Conditional Execution

Decision making with `if-else` statements

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Boolean Expressions

The Boolean Data Type

- A **boolean expression** is an expression that is evaluated to either `True` or `False`.
- In `Python`, the boolean data type can only take the values `True` or `False`.
- Note that `True` or `False` must begin with a capital letter. These are special values which are not strings.
- `Python` specifies this data type as: `bool`

Comparison Operators

- The following comparison operators compare two numbers, and give back a boolean value.

Comparison Operator	Description
>	greater than
>=	greater than or equal to
<	less than
<=	less than or equal to
==	equal to
!=	not equal to

- Note that == denotes logical equality, while = is the assignment operator.
- Confusing these two items is a common source of errors.

Logical Operators

- There are three logical operators in `Python`.

Rank	Operator	Example	Result
1	`not`	`not a`	`True` if `a` is `False`, and `False` if `a` is `True`.
2	`and`	`a and b`	`True` if `a` and `b` are both `True`, and `False` otherwise.
3	`or`	`a or b`	`True` if either `a` or `b` are `True`, and `False` otherwise.

- Logical operators must be evaluated in the following order of precedence: `not`, `and`, `or`.

Truth Tables

- A logical operation can be described by a **truth table** that lists all of the possible combinations of values for the input variables involved in an expression.
- The following is a two-valued truth table. It shows the outputs for the `and`, `or` operators.

		logical and	**logical or**
`a`	`b`	`a and b`	`a or b`
`False`	`False`	`False`	`False`
`False`	`True`	`False`	`True`
`True`	`False`	`False`	`True`
`True`	`True`	`True`	`True`

The `not` Operator

- The `not` operator gives the logical complement of a boolean value.
- It does not alter the variable upon which it acts.
- The following is the truth table for the `not` operator:

	logical not
`a`	`not a`
`False`	`True`
`True`	`False`

```
if (not lights):
    print("The room is dark.")
```

The and Operator

- The result of a logical `and` operation is `True` if both operands are `True`, but `False` otherwise.

```
if (chips > 0 and soda > 0):
    print("You have snacks.")
```

The or Operator

- The result of a logical or operation is True if one or the other or both of the operands are True, but False otherwise.

```
if (money > 1000 or creditcard == True):
    print("You can buy an iPhone.")
```

The `if` Statement

Conditional Execution

Conditional statements give us the ability to check a condition, and change the behaviour of the program accordingly.

The `if` Statement

- This allows us to perform actions only when certian conditions are met, and to skip the block of code otherwise.
- The structure of the `if` statement consists of the following:

```
if condition:
    code block of statements
```

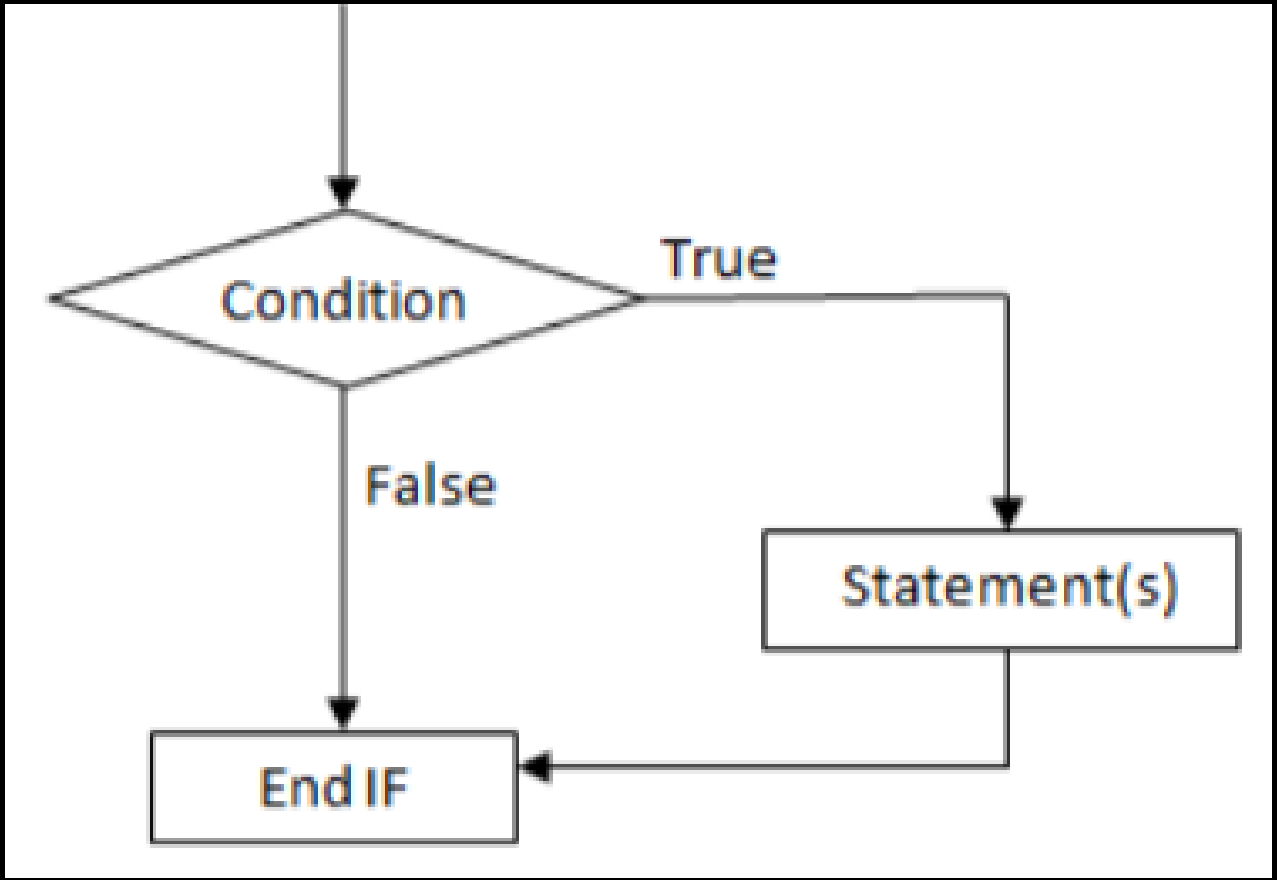
The `if` Statement

- The first line has the keyword `if`, then a **condition** which must be `True` or `False` expression, then a colon.
- Then, there is the body of the `if` statement, which consists of one or more indented lines.
- According to good programming practice, there should be 4 spaces of indent.

```
if age >= 18:
    print("You can drive.")
```

- If the logical condition is `True`, then the indented block of code gets executed. If the logical condition is `False`, then the indented block of code is skipped.

Flowchart of the `if` Statement



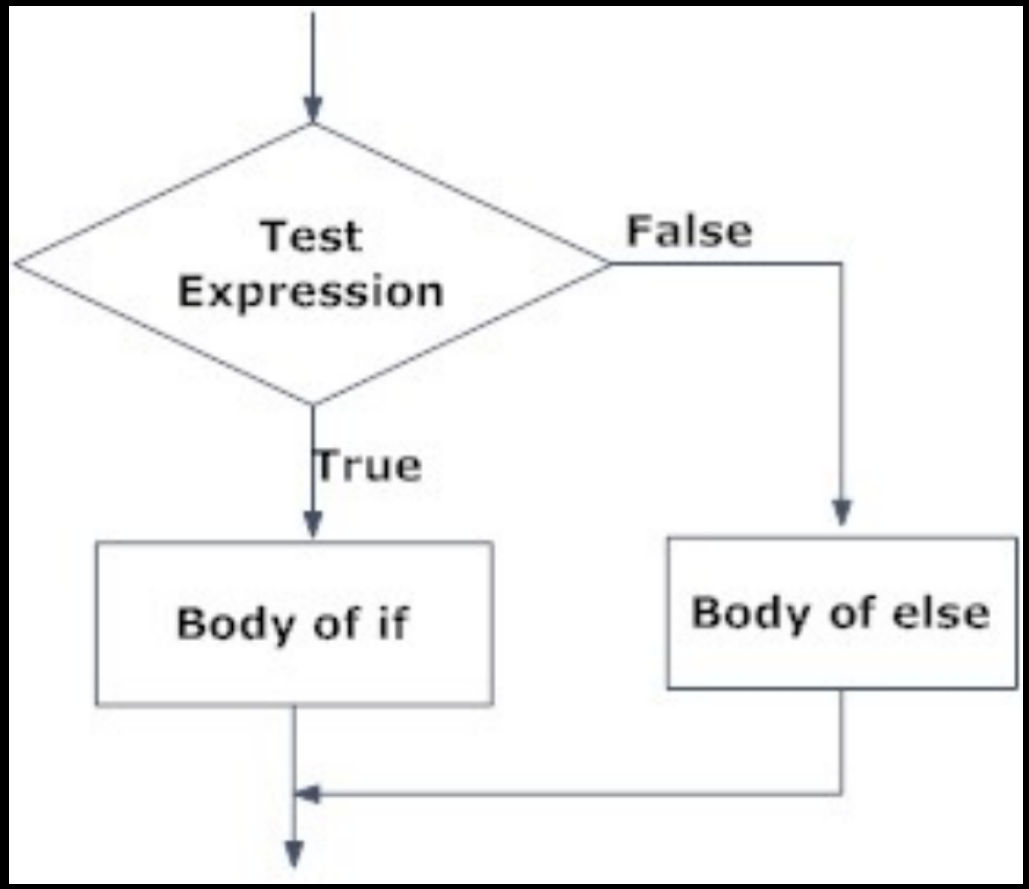
The `if-else` Statement

- Often, you want to test some condition, and take either one action or another action, depending upon whether the condition is `True` or `False`.
- With an `if-else` statement, there are two possibilities, and the condition determines which one is executed.
- The structure of the `if-else` statement consists of the following:

```
if condition:
    code block if the condition is True
else:
    code block if the condition is False
```

Flowchart of the `if-else` Statement

- Since the condition must be either `True` or `False`, exactly one of the possible branches must be executed.



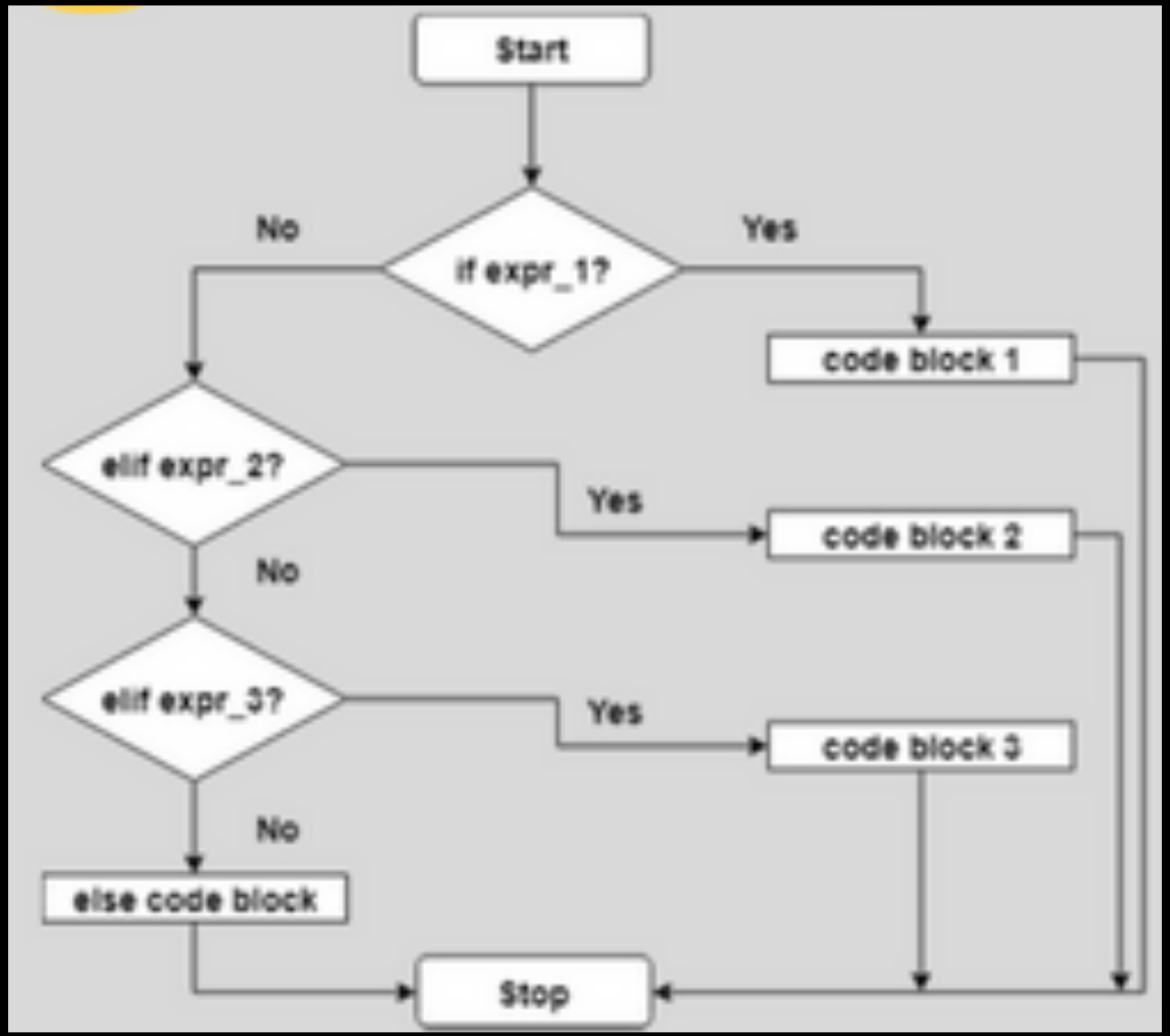
The `if-elif-else` Statement

- Sometimes, there are more than two possibilities which can be selected, so we need more than two logical branches.
- We can use an `if-elif-else` statement, which allows us to check several conditions in a row.
- The keyword `elif` is an abbreviation for `else if`, since it is the same as putting an `if` statement inside an `else` block.
- You can combine any number of `elif` statements in your structure.
- The `else` statement at the end is optional. If you include an `else` statement, then it must come at the very end of the structure.

The if-elif-else Statement

```
if first_condition:
    code block if first_condition is True
elif second_condition:
    code block if second_condition is True
elif third_condition:
    code block if third_condition is True
else:
    code block if all other conditions are False
```

Flowchart of the `if-elif-else` Statement



Short-Circuit Evaluation

- The `and` and `or` operators are short-circuited.
- If the left operand is enough to decide the boolean result of the operation, then the right operand is not evaluated.

`and`

If the left operand is `False`, then the result of the entire expression will be `False`, no matter what the right operand is.

```
sh = False and (False and (True or False) or True)
```

`or`

If the left operand is `True`, then the result of the entire expression will be `True`, no matter what the right operand is.

```
cr = True or (False and (True or False) or True)
```

Conditional Execution: End of Notes