

# Control Flow

## SyntaxError

A `SyntaxError` is reported by the Python interpreter when some portion of the code is incorrect. This can include misspelled keywords, missing or too many brackets or parentheses, incorrect operators, missing or too many quotation marks, or other conditions.

```
age = 7 + 5 = 4
```

```
File "<stdin>", line 1
```

```
SyntaxError: can't assign to operator
```

## elif Statement

The Python `elif` statement allows for continued checks to be performed after an initial `if` statement. An `elif` statement differs from the `else` statement because another expression is provided to be checked, just as with the initial `if` statement.

If the expression is `True`, the indented code following the `elif` is executed. If the expression evaluates to `False`, the code can continue to an optional `else` statement. Multiple `elif` statements can be used following an initial `if` to perform a series of checks. Once an `elif` expression evaluates to `True`, no further `elif` statements are executed.

```
# elif Statement
```

```
pet_type = "fish"
```

```
if pet_type == "dog":
    print("You have a dog.")
elif pet_type == "cat":
    print("You have a cat.")
elif pet_type == "fish":
    # this is performed
    print("You have a fish")
else:
    print("Not sure!")
```

## or Operator

The Python `or` operator combines two Boolean expressions and evaluates to `True` if at least one of the expressions returns `True`. Otherwise, if both expressions are `False`, then the entire expression evaluates to `False`.

```
True or True      # Evaluates to True
True or False     # Evaluates to True
False or False    # Evaluates to False
1 < 2 or 3 < 1     # Evaluates to True
3 < 1 or 1 > 6     # Evaluates to False
1 == 1 or 1 < 2    # Evaluates to True
```

## Equal Operator ==

The equal operator, `==`, is used to compare two values, variables or expressions to determine if they are the same.

If the values being compared are the same, the operator returns `True`, otherwise it returns `False`.

The operator takes the data type into account when making the comparison, so a string value of `"2"` is *not* considered the same as a numeric value of `2`.

```
# Equal operator

if 'Yes' == 'Yes':
    # evaluates to True
    print('They are equal')

if (2 > 1) == (5 < 10):
    # evaluates to True
    print('Both expressions give the same
result')

c = '2'
d = 2

if c == d:
    print('They are equal')
else:
    print('They are not equal')
```

## Not Equals Operator !=

The Python not equals operator, `!=`, is used to compare two values, variables or expressions to determine if they are NOT the same. If they are NOT the same, the operator returns `True`. If they are the same, then it returns `False`.

The operator takes the data type into account when making the comparison so a value of `10` would NOT be equal to the string value `"10"` and the operator would return `True`. If expressions are used, then they are evaluated to a value of `True` or `False` before the comparison is made by the operator.

```
# Not Equals Operator

if "Yes" != "No":
    # evaluates to True
    print("They are NOT equal")

val1 = 10
val2 = 20

if val1 != val2:
    print("They are NOT equal")

if (10 > 1) != (10 > 1000):
    # True != False
    print("They are NOT equal")
```

## Comparison Operators

In Python, *relational operators* compare two values or expressions. The most common ones are:

- `<` less than
- `>` greater than
- `<=` less than or equal to
- `>=` greater than or equal too

If the relation is sound, then the entire expression will evaluate to `True`. If not, the expression evaluates to `False`.

```
a = 2
b = 3

a < b # evaluates to True
a > b # evaluates to False
a >= b # evaluates to False
a <= b # evaluates to True
a <= a # evaluates to True
```

## if Statement

The Python `if` statement is used to determine the execution of code based on the evaluation of a Boolean expression.

- If the `if` statement expression evaluates to `True`, then the indented code following the statement is executed.
- If the expression evaluates to `False` then the indented code following the `if` statement is skipped and the program executes the next line of code which is indented at the same level as the `if` statement.

```
# if Statement

test_value = 100

if test_value > 1:
    # Expression evaluates to True
    print("This code is executed!")

if test_value > 1000:
    # Expression evaluates to False
    print("This code is NOT executed!")

print("Program continues at this point.")
```

## else Statement

The Python `else` statement provides alternate code to execute if the expression in an `if` statement evaluates to `False`.

The indented code for the `if` statement is executed if the expression evaluates to `True`. The indented code immediately following the `else` is executed only if the expression evaluates to `False`. To mark the end of the `else` block, the code must be unindented to the same level as the starting `if` line.

```
# else Statement

test_value = 50

if test_value < 1:
    print("Value is < 1")
else:
    print("Value is >= 1")

test_string = "VALID"

if test_string == "NOT_VALID":
    print("String equals NOT_VALID")
else:
    print("String equals something else!")
```

## and Operator

The Python `and` operator performs a Boolean comparison between two Boolean values, variables, or expressions. If both sides of the operator evaluate to `True` then the `and` operator returns `True`. If either side (or both sides) evaluates to `False`, then the `and` operator returns `False`. A non-Boolean value (or variable that stores a value) will always evaluate to `True` when used with the `and` operator.

```
True and True      # Evaluates to True
True and False     # Evaluates to False
False and False    # Evaluates to False
1 == 1 and 1 < 2    # Evaluates to True
1 < 2 and 3 < 1     # Evaluates to False
"Yes" and 100      # Evaluates to True
```

## Boolean Values

Booleans are a data type in Python, much like integers, floats, and strings. However, booleans only have two values:

- `True`
- `False`

Specifically, these two values are of the `bool` type. Since booleans are a data type, creating a variable that holds a boolean value is the same as with other data types.

```
is_true = True
is_false = False

print(type(is_true))
# will output: <class 'bool'>
```

## not Operator

The Python Boolean `not` operator is used in a Boolean expression in order to evaluate the expression to its inverse value. If the original expression was `True`, including the `not` operator would make the expression `False`, and vice versa.

```
not True           # Evaluates to False
not False          # Evaluates to True
1 > 2              # Evaluates to False
not 1 > 2          # Evaluates to True
1 == 1             # Evaluates to True
not 1 == 1         # Evaluates to False
```

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