

# Python Type Casting vs Type Conversion

## 1. Type Conversion (Automatic by Python)

Python automatically converts one data type to another without programmer's intervention. It is also called **implicit type conversion** or **type promotion**.

Happens when:

- Operation involves two different data types.
- Python promotes smaller type → larger type to avoid data loss.

## Examples of Type Conversion

```
# Example 1: int → float
x = 5
y = 2.5
z = x + y
print(z)           # 7.5
print(type(z))     # <class 'float'>

# Example 2: bool → int
a = True
b = 5
c = a + b
print(c)           # 6
print(type(c))     # <class 'int'>

# Example 3: int → complex
num = 5 + 2j
x = 10
result = num + x
print(result)       # (15+2j)
print(type(result)) # <class 'complex'>

# Rule: bool → int → float → complex
```

## 2. Type Casting (Explicit by Programmer)

Programmer manually changes data type using **built-in functions**. Also called **explicit type conversion**.

Used when:

- Automatic conversion is not possible.

- Preparing data for operations (e.g., user input str → int).

## Examples of Type Casting

```
# Numeric Casting
print(int(5.9))      # 5
print(float(10))     # 10.0
print(complex(2, 5)) # (2+5j)

# String Casting
print(str(123))      # '123'
print(str([1,2]))    # '[1, 2]'

# Sequence Casting
print(list("abc"))   # ['a', 'b', 'c']
print(tuple([1, 2])) # (1, 2)
print(set([1, 1, 2])) # {1, 2}

# Dictionary Casting
pairs = [("a", 1), ("b", 2)]
print(dict(pairs))   # {'a': 1, 'b': 2}

# Boolean Casting
print(bool(0))       # False
print(bool(""))      # False
print(bool(123))     # True
print(bool([1]))     # True

# Invalid Casting
# print(int("abc"))  # ■ ValueError
```

## 3. Comparison

Type Conversion (Implicit) vs Type Casting (Explicit)

- Who performs it?  
Conversion → Python  
Casting → Programmer
- Safety:  
Conversion → Always safe  
Casting → May cause data loss
- Example:  
Conversion → 10 + 2.5 → 12.5  
Casting → int(3.9) → 3

## 4. Practical Example Mixing Both

```
a = input("Enter number: ")    # str
b = input("Enter number: ")    # str

# Without casting → concatenation
print(a + b)    # "5" + "10" = "510"

# With explicit casting
sum_result = int(a) + int(b)

# Implicit conversion with float
final = sum_result + 2.5    # int + float → float

print("Final:", final)
```

## Summary

- Type Conversion (Implicit): Automatic, safe promotion (int + float → float).
- Type Casting (Explicit): Manual with int(), float(), str(), etc.
- Implicit = automatic, Explicit = manual.