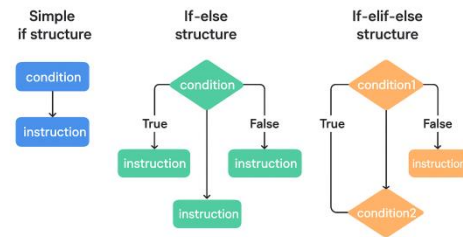


CHAPTER 3:

CONDITIONAL STRUCTURES IN PYTHON

Conditional Structures in Python



1. Introduction to control structures

Definition

Control structures allow you to **modify the normal flow of a program** . They allow you to:

- **To make decisions** (to execute certain instructions according to a condition),
- **Repeating instructions** (using loops, seen in the next chapter).

Python normally executes instructions **in order** . But thanks to **conditional structures** , we can **choose** which instructions to execute based on a **logical condition** .

Example of a situation

In chemistry or physics:

- If the **temperature > 100 °C** , then the water **boils** .
- Otherwise, it **remains liquid** .

This reasoning is exactly what a **conditional structure reproduces** .

2. Simple conditional structure (if)

Syntax

```
if condition:
    instruction1
    instruction 2
```

If the **condition** is true, the indented instructions are executed. Otherwise, they are ignored.

Example 1:

```
temperature = 105
if temperature > 100:
    print("The water is boiling.")
```

Example 2: (simple scientific calculation)

```
pressure = 1.2
```

```
if pressure > 1:  
    print("The pressure is higher than atmospheric pressure.")
```

3. Double conditional structure (if-else)

Syntax

```
if condition:  
    instructions_if_true  
else:  
    instructions_if_false
```

This structure allows you to **choose between two cases** :

- If the condition is true → the if block is executed.
- Otherwise → we execute the else block.

Example 1: (positive or negative number)

```
x = float(input("Enter a number: "))  
if x >= 0:  
    print("The number is positive.")  
else:  
    print("The number is negative.")
```

Result :

Enter a number: -5

The number is negative.

Example 2: Application in chemistry

```
pH = float(input("Enter the pH value: "))  
if pH < 7:  
    print("The solution is acidic.")  
else:  
    print("The solution is basic or neutral.")
```

4. Nested conditional structures (if-elif-else)

General Syntax

```
if condition1:  
    instructions1  
elif condition2:
```

```
instructions2
elif condition3:
instructions3
else:
default_instructions
```

We use `elif` (short for *else if*) to **test several successive cases** .

Example 1: Categorizing a number

```
x = float(input("Enter a number: "))
if x > 0:
print("Positive")
elif x == 0:
    print("Null")
else:
print("Negative")
```

Example 2: Application in chemistry — pH classification

```
pH = float(input("Enter the pH value: "))
if pH < 7:
print("Acid solution")
elif pH == 7:
print("Neutral solution")
else:
    print("Basic solution")
```

Example 3: Application in physics — state of water according to temperature

```
T = float(input("Enter the water temperature (°C): "))
if T <= 0:
print("The water is in solid form (ice).")
elif T < 100:
print("Water is liquid.")
else:
print("The water is in vapor form.")
```

5. Use of multiple logical conditions

Multiple conditions can be combined using **logical operators** :

- and
- or
- not (no)

Example

```
temperature = 25
```

```
pressure = 1.0
```

```
if temperature > 20 and pressure == 1.0:
```

```
print("Normal conditions for experiment.")
```

6. Summary of conditional structures

| Kind | Syntax | Description |
|---------------------|--------------------------------|---|
| if | if condition: | Executes the block if the condition is true |
| if-else | If condition: ... else: ... | Choose between two cases |
| if-elif-else | if ... elif ... else ... | Test several successive cases |
| Combined conditions | and, or, not | Combines several conditions |

7. Simple exercises (for students)

Exercise 1:

Write a program that reads the temperature and displays:

- "Cold" if $T < 10$,
- "Pleasant" if $10 \leq T \leq 25$,
- Otherwise, it'll be "hot".

Exercise 2:

Read two numbers a and b and display the larger one.

Exercise 3:

Read the pH value and indicate the type of solution:

- acidic if $\text{pH} < 7$
- neutral if $\text{pH} = 7$
- basic if $\text{pH} > 7$.