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Python for Data Science: SW02

Code structure
if-else statement
match-case statement

Information Technology
February 25, 2025

FH Zentralschweiz

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Sequential data types (repetition)

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Sequential data types (repetition)

In Python, sequential data types may comprise **mixed data types** and can have **multiple dimensions**.

Type	Example for assignment	Properties
List	`li = [1,'hello',2,[4,6,'a'],(3,9)]`	ordered; changeable
Tuple	`tp = (77,(55,1),9,37) or tp = 77,(55,1),9,37`	ordered; unchangeable
Dictionary	`di = {'a':1, 'b':2, 'c':{'aa':11, 'bb':22}}`	key-value pair; ordered; changable; key must be string; no duplication of elements
Set	`se = {1,28,6,(18,88),11}`	no duplication of elements; unordered; unindexed; contains only hashable elements

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Type casting

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Type casting

Depending on operation, same data have to appear in **different** types.
E.g. Concatenating strings require string representation of all concatenating elements: ~~“hello “ + 1 + “st world”~~

-> data of a particular type are **transformed** into a different data type.

int:
```
int(‘3’), int(0x13), int(3.141592), ~~int(3+3j), int(‘hello’)~~
# any numerical value in string or number format, excl. complex numbers
```

float:
```
float(‘3’), float(0x13), float(3), ~~float(3+3j), float(‘hello’)~~
# any numerical value in string or number format, excl. complex numbers
```

string:
```
str(3), str(0x13), str([1,2,3]), str({‘a’:5, ‘b’:3}), str(...)
# any object supporting string representation
```

bool:
```
bool(‘3’), bool(0x13), bool(-3.1415)
# everything except 0, “”, None, empty or False evaluates to True
```

complex:
```
complex(‘3’), complex(‘3+3j’), complex(3.1415)
# any numerical value in string or number format
```

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Input and output

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Input and output

Interaction with an application requires input and output.

Input options:

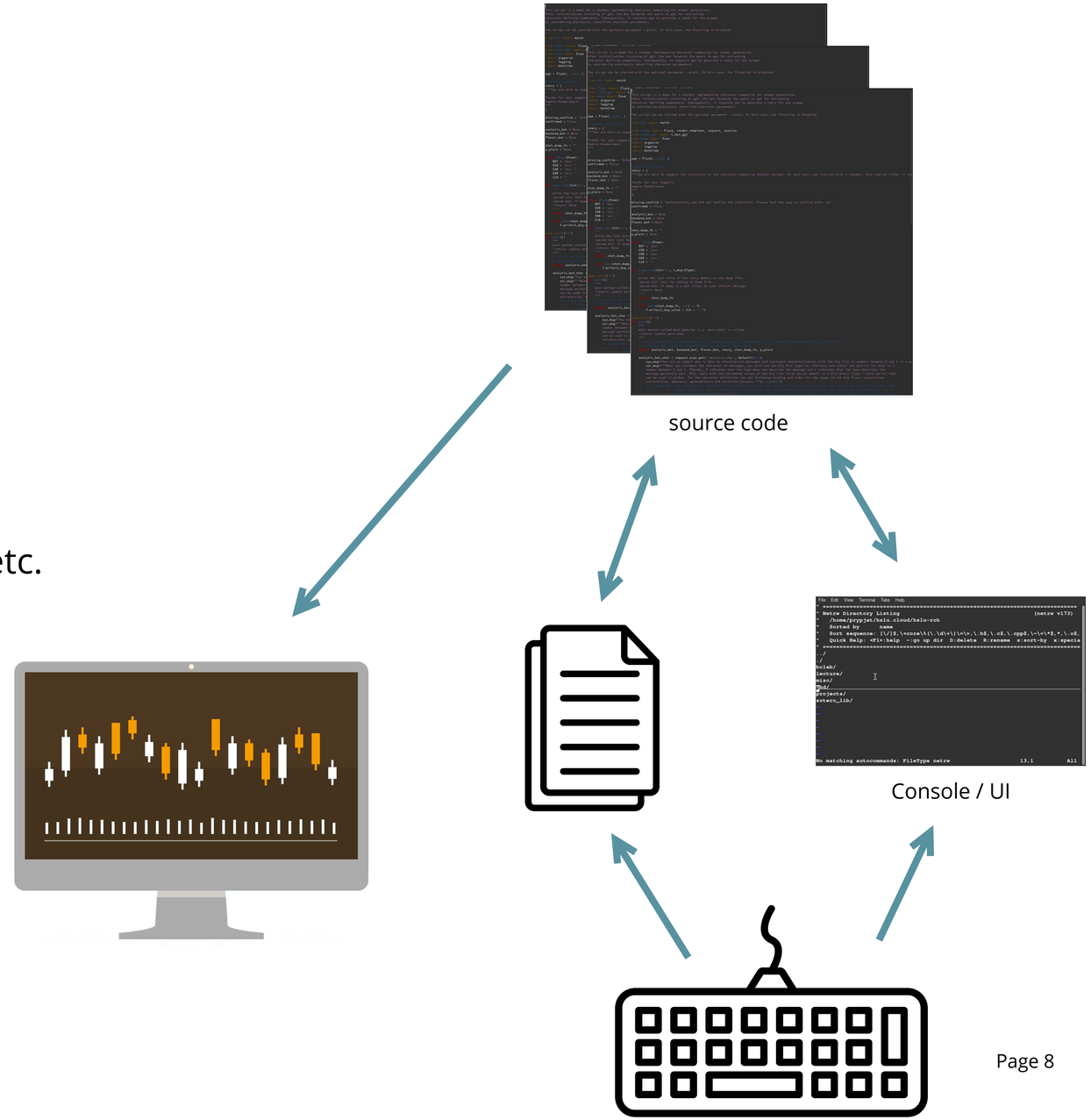
Camera, **File**, **Keyboard**, Microphone, Mouse, USB, etc.

Output options:

File, Speaker, **Terminal**, USB, User Interface (text, figures), etc.

Documentation:

https://docs.python.org/3/tutorial/inputoutput.html



Input and output

Reading from standard input using the function `input(prompt)`:
Doc: https://docs.python.org/3/library/functions.html#input

- The input function prints the passed string to the standard output (i.e. terminal)
  -> without trailing newline (“`\n`”).
- Reads from standard input (i.e. terminal) and converts it to string.
  -> no trailing newline (“`\n`”) at the end.
- `eval()` allowes to evaluate Python expressions. This is helpful when receiving expressions as input: `eval(“3+5”)`

```
>>> s = input('--> ')
--> Monty Python's Flying Circus
>>> s
"Monty Python's Flying Circus"
>>> s = input('integer? ')
integer? 44
>>> s
'44'
>>>
```

Input and output

Sending information to standard output using the function:

```
print(*objects, sep=' ', end='\n', file=None, flush=False)
```

Doc: https://docs.python.org/3/library/functions.html#print

- The function sends all arguments in objects to the standard output (i.e. terminal).
- Parameters are:

`*objects`:	one or more **string** elements
`sep`:	string written in between of elements
`end`:	trailing string
`file`:	file object providing `write(string)` method
`flush`:	boolean if stream will be forcibly flushed

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Boolean operation

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Boolean operation

A boolean expression can be of two states only:

`0` or `1` **`left` or `right`** **`true` or `false`**

Doc: https://docs.python.org/3/library/stdtypes.html#boolean-operations-and-or-not

Python treats all that is NOT **empty**, **0, False** or **None** as **True**.

```
>>> bool(None)
False
>>> bool("")==bool(0)==bool(None)==False==(not True)
True
>>>
```

Boolean operation: or, and, not

or

- `x or y`
- Priority: 1
- if x is true, then x, else y

	True	False
True	True	True
False	True	False

and

- `x and y`
- Priority: 2
- if x is false, then x, else y

	True	False
True	True	False
False	False	False

not

- `not x`
- Priority 3
- if x is false, then True, else False
- `x == not y` -> syntax error
- `not x == y` equal as
  `not ( x == y )`

True -> False

False -> True

or: short-circuit operator; second argument is **only** evaluated if first one is **false**
and: short-circuit operator; second argument is **only** evaluated if first one is **true**

Boolean operation: operators

Bitwise operators

Operation	Result
`x	y`	bitwise or of x and y
`x ^ y`	bitwise exclusive or of x and y
`x & y`	bitwise and of x and y
`x << n`	x shifted left by n bits
`x >> n`	x shifted right by n bits
`~x`	the bits of x inverted

Comparison operators

Operation	Meaning
`<`	strictly less than
`<=`	less than or equal
`>`	strictly greater than
`>=`	greater than or equal
`==`	equal
`!=`	not equal
`is`	object identity
`is not`	negated object identity

Comparisons can be chained arbitrarily: `x < y <= z` is equivalent to `x < y and y <= z`
`z` is not evaluated at all when `x < y` is found to be **false**.

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Indentation and syntax

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Indentation and syntax

In Python, the code structure is mainly given by **indentations** and **priorities**.

Boolean operations:

- Structure is given by operation priorities.
- How does the code have to be changed to become **True**?

```
>>> True and False or False and True or False
False
>>>
```

- Priorities can be changed by grouping in brackets:

```
True and (False or False) and (True or False)
```

- Boolean operations allow for **combining** conditions.
  e.g. matching even number in range: 12 < x < 20

```
12 < x < 20 and not x % 2
```

Indentation and syntax

Block operations start with a column (:) and are defined by indentations:
-> indentations can have arbitrary **number of spaces** but must be **constant** for all instructions of the same block content
Doc: https://docs.python.org/3/reference/lexical_analysis.html#indentation

Single block

```
instruction
instruction
block header:
    block instruction
    block instruction
    block instruction
instruction
instruction
```

Nested block(s)

```
instruction
instruction
block 1 header:
    block 1 instruction
    block 2 header:
        block 2 instruction
        block 2 instruction
    block 1 instruction
    block 1 instruction
instruction
instruction
```

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If-else condition

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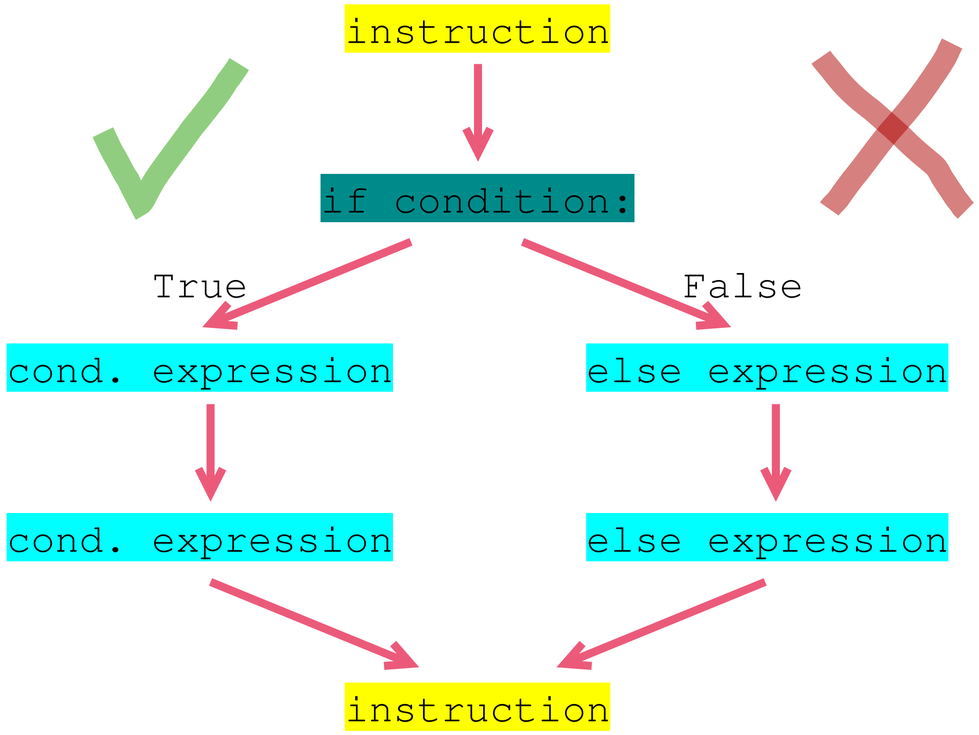
If-else statement: Concept and components

The if-else statement is a switch for proving and catching a condition being required for a conditional expression.

- It allows for executing expressions (a block) under certain conditions (if condition is True).
- The else block is **not** mandatory.



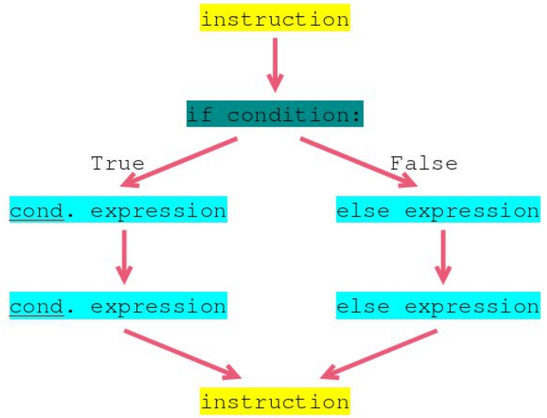

```
instruction
if condition:
    cond. expression
    cond. expression
else:
    else expression
    else expression
instruction
```

If-else statement: Concept and components

Following an example switching between conditional expressions:

```
x = 7                   # x = 7
if x > 10:              # 7 > 10 -> condition = False
    print(x)            # not executed
else:                   # switch to else
    x = x + 5           # x = 12
print(x)                # print 12 to console

if x > 10:              # 12 > 10 -> condition = True
    print(x)            # print 12 to console
else:                   # no switch to else
    x = x + 5           # not executed
print(x)                # print 12 to console
```



If-else statement: Elif concatenation

In the regular if-statement expression, elif allows for concatenating conditions.

- **elif** brings the **nested** if-statement to the same level of the previous if-statement.
- elif can always be used as replacement for the else statement to bring in another condition.

```
x = 30
if not x % 2:                    # True if x not even number
    x = x + 1                    # increment x
elif x < 10:                     # True if x < 10
    x = x                        # parity
else:                            # x is even number and x >= 10
    x = x / 10
```

If-else statement: Shorthand statement

Frequently, conditional statements only affect a single expression. In this case, shorthand if-statements allow for less code and better readability.

```
x = 30
x = x + 1 if x % 2 else x                    # increase to next even number if x == odd
```

Shorthand if-statements can also be concatenated:

```
x = x + 1 if x % 2 else x if x < 10 else x / 10 # increase to next even number if x == odd else
                                                # divide by 10 if x >= 10
```

Shorthand if-statement also applicable with function calls:

```
print('hello world') if x % 2 else print('end')
```

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Match case

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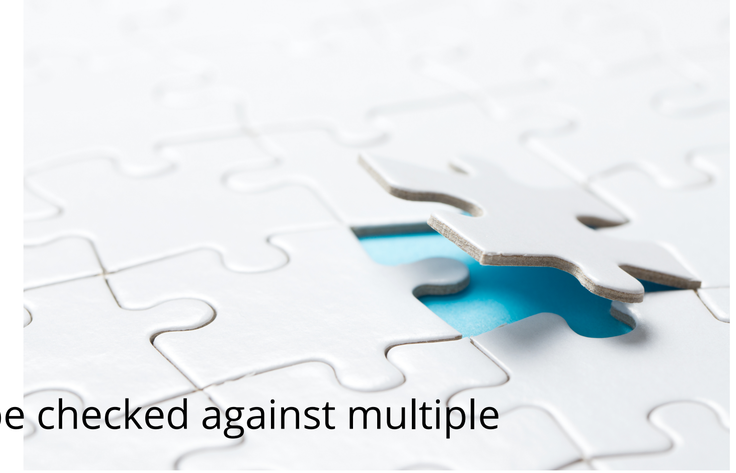
Match case



As an alternative to multiple combined conditions with elif-statements, an expression can be checked against multiple **particular cases** to which it matches.

- The **default case** is given with an underscore: _
- A match breaks the statement. All other cases are not proved.
- Doc: https://docs.python.org/3/tutorial/controlflow.html#match-statements

Elif-statement

```
x = 2
if x == 0:
    print(‘number is 0’)
elif x == 1:
    print(‘number is 1’)
elif x == 2:
    print(‘number is 2’)
else:
    print(‘number unknown’)
```

Match-case-statement

```
x = 2
match x:
    case 0:
        print(‘number is 0’)
    case 1:
        print(‘number is 1’)
    case 2:
        print(‘number is 2’)
    case _:
        print(‘number unknown’)
```

Match case: guard clause

Match case statements prove against particular expressions and not conditions. Despite, guard clause allows to prove against conditions. Usually, this case is solved with elif-statements.

Elif-statement

```
x = 177
e = 0
if 100 > x >= 10:
    e = 1
elif 1000 > x >= 100:
    e = 2
elif x >= 1000:
    e = 3
else:
    print(‘irregular number’)
print(x/(10**e), “E+”, e)
```

Match-case-statement

```
x = 177
e = 0
match x:
    case x if 100 > x >= 10:
        e = 1
    case x if 1000 > x >= 100:
        e = 2
    case x if x >= 1000:
        e = 3
    case _:
        print(‘irregular number’)
print(x/(10**e), “E+”, e)
```

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