zara Ali" are the values assigned to counter, miles, and name variables, respectively. When running the above Python program, this produces the following result –

```
100
1000.0
```

```
Zara Ali
```

Deleting Python Variables

You can delete the reference to a number object by using the del statement. The syntax of the del statement is –

```
del var1[,var2[,var3[....,varN]]]
```

You can delete a single object or multiple objects by using the del statement. For example –

```
del var
del var_a, var_b
```

Example

Following examples shows how we can delete a variable and if we try to use a deleted variable then Python interpreter will throw an error:

</> Open Compiler

```
counter = 100
print (counter)

del counter
print (counter)
```

This will produce the following result:

```
100
Traceback (most recent call last):
  File "main.py", line 7, in <module>
    print (counter)
NameError: name 'counter' is not defined
```

Getting Type of a Variable

You can get the data type of a Python variable using the python built-in function type() as follows.

Example: Printing Variables Type

</> Open Compiler

```
x = "Zara"
y =  10
z =  10.10

print(type(x))
print(type(y))
print(type(z))
```

This will produce the following result:

```
<class 'str'>
<class 'int'>
<class 'float'>
```

Casting Python Variables

You can specify the data type of a variable with the help of casting as follows:

Example

This example demonstrates case sensitivity of variables.

</> Open Compiler

```
x = str(10)    # x will be '10'
y = int(10)    # y will be 10
z = float(10)  # z will be 10.0

print( "x =", x )
print( "y =", y )
print( "z =", z )
```

This will produce the following result:

```
x = 10
y = 10
z = 10.0
```

Case-Sensitivity of Python Variables

Python variables are case sensitive which means **Age** and **age** are two different variables:

</> Open Compiler

```
age = 20
Age = 30

print( "age =", age )
print( "Age =", Age )
```

This will produce the following result:

```
age = 20
Age = 30
```

Python Variables - Multiple Assignment

Python allows to initialize more than one variables in a single statement. In the following case, three variables have same value.

```
>>> a=10
>>> b=10
>>> c=10
```

Instead of separate assignments, you can do it in a single assignment statement as follows –

```
>>> a=b=c=10
>>> print (a,b,c)
10 10 10
```

In the following case, we have three variables with different values.

```
>>> a=10
>>> b=20
>>> c=30
```

These separate assignment statements can be combined in one. You need to give comma separated variable names on left, and comma separated values on the right of = operator.

```
>>> a,b,c = 10,20,30
>>> print (a,b,c)
10 20 30
```

Let's try few examples in script mode: –

</> Open Compiler

```
a = b = c = 100

print (a)
print (b)
print (c)
```

This produces the following result:

```
100
100
100
```

Here, an integer object is created with the value 1, and all three variables are assigned to the same memory location. You can also assign multiple objects to multiple variables. For example –

</> Open Compiler

```
a,b,c = 1,2,"Zara Ali"

print (a)
print (b)
print (c)
```

This produces the following result:

```
1
2
Zara Ali
```

Here, two integer objects with values 1 and 2 are assigned to variables a and b respectively, and one string object with the value "Zara Ali" is assigned to the variable c.

Python Variables - Naming Convention

Every Python variable should have a unique name like a, b, c. A variable name can be meaningful like color, age, name etc. There are certain rules which should be taken care while naming a Python variable:

- A variable name must start with a letter or the underscore character
- A variable name cannot start with a number or any special character like $, (, * % etc.
- A variable name can only contain alpha-numeric characters and underscores (A-z, 0-9, and _)
- Python variable names are case-sensitive which means Name and NAME are two different variables in Python.
- Python reserved keywords cannot be used naming the variable.

If the name of variable contains multiple words, we should use these naming patterns –

- **Camel case** – First letter is a lowercase, but first letter of each subsequent word is in uppercase. For example: kmPerHour, pricePerLitre
- **Pascal case** – First letter of each word is in uppercase. For example: KmPerHour, PricePerLitre
- **Snake case** – Use single underscore (_) character to separate words. For example: km_per_hour, price_per_litre

Example

Following are valid Python variable names:

```
counter = 100
_count  = 100
name1 = "Zara"
name2 = "Nuha"
Age  = 20
zara_salary = 100000

print (counter)
print (_count)
print (name1)
print (name2)
print (Age)
print (zara_salary)
```

This will produce the following result:

```
100
100
Zara
Nuha
20
100000
```

Example

Following are invalid Python variable names:

</> Open Compiler

```
1counter = 100
$_count  = 100
zara-salary = 100000

print (1counter)
print ($count)
print (zara-salary)
```

This will produce the following result:

```
File "main.py", line 3
    1counter = 100
       ^
SyntaxError: invalid syntax
```

Example

Once you use a variable to identify a data object, it can be used repeatedly without its id() value. Here, we have a variables height and width of a rectangle. We can compute the area and perimeter with these variables.

```
>>> width=10
>>> height=20
>>> area=width*height
>>> area
200
>>> perimeter=2*(width+height)
>>> perimeter
60
```

Use of variables is especially advantageous when writing scripts or programs. Following script also uses the above variables.

</> Open Compiler

```
#! /usr/bin/python3

width = 10
height = 20
area = width*height
perimeter = 2*(width+height)
print ("Area = ", area)
print ("Perimeter = ", perimeter)
```

Save the above script with .py extension and execute from command-line. The result would be –

```
Area = 200
Perimeter = 60
```

Python Local Variables

Python Local Variables are defined inside a function. We can not access variable outside the function.

> *A Python functions is a piece of reusable code and you will learn more about function in Python - Functions tutorial.*

Example

Following is an example to show the usage of local variables:

</> Open Compiler

```
def sum(x,y):
   sum = x + y
   return sum
print(sum(5, 10))
```

This will produce the following result –

```
15
```

Python Global Variables

Any variable created outside a function can be accessed within any function and so they have global scope.

Example

Following is an example of global variables –

</> Open Compiler

```
x = 5
y = 10
def sum():
   sum = x + y
```

```
    return sum
print(sum())
```

This will produce the following result –

```
15
```

Constants in Python

Python doesn't have any formally defined constants, However you can indicate a variable to be treated as a constant by using all-caps names with underscores. For example, the name PI_VALUE indicates that you don't want the variable redefined or changed in any way.

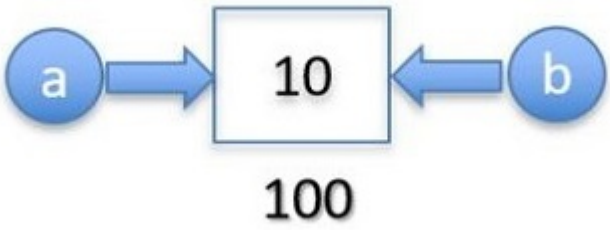
> *The naming convention using all-caps is sometimes referred to as screaming snake case - where the all-caps (screaming) and the underscores (snakes).*

Python vs C/C++ Variables

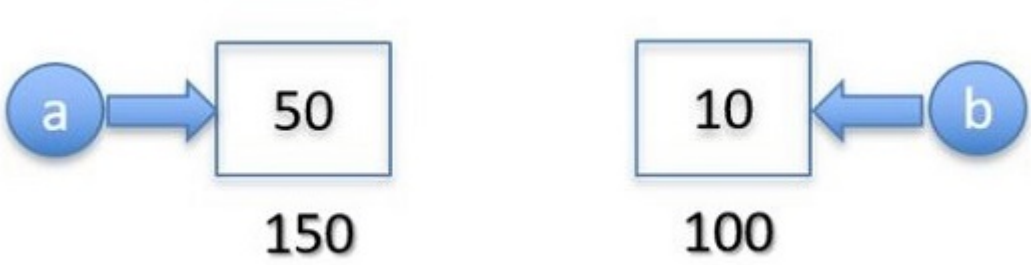
The concept of variable works differently in Python than in C/C++. In C/C++, a variable is a named memory location. If a=10 and also b=10, both are two different memory locations. Let us assume their memory address is 100 and 200 respectively.

If a different value is assigned to "a" - say 50, 10 in the address 100 is overwritten.

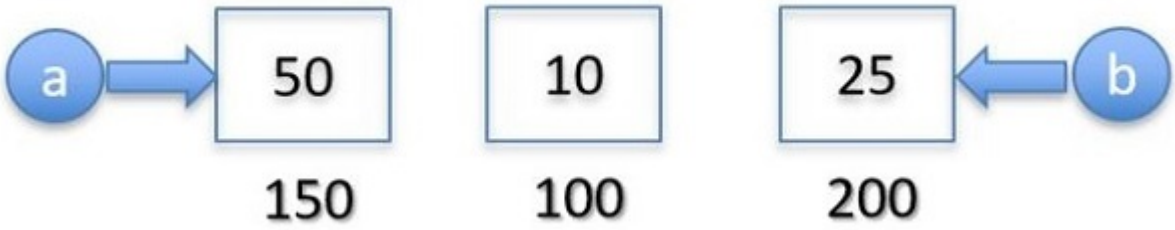
A Python variable refers to the object and not the memory location. An object is stored in memory only once. Multiple variables are really the multiple labels to the same object.



The statement a=50 creates a new **int** object 50 in the memory at some other location, leaving the object 10 referred by "b".



Further, if you assign some other value to b, the object 10 remains unreferred.



Python's garbage collector mechanism releases the memory occupied by any unreferred object.

Python's identity operator **is** returns True if both the operands have same id() value.

```
>>> a=b=10
>>> a is b
True
>>> id(a), id(b)
(140731955278920, 140731955278920)
```