Chapter 2 - Operators

Operators

Boolean Operators

Learning Objectives - Boolean Operators

- **Describe the difference between `=` and `==`**
- **Explain how boolean statements are evaluated**
- **Describe how to use the AND and OR operators**

Equal To & Not Equal To

Boolean operators are operators that return a boolean value (true or false).

Equal To

Python uses the `==` operator to determine equality. Beginners often confuse the `=` and the `==` operators. Remember, `=` is the assignment operator.

```
a = 5
b = 5
print(a == b)
```

challenge

What happens if you:

- Change `b` to `1`?
- Change `a` to `True` and `b` to `1`?
- Change `a` to `True` and `b` to `False`?

Not Equal To

The `!=` operator checks to see if two values are not equal.

```
a = 5
b = 5
print(a != b)
```

challenge

What happens if you:

- Change `b` to `1`?
- Change `a` to `True` and `b` to `1`?
- Change `a` to `True` and `b` to `False`?

Less Than & Less Than or Equal To

Less Than

The `<` operator is used to check if one value is less than another value.

```
a = 5
b = 7
print(a < b)
```

challenge

What happens if you:

- Change `b` to `1`?
- Change `b` to `5`?
- Change `b` to `False`?

Less Than or Equal To

The `<=` operator is used to check if one value is less than or equal to another value.

```
a = 5
b = 7
print(a <= b)
```

challenge

What happens if you:

- Change `b` to `1`?
- Change `b` to `5`?
- Change `a` to `False` and `b` to `True`?

Greater Than & Greater Than or Equal To

Greater Than

The `>` operator is used to check if one value is greater than another value.

```
a = 9
b = 17
print(a > b)
```

challenge

What happens if you:

- Change `b` to `1`?
- Change `b` to `9`?
- Change `b` to `False`?

Greater Than or Equal To

The `>=` operator is used to check if one value is greater than or equal to another value.

```
a = 9
b = 17
print(a >= b)
```

challenge

What happens if you:

- Change `b` to `1`?
- Change `b` to `9`?
- Change `a` to `True` and `b` to `False`?

And

The `and` Operator

The `and` operator allows for compound (more than one) boolean expressions. All boolean expressions **must** be true in order for the whole thing to be true. If only one boolean expressions is false, then the whole thing is false.

```
a = True
b = True
c = False
print(a and b)
```

challenge

What happens if you:

- Change `print` to `print(a and c)`?
- Change `print` to `print(c and b)`?

Multiple `and` Statements

You can chain several `and` statements together. They are evaluated in a left-to-right manner.

```
a = True
b = True
c = False
print(a and b and c)
```

challenge

What happens if you:

- Change `print` to `print(a and b and a and b and a)`?
- Change `print` to `print(a and b and a and b and c)`?

Or

The `or` Operator

The `or` operator allows for compound (more than one) boolean expressions. If only one boolean expressions is true, then the whole thing is true. To be false, all boolean expressions **must** be false.

```
a = True
b = True
c = False
d = False
print(a or b)
```

challenge

What happens if you:

- Change `print` to `print(a or c)`?
- Change `print` to `print(c or d)`?

Multiple `or` Statements

You can chain several `or` statements together. They are evaluated in a left-to-right manner.

```
a = True
b = True
c = False
print(a or b or c)
```

challenge

What happens if you:

- Change `print` to `print(a or c or c or c or c)`?
- Change `print` to `print(c and c and c and c and c)`?

Not

The `not` Operator

The `not` operator produces the opposite of the boolean expression that it modifies.

```
print(not True)
```

challenge

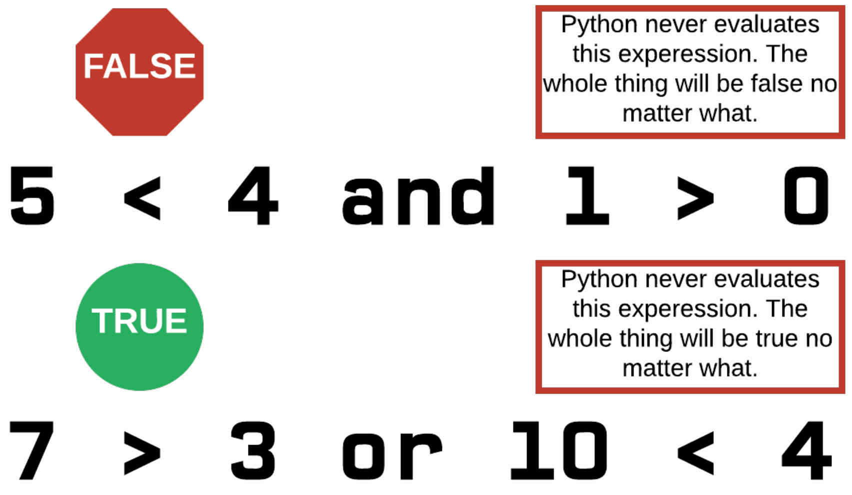
What happens if you:

- Change `print` to `print(not True and False)`?
- Change `print` to `print(not (True and False))`?
- Change `print` to `print(not not True)`?

Short Circuiting

Short Circuiting

If Python can determine the result of a boolean expression before evaluating the entire thing, it will stop and return the value.


FALSE
Python never evaluates this experession. The whole thing will be false no matter what.
5 < 4 and 1 > 0
TRUE
Python never evaluates this experession. The whole thing will be true no matter what.
7 > 3 or 10 < 4

Short Circuiting