Python Operators:

Learning the operators is an excellent place to start to learn Python. Operators are special symbols that perform specific operations on one or more operands (values) and then return a result. For example, you can calculate the sum of two numbers using an addition (+) operator.

The following image shows operator and operands

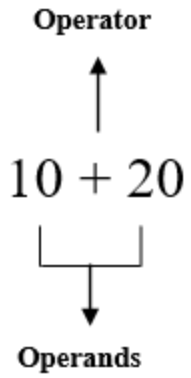


Fig: Operator and operands

Python has seven types of operators that we can use to perform different operation and produce a result.

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

Arithmetic operator

Arithmetic operators are the most commonly used. The Python programming language provides arithmetic operators that perform addition, subtraction, multiplication, and division. It works the same as basic mathematics.

There are seven arithmetic operators we can use to perform different mathematical operations, such as:

1. `+` (Addition)
2. `-` (Subtraction)
3. `*` (Multiplication)
4. `/` (Division)
5. `//` Floor division)
6. `%` (Modulus)
7. `**` (Exponentiation)

Now, let's see how to use each arithmetic operator in our program with the help of examples.

Addition operator `+`

It adds two or more operands and gives their sum as a result. It works the same as a unary plus. In simple terms, It performs the addition of two or more than two values and gives their sum as a result.

Example

```
x = 10
y = 40
print(x + y)

# Output 50
```

Also, we can use the addition operator with strings, and it will become string concatenation.

```
name = "Kelly"
surname = "Ault"
print(surname + " " + name)
# Output Ault Kelly
```

Subtraction `-`

Use to subtracts the second value from the first value and gives the difference between them. It works the same as a unary minus. The subtraction operator is denoted by `-` symbol.

Example

```
x = 10
y = 40
print(y - x)
# Output 30
```

Multiplication `*`

Multiply two operands. In simple terms, it is used to multiplies two or more values and gives their product as a result. The multiplication operator is denoted by a `*` symbol.

Example

```
x = 2
y = 4
z = 5
print(x * y)
# Output 8 (2*4)
print(x * y * z)
# Output 40 (2*4*5)
```

You can also use the multiplication operator with string. When used with string, it works as a repetition.

Example

```
name = "Jessa"
print(name * 3)
# Output JessaJessaJessa
```

Division `/`

Divide the left operand (dividend) by the right one (divisor) and provide the result (quotient) in a float value. The division operator is denoted by a `/` symbol.

Note:

- The division operator performs floating-point arithmetic. Hence it always returns a float value.
- Don't divide any number by zero. You will get a `Zero Division Error: Division by zero`

- **Example**

```
x = 2
y = 4
z = 8
print(y / x)
# Output 2.0
print(z / y / x)
# Output 1.0
# print(z / 0)  # error
```

Floor division `//`

Floor division returns the quotient (the result of division) in which the digits after the decimal point are removed. In simple terms, It is used to divide one value by a second value and gives a quotient as a round figure value to the next smallest whole value.

It works the same as a division operator, except it returns a possible integer. The // symbol denotes a floor division operator.

Note:

- Floor division can perform both floating-point and integer arithmetic.
- If both operands are int type, then the result types. If at least one operand type, then the result is a `float` type.

Example

```
x = 2
y = 4
z = 2.2

# normal division
print(y / x)
# Output 2.0

# floor division to get result as integer
print(y // x)
# Output 2

# normal division
print(y / z)  # 1.81

# floor division.
# Result as float because one argument is float

print(y // z)  # 1.0
```

Modulus `%`

The remainder of the division of left operand by the right. The modulus operator is denoted by a `%` symbol. In simple terms, the Modulus operator divides one value by a second and gives the remainder as a result.

Example

```
x = 15
y = 4

print(x % y)
# Output 3
```

Exponent `**`

Using exponent operator left operand raised to the power of right. The exponentiation operator is denoted by a double asterisk ** symbol. You can use it as a shortcut to calculate the exponential value.

For example, `2**3` Here 2 is multiplied by itself 3 times, i.e., `2*2*2`. Here the 2 is the base, and 3 is an exponent.

Example

```
num = 2
# 2*2
print(num ** 2)
# Output 4

# 2*2*2
print(num ** 3)

# Output 8
```

Relational (comparison) operators

Relational operators are also called comparison operators. It performs a comparison between two values. It returns a boolean True or False depending upon the result of the comparison.

Python has the following six relational operators.

Assume variable `x` holds 10 and variable `y` holds 5

Operator	Description	Example
> (Greater than)	It returns True if the left operand is greater than the right	x > y result is True
< (Less than)	It returns True if the left operand is less than the right	x < y result is False
== (Equal to)	It returns True if both operands are equal	x == y result is False
!= (Not equal to)	It returns True if both operands are equal	x != y result is True

Operator	Description	Example
>= (Greater than or equal to)	It returns True if the left operand is greater than or equal to the right	x >= y result is True
<= (Less than or equal to)	It returns True if the left operand is less than or equal to the right	x <= y result is False

Python Relational (comparison) operators

You can compare more than two values also. Assume variable `x` holds 10, variable `y` holds 5, and variable `z` holds 2.

So `print(x > y > z)` will return `True` because x is greater than y, and y is greater than z, so it makes x is greater than z.

Example

```
x = 10
y = 5
z = 2

# > Greater than
print(x > y)  # True
print(x > y > z)  # True

# < Less than
print(x < y)  # False
print(y < x)  # True

# Equal to
print(x == y)  # False
print(x == 10)  # True

# != Not Equal to
print(x != y)  # True
print(10 != x)  # False

# >= Greater than equal to
print(x >= y)  # True
print(10 >= x)  # True

# <= Less than equal to
```

```
print(x <= y)  # False
print(10 <= x)  # True
```

Assignment operators

In Python, Assignment operators are used to assigning value to the variable. Assign operator is denoted by = symbol. For example, `name = "Jessa"` here, we have assigned the string literal 'Jessa' to a variable name.

Also, there are shorthand assignment operators in Python. For example, `a+=2` which is equivalent to `a = a+2`.

Operator	Meaning	Equivalent
`=` (Assign)	`a=5`Assign 5 to variable `a`	a = 5
`+=` (Add and assign)	`a+=5`Add 5 to a and assign it as a new value to `a`	a = a+5
`-=` (Subtract and assign)	`a-=5`Subtract 5 from variable `a` and assign it as a new value to `a`	a = a-5
`*=` (Multiply and assign)	`a*=5`Multiply variable `a` by 5 and assign it as a new value to `a`	a = a*5

Operator	Meaning	Equivalent
`/=` (Divide and assign)	`a/=5`Divide variable `a` by 5 and assign a new value to `a`	a = a/5
`%=` (Modulus and assign)	`a%=5`Performs modulus on two values and assigns it as a new value to `a`	a = a%5
`**=` (Exponentiation and assign)	`a**=5`Multiply `a` five times and assigns the result to `a`	a = a**5
`//=` (Floor-divide and assign)	`a//=5`Floor-divide `a` by 5 and assigns the result to `a`	a = a//5

Python assignment operators

Example

```
a = 4
b = 2

a += b
print(a)  # 6

a = 4
a -= 2
print(a)  # 2

a = 4
a *= 2
print(a)  # 8

a = 4
a /= 2
print(a)  # 2.0
```

```
a = 4
a **= 2
print(a)  # 16

a = 5
a %= 2
print(a)  # 1

a = 4
a //= 2
print(a)  # 2
```

Logical operators

Logical operators are useful when checking a condition is `true` or not. Python has three logical operators. All logical operator returns a boolean value `True` or `False` depending on the condition in which it is used.

Operator	Description	Example
`and` (Logical and)	True if both the operands are True	a and b
`or` (Logical or)	True if either of the operands is True	a or b
`not` (Logical not)	True if the operand is False	not a

Python Logical Operators

and (Logical and)

The logical `and` operator returns `True` if both expressions are True. Otherwise, it will return. `False`.

Example

```
print(True and False)  # False
# both are True
print(True and True)  # True
print(False and False)  # False
print(False and True)  # false
```

```
# actual use in code
a = 2
b = 4

# Logical and
if a > 0 and b > 0:
    # both conditions are true
    print(a * b)
else:
    print("Do nothing")
```

Output

```
False

True

False

False

 8
```

In the case of **arithmetic values**, Logical `and` always returns the **second value**; as a result, see the following example.

Example

```
print(10 and 20) # 20
print(10 and 5)  # 5
print(100 and 300) # 300
```

or (Logical or)

The **logical** `or` the operator returns a boolean `True` if one expression is true, and it returns `False` if both values are `false`.

Example

```
print(True or False)  # True
print(True or True)  # True
print(False or False)  # false
print(False or True)  # True
```

```
# actual use in code
a = 2
b = 4

# Logical and
if a > 0 or b < 0:
    # at least one expression is true so conditions is true
    print(a + b)  # 6
else:
    print("Do nothing")
```



```
Output

True

True

False

True

6
```

In the case of **arithmetic values**, Logical `or` it always returns the first value; as a result, see the following code.

Example

```
print(10 or 20) # 10
print(10 or 5) # 10
print(100 or 300) # 100
```

not (Logical not)

The **logical** `not` operator returns boolean `True` if the expression is `false`.

Example

```
print(not False)  # True return complements result
print(not True)  # True return complements result
```

```
# actual use in code
a = True

# Logical not
if not a:
    # a is True so expression is False
    print(a)
else:
    print("Do nothing")
```


Output

```
Do nothing
```

In the case of **arithmetic values**, Logical `not` always return `False` for **nonzero** value.

Example

```
print(not 10) # False. Non-zero value
print(not 1)  # True. Non-zero value
print(not 5)  # False. Non-zero value
print(not 0)  # True. zero value
```

Membership operators

Python's membership operators are used to check for membership of objects in sequence, such as string, `list`, `tuple`. It checks whether the given value or variable is present in a given sequence. If present, it will return `True` else `False`.

In Python, there are two membership operator `in` and `not in`

In operator

It returns a result as `True` if it finds a given object in the sequence. Otherwise, it returns `False`.

Let's check if the number 15 present in a given list using the `in` operator.

Example

```
my_list = [11, 15, 21, 29, 50, 70]
number = 15
if number in my_list:
    print("number is present")
else:
    print("number is not present")
```

Output

```
number is present
```

Not in operator

It returns `True` if the object is not present in a given sequence. Otherwise, it returns `False`

Example

```
my_tuple = (11, 15, 21, 29, 50, 70)
number = 35
if number not in my_tuple:
    print("number is not present")
else:
    print("number is present")
```

Output

```
number not is present
```

Identity operators

Use the Identity operator to check whether the value of two variables is the same or not. This operator is known as a **reference-quality operator** because the identity operator compares values according to two variables' memory addresses.

Python has 2 identity operators `is` and `is not`.

`is` operator

The `is` operator returns Boolean `True` or `False`. It Return `True` if the memory address first value is equal to the second value. Otherwise, it returns `False`.

Example

```
x = 10
y = 11
z = 10
print(x is y) # it compare memory address of x and y
print(x is z) # it compare memory address of x and z
```

Output

```
False

True
```

Here, we can use `is()` function to check whether both variables are pointing to the same object or not.

`is not` operator

The `is not` the operator returns boolean values either `True` or `False`. It Return `True` if the first value is not equal to the second value. Otherwise, it returns `False`.

Example

```
x = 10
y = 11
z = 10
print(x is not y) # it campare memory address of x and y
print(x is not z) # it campare memory address of x and z
```

Output

```
True

False
```

Bitwise Operators

In Python, bitwise operators are used to performing bitwise operations on integers. To perform bitwise, we first need to convert integer value to binary (0 and 1) value.

The bitwise operator operates on values bit by bit, so it's called **bitwise**. It always returns the result in decimal format. Python has 6 bitwise operators listed below.

1. `&` Bitwise and
2. `|` Bitwise or
3. `^` Bitwise xor
4. `~` Bitwise 1's complement
5. `<<` Bitwise left-shift
6. `>>` Bitwise right-shift

Bitwise and `&`

It performs **logical AND** operation on the integer value after converting an integer to a binary value and gives the result as a decimal value. It returns `True` only if both operands are True. Otherwise, it returns `False`.

Example

```
a = 7
b = 4
c = 5
print(a & b)
print(a & c)
print(b & c)
```

Output

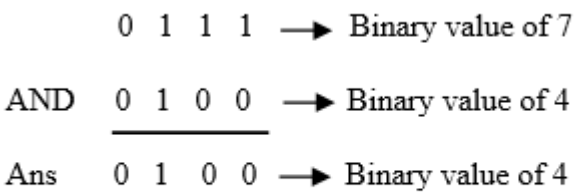

```
4

5

4
```

Here, every integer value is converted into a binary value. For example, `a =7`, its binary value is 0111, and `b=4`, its binary value is 0100. Next we performed logical AND, and got 0100 as a result, similarly for a and c, b and c

Following diagram shows AND operator evaluation.



AND operators Truth table (True = 1, False = 0)

First operand (X)	Second Operand(Y)	X & Y
1	1	1
1	0	0
0	1	0
0	0	0

Python bitwise AND

Bitwise or |

It performs **logical OR** operation on the integer value after converting integer value to binary value and gives the result a decimal value. It returns `False` only if both operands are `True`. Otherwise, it returns `True`.

Example

```
a = 7
b = 4
c = 5
print(a | b)
print(a | c)
print(b | c)
```

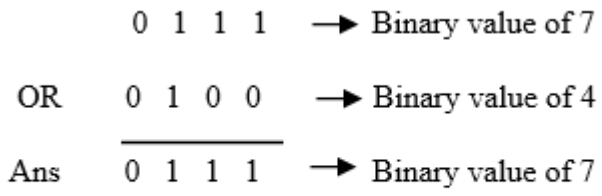
Output


```
7

7

5
```

Here, every integer value is converted into binary. For example, `a =7` its binary value is 0111, and `b=4`, its binary value is 0100, after logical OR, we got 0111 as a result. Similarly for `a` and `c`, `b` and `c`.



OR operators Truth table (True = 1, False = 0)

First operand (X)	Second Operand (Y)	X | Y
1	1	1
1	0	1
0	1	1
0	0	0

Python bitwise OR

Bitwise xor ^

It performs Logical XOR `^` operation on the binary value of a integer and gives the result as a decimal value.

Example: –

```
a = 7
b = 4
c = 5
print(a ^ c)
print(b ^ c)
```

Output

```
3

2

1
```


Here, again every integer value is converted into binary. For example, `a =7` its binary value is 0111 and `b=4`, and its binary value is 0100, after logical XOR we got 0011 as a result. Similarly for `a` and `c`, `b` and `c`.

```
        0  1  1  1   ⟶ Binary value of 7
XOR     0  1  0  0   ⟶ Binary value of 4
        ------------
Ans     0  0  1  1   ⟶ Binary value of 3
```

XOR operators Truth table (True = 1, False = 0)

First operand (X)	Second Operand (Y)	X ^ Y
1	1	0
1	0	1
0	1	1
0	0	0

Python bitwise XOR

Bitwise 1’s complement ~

It performs 1’s complement operation. It invert each bit of binary value and returns the bitwise negation of a value as a result.

Example

```
a = 7
b = 4
c = 3
print(~a, ~b, ~c)
# Output -8 -5 -4
```

Bitwise left-shift <<

The left-shift `<<` operator performs a shifting bit of value by a given number of the place and fills 0’s to new positions.

Example: –

```
print(4 << 2)
# Output 16
print(5 << 3)
# Output 40
```

Example: 4<<2

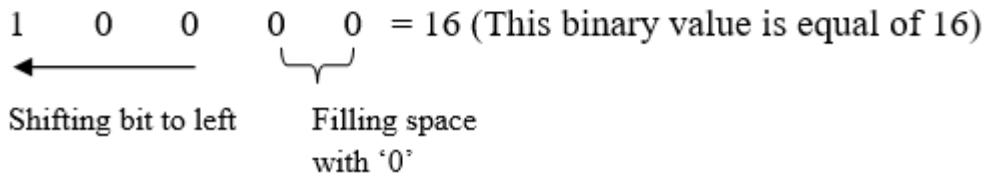
Here we have to shift to 2 bits

So, the binary value of 4 is = 100

Now, shifting every bit to the left with 2 spaces and

filling blank spaces with '0.'

That is,

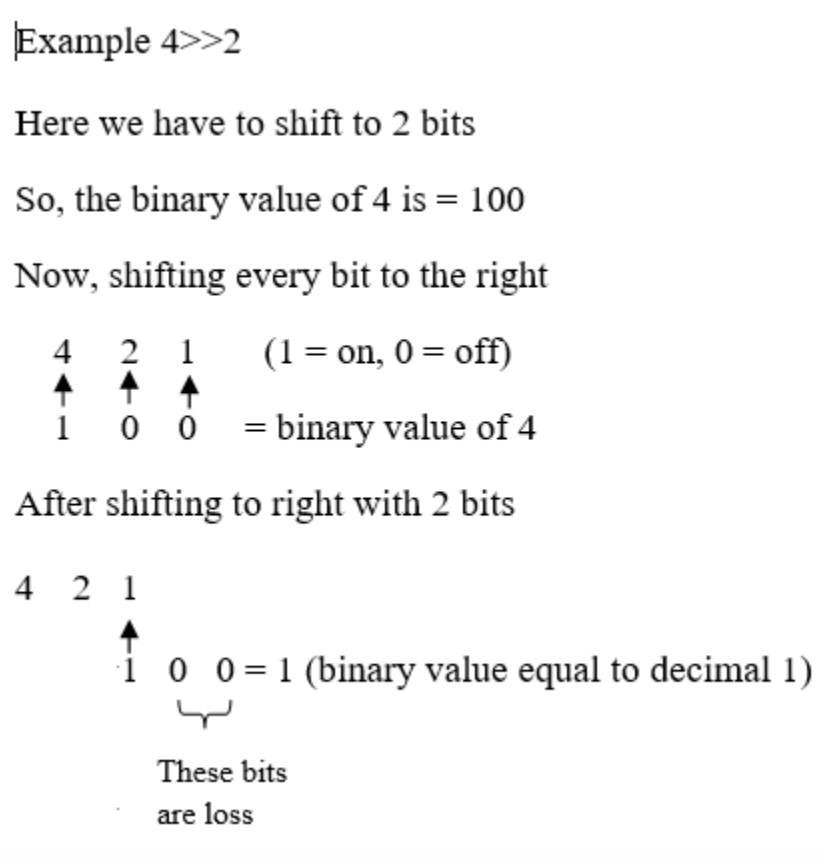


Python bitwise left shift

Bitwise right-shift >>

The left-shift `>>` operator performs shifting a bit of value to the right by a given number of places. Here some bits are lost.

```
print(4 >> 2)
# Output
print(5 >> 2)
# Output
```



Python bitwise right shift

Python Operators Precedence

In Python, operator precedence and associativity play an essential role in solving the expression. An expression is the combination of variables and operators that evaluate based on operator precedence.

We must know what the precedence (priority) of that operator is and how they will evaluate down to a single value. Operator precedence is used in an expression to determine which operation to perform first.

Example: –

```
print((10 - 4) * 2 +(10+2))
# Output 24
```

In the above example. 1st precedence goes to a parenthesis `()`, then for plus and minus operators. The expression will be executed as.

```
(10 - 4) * 2 +(10+2)

6 * 2 + 12

12 + 12
```

The following tables shows operator precedence highest to lowest.

Precedence level	Operator	Meaning
1 (Highest)	`()`	Parenthesis
2	`**`	Exponent
3	`+x`, `-x` ,`~x`	Unary plus, Unary Minus, Bitwise negation
4	`*`, `/`, `//`, `%`	Multiplication, Division, Floor division, Modulus
5	`+`, `-`	Addition, Subtraction
6	`<<`, `>>`	Bitwise shift operator
7	`&`	Bitwise AND
8	`^`	Bitwise XOR
9	`|`	Bitwise OR
10	`==`, `!=`, `>`, `>=`, `<`, `<=`	Comparison

Precedence level	Operator	Meaning
11	`is`, `is not`, `in`, `not in`	Identity, Membership
12	not	Logical NOT
13	and	Logical AND
14 (Lowest)	or	Logical OR

Python Operators Precedence