

## CHAP 2 : Data Structure    هيكل البيانات

### 2-1-Variables:    المتغيرات

In Python, variables are used to store data values. Variables do not need explicit declaration to reserve memory space. The declaration happens automatically when you assign a value to a variable. Variables can store different types of data, such as integers, floating-point numbers, strings, lists, and more.

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Let's explore how variables work in Python with explanations and examples.

#### 1. Creating and Assigning Variables    انشاء و تعيين المتغيرات

You can create and assign a variable using the equals sign =. The value on the right side is assigned to the variable on the left side.

##### *Example:*

```
Python Code
# Assigning values to variables
x = 10
y = 3.14
name = "Ali"
```

```
# Printing variable values
print("x =", x)
print("y =", y)
print("name =", name)
```

##### *Output:*

```
x = 10
y = 3.14
name = Ali
```

## 2. Reassigning Variables

## إعادة تعيين المتغيرات

You can change the value of a variable by assigning a new value to it. Python is dynamically typed, so you can assign a different type to the same variable.

### *Example:*

Python Code

```
# Reassigning variables
```

```
x = 100
```

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

```
# Changing the type of a variable
```

```
x = "Hello"
```

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

### *Output:*

```
x = 100
```

```
x = Hello
```

## 3. Multiple Variable Assignment

## تعيينات متعددة للمتغيرات

You can assign values to multiple variables in a single line using multiple assignment.

### *Example:*

Python Code

```
# Multiple assignment
```

```
a, b, c = 5, 10, 15
```

```
# Print the values
```

```
print("a =", a)
```

```
print("b =", b)
```

```
print("c =", c)
```

### *Output:*

```
a = 5
```

```
b = 10
```

```
c = 15
```

## 4. Global and Local Variables

## المتغيرات العامة و المتغيرات المحلية

- **Local variables** are defined inside a function and are only accessible within that function.
- **Global variables** are defined outside of functions and are accessible throughout the entire program.

### *Example:*

Python Code

```
# Global variable
```

```
x = "global"
```

```
def my_function():
```

```
    # Local variable
```

```
    x = "local"
```

```
print("Inside function:", x)

# Calling the function
my_function()
```

```
# Outside the function
print("Outside function:", x)
```

***Output:***

```
Inside function: local
Outside function: global
```

***Example with Global Keyword:***

You can use the global keyword to modify a global variable inside a function.

Python Code

```
x = "global"

def my_function():
    global x
    x = "modified global"
    print("Inside function:", x)
```

```
# Calling the function
my_function()
```

```
# Outside the function
print("Outside function:", x)
```

***Output:***

```
Inside function: modified global
Outside function: modified global
```

## 5. Variable Types

## انواع المتغيرات

### ***6.1. Integer Variables***

```
python
Code
a = 10
b = -5
print("a =", a, "b =", b)
```

***Output:***

```
a = 10 b = -5
```

### ***6.2. Float Variables***

```
Python Code
x = 3.14
y = -0.001
print("x =", x, "y =", y)
```

***Output:***

```
x = 3.14 y = -0.001
```

### ***6.3. String Variables***

Python Code

```
first_name = "John"
last_name = "Doe"
full_name = first_name + " " + last_name
print("Full Name:", full_name)
```

**Output:**

Full Name: John Doe

## 6. Constants الثوابت

Python doesn't have a built-in constant type, but by convention, you can define constants using all capital letters. Constants are variables whose values should not be changed during the execution of the program.

**Example:**

```
Python Code
PI = 3.1416
GRAVITY = 9.8
```

```
print("PI =", PI)
print("Gravity =", GRAVITY)
```

**Output:**

```
PI = 3.1416
Gravity = 9.8
```

## 6. Type Checking with type() التحقق من طبيعة المتغير

You can check the data type of a variable using the type() function.

**Example:**

```
Python Code
x = 10
y = 3.14
name = "Alice"
```

```
print("Type of x:", type(x))
print("Type of y:", type(y))
print("Type of name:", type(name))
```

**Output:**

```
Type of x: <class 'int'>
Type of y: <class 'float'>
Type of name: <class 'str'>
```

## 7. Deleting Variables حذف المتغيرات

You can delete a variable using the del keyword.

**Example:**

```
Python Code
x = 10
print("x =", x)
```

```
# Deleting variable x
del x

# Trying to access the deleted variable will raise an error
# print(x) # Uncommenting this line will raise a NameError
```

***Output:***

```
x = 10
```

## 8. Dynamic Typing in Python

Python is dynamically typed, meaning you don't need to declare a variable's type explicitly. The type of the variable is determined based on the value assigned to it.

***Example:***

Python Code

```
x = 10 # x is an integer
print("x =", x)
```

```
x = 3.14 # Now x is a float
print("x =", x)
```

```
x = "Hello" # Now x is a string
print("x =", x)
```

***Output:***

```
x = 10
x = 3.14
x = Hello
```

## 9. Variable Naming Rules

## قواعد تسمية المتغيرات

There are certain rules and conventions to follow when naming variables:

- Variable names must start with a letter or an underscore \_.
- The rest of the variable name can contain letters, numbers, or underscores.
- Variable names are case-sensitive (myVariable and myvariable are different).

***Example of Valid and Invalid Variable Names:***

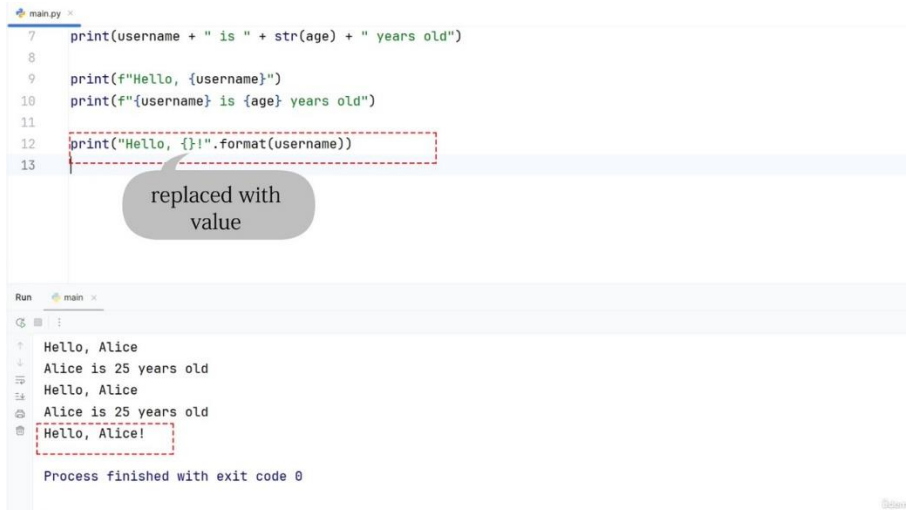
```
# Valid variable names
age = 25
2name = " Alice "
My-variable = 10
```

```
# Invalid variable names (will cause syntax errors)
# 2name = "Alice" # Cannot start with a number
# my-variable = 10 # Hyphens are not allowed
```

## 10-Display Variables: عرض المتغيرات

username=Alice

age=25



The screenshot shows a Python IDE with a file named `main.py`. The code contains five `print` statements. The first line is `print(username + " is " + str(age) + " years old")`. The second line is `print(f"Hello, {username}")`. The third line is `print(f"{username} is {age} years old")`. The fourth line is `print("Hello, {}".format(username))`. The fifth line is empty. A red dashed box highlights the fourth line, and a callout bubble points to it with the text "replaced with value". Below the code editor, the Run window shows the output of the program: "Hello, Alice", "Alice is 25 years old", "Hello, Alice", "Alice is 25 years old", and "Hello, Alice!". The process finished with exit code 0.


```
7 print(username + " is " + str(age) + " years old")
8
9 print(f"Hello, {username}")
10 print(f"{username} is {age} years old")
11
12 print("Hello, {}".format(username))
13
```

replaced with value

Run

↑ Hello, Alice  
↓ Alice is 25 years old  
Hello, Alice  
Alice is 25 years old  
Hello, Alice!

Process finished with exit code 0



The screenshot shows a Python IDE with a file named `main.py`. The code contains three lines: `username = "Alice"`, `print(username)`, and `print("Hello, " + username)`. A red dashed box highlights the third line, and a callout bubble points to it with the text "plus (+) Used for Concatenate". Below the code editor, the Run window shows the output of the program: "Alice" and "Hello, Alice". The process finished with exit code 0.

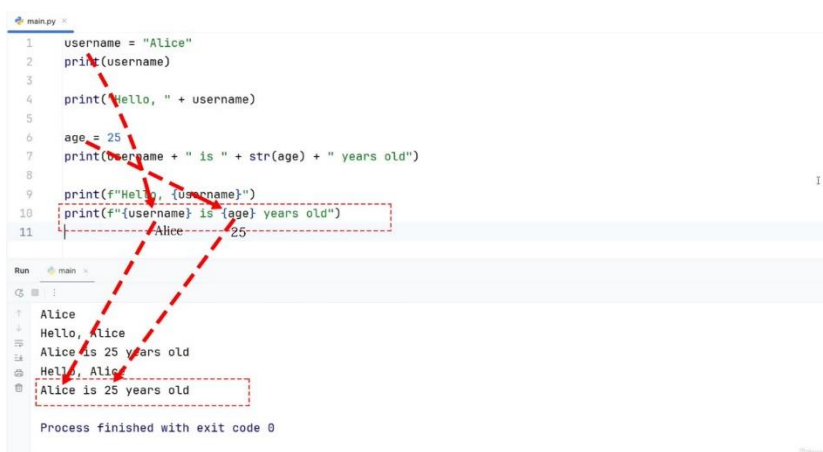
```
1 username = "Alice"
2 print(username)
3 print("Hello, " + username)
```

plus (+) Used for Concatenate

Run

↑ Alice  
↓ Hello, Alice

Process finished with exit code 0



The screenshot shows a Python IDE with a file named `main.py`. The code contains eleven lines: `username = "Alice"`, `print(username)`, `print("Hello, " + username)`, `age = 25`, `print(username + " is " + str(age) + " years old")`, `print(f"Hello, {username}")`, `print(f"{username} is {age} years old")`, and three empty lines. A red dashed box highlights the seventh line, and a callout bubble points to it with the text "Alice". Another red dashed box highlights the eighth line, and a callout bubble points to it with the text "25". Below the code editor, the Run window shows the output of the program: "Alice", "Hello, Alice", "Alice is 25 years old", "Hello, Alice", and "Alice is 25 years old". The process finished with exit code 0.

```
1 username = "Alice"
2 print(username)
3 print("Hello, " + username)
4
5 age = 25
6 print(username + " is " + str(age) + " years old")
7 print(f"Hello, {username}")
8 print(f"{username} is {age} years old")
9
10
11
```

Alice

25

Run

↑ Alice  
↓ Hello, Alice  
Alice is 25 years old  
Hello, Alice  
Alice is 25 years old

Process finished with exit code 0

```
main.py x
1  username = "Alice"
2  print(username)
3
4  print("Hello, " + username)
5
6  age = 25
7  print(username + " is " + str(age) + " years old")
8
```

Run main x

Alice  
Hello, Alice  
Alice is 25 years old

Process finished with exit code 0

```
main.py x
1  username = "Alice"
2  print(username)
3
4  print("Hello, " + username)
5
6  age = 25
7  print(username + " is " + str(age) + " years old")
8  Alice
```