Python 3 Cheat Sheet

Latest version on :
https://perso.limsi.fr/pointal/python:memento

Base Types

integer, float, boolean, string, bytes

```
  int 783   0  -192   0b010  0o642  0xF3
            null      binary octal  hexa
float 9.23 0.0   -1.7e-6
                       ×10⁻⁶
 bool True  False
  str "One\nTwo"            Multiline string:
   escaped new line          """X\tY\tZ
      'I\'m'                 1\t2\t3"""
      escaped '               escaped tab
bytes b"toto\xfe\775"
      hexadecimal  octal               ☝ immutables
```

Container Types

▪ **ordered sequences**, fast index access, repeatable values

```
      list  [1,5,9]    ["x",11,8.9]    ["mot"]     []
     tuple  (1,5,9)     11,"y",7.4     ("mot",)    ()
```

Non modifiable values (immutables) — ☝ *expression with just comas →* `tuple`

`str bytes` *(ordered sequences of chars / bytes)* — `""` `b""`

▪ **key containers**, no *a priori* order, fast key acces, each key is unique

```
dictionary     dict {"key":"value"}      dict(a=3,b=4,k="v")    {}
(key/value associations) {1:"one",3:"three",2:"two",3.14:"π"}
collection     set {"key1","key2"}       {1,9,3,0}          set()
```

☝ *keys=hashable values (base types, immutables…)* — `frozenset` *immutable set* — *empty*

Identifiers

for variables, functions, modules, classes… names

a…zA…Z_ followed by **a…zA…Z_0…9**

- □ diacritics allowed but should be avoided
- □ language keywords forbidden
- □ lower/UPPER case discrimination

☺ `a toto x7 y_max BigOne`
☹ ~~`8y and for`~~

= Variables assignment

1) evaluation of right side expression value
2) assignment in order with left side names

☝ assignment ⇔ **binding** of a *name* with a *value*

```
x=1.2+8+sin(y)
a=b=c=0          assignment to same value
y,z,r=9.2,-7.6,0 multiple assignments
a,b=b,a          values swap
a,*b=seq  } unpacking of sequence in
*a,b=seq  } item and list
x+=3      increment ⇔ x=x+3          and
x-=2      decrement ⇔ x=x-2          *=
x=None    « undefined » constant value  /=
del x     remove name x              %=
                                     …
```

Conversions

`type(`*expression*`)`

```
int("15") → 15
int("3f",16) → 63        can specify integer number base in 2nd parameter
int(15.56) → 15          truncate decimal part
float("-11.24e8") → -1124000000.0
round(15.56,1)→ 15.6     rounding to 1 decimal (0 decimal → integer number)
bool(x)  False for null x, empty container x , None or False x ; True for other x
str(x)→ "…"    representation string of x for display (cf. formating on the back)
chr(64)→'@'  ord('@')→64        code ↔ char
repr(x)→ "…"   literal representation string of x
bytes([72,9,64]) → b'H\t@'
list("abc") → ['a','b','c']
dict([(3,"three"),(1,"one")]) → {1:'one',3:'three'}
set(["one","two"]) → {'one','two'}
```

separator `str` *and sequence of* `str` *→ assembled* `str`

```
   ':'.join(['toto','12','pswd']) → 'toto:12:pswd'
```

`str` *splitted on whitespaces →* `list` of `str`

```
   "words with  spaces".split() → ['words','with','spaces']
```

`str` *splitted on separator* `str` → `list` *of* `str`

```
   "1,4,8,2".split(",") → ['1','4','8','2']
```

sequence of one type → `list` of another type *(via comprehension list)*

```
   [int(x) for x in ('1','29','-3')] → [1,29,-3]
```

Sequence Containers Indexing

for lists, tuples, strings, bytes…

negative index	-5	-4	-3	-2	-1	
positive index	0	1	2	3	4	
`lst=`	`[10,`	`20,`	`30,`	`40,`	`50]`	
positive slice	0	1	2	3	4	5
negative slice	-5	-4	-3	-2	-1	

Items count

`len(lst)→5`

☝ **index from 0**
(here from 0 to 4)

Individual access to **items** via `lst[`*index*`]`

```
lst[0]→10    ⇒ first one      lst[1]→20
lst[-1]→50   ⇒ last one       lst[-2]→40
```

On mutable sequences (`list`*), remove with* `del lst[3]` *and modify with assignment* `lst[4]=25`

Access to **sub-sequences** via `lst[`*start slice*`:`*end slice*`:`*step*`]`

```
lst[:-1]→[10,20,30,40]  lst[::-1]→[50,40,30,20,10]  lst[1:3]→[20,30]    lst[:3]→[10,20,30]
lst[1:-1]→[20,30,40]    lst[::-2]→[50,30,10]        lst[-3:-1]→[30,40]  lst[3:]→[40,50]
lst[::2]→[10,30,50]     lst[:]→[10,20,30,40,50] shallow copy of sequence
```

Missing slice indication → from start / up to end.
On mutable sequences (`list`*), remove with* `del lst[3:5]` *and modify with assignment* `lst[1:4]=[15,25]`

Boolean Logic

Comparators: `< > <= >= == !=`
(boolean results) ≤ ≥ = ≠

`a and b` logical and — *both simulta--neously*

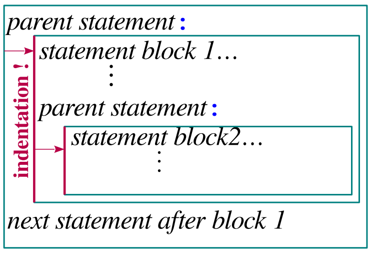
`a or b` logical or — *one or other or both*

☝ pitfall : `and` *and* `or` *return value of* `a` *or of* `b` *(under shortcut evaluation).*
⇒ ensure that `a` *and* `b` *are booleans.*

`not a` logical not

`True` } `False` } True and False constants

Statements Blocks



parent statement **:**
statement block 1…
parent statement **:**
statement block2…
next statement after block 1

☝ *configure editor to insert 4 spaces in place of an indentation tab.*

Modules/Names Imports

module `truc`*⇔file* `truc.py`

`from monmod import nom1,nom2 as fct`
→direct acces to names, renaming with `as`

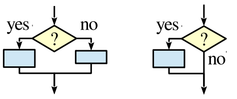
`import monmod` *→acces via* `monmod.nom1` *…*

☝ modules and packages searched in *python path* (cf `sys.path`)

Conditional Statement

statement block executed only ***if*** *a condition is true*

```
if logical condition:
    statements block
```



Can go with several *elif*, *elif*... and only one final *else*. Only the block of first true condition is executed.

```
if age<=18:
    state="Kid"
elif age>65:
    state="Retired"
else:
    state="Active"
```

☝ *with a var* ***x****:*

```
if bool(x)==True:  ⇔ if x:
if bool(x)==False: ⇔ if not x:
```

Maths

☝ *floating numbers… approximated values*

Operators: `+ - * / // % **`
Priority `(…)` × ÷ (integer ÷) (÷ remainder) a^b

`@` → matrix × *python3.5+numpy*

```
(1+5.3)*2→12.6
abs(-3.2)→3.2
round(3.57,1)→3.6
pow(4,3)→64.0
```

☝ *usual priorities*

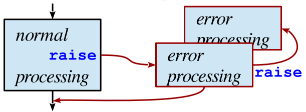
angles in radians

```
from math import sin,pi…
sin(pi/4)→0.707…
cos(2*pi/3)→-0.4999…
sqrt(81)→9.0     √
log(e**2)→2.0
ceil(12.5)→13
floor(12.5)→12
```

modules `math`, `statistics`, `random`, `decimal`, `fractions`, `numpy`, etc. *(cf. doc)*

Exceptions on Errors

Signaling an error:
`raise` *Exception(…)*



Errors processing:

```
try:
    normal procesising block
except Exception as e:
    error processing block
```

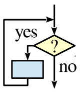
☝ `finally` *block for final processing in all cases.*

Conditional Loop Statement

statements block executed *as long as* condition is true

☝ *beware of infinite loops!*

```
while logical condition:
    statements block
```



```
s = 0  } initializations before the loop
i = 1  } condition with a least one variable value (here i)
while i <= 100:
    s = s + i**2
    i = i + 1        ☝ make condition variable change !
print("sum:",s)
```

Algo: $s=\sum_{i=1}^{i=100} i^2$

Loop Control

`break` *immediate exit*

`continue` *next iteration*

☝ `else` *block for* ***normal*** *loop exit.*

Display

```
print("v=",3,"cm :",x,",",y+4)
```

items to display : literal values, variables, expressions

`print` options:

□ `sep=" "`	items separator, default space
□ `end="\n"`	end of print, default new line
□ `file=sys.stdout`	print to file, default standard output

Input

```
s = input("Instructions:")
```

☝ **`input`** always returns a **string**, convert it to required type (cf. boxed *Conversions* on the other side).

Generic Operations on Containers

`len(c)` → items count

`min(c)` `max(c)` `sum(c)`

Note: For dictionaries and sets, these operations use ***keys****.*

`sorted(c)` → `list` sorted *copy*

`val in c` → boolean, membership operator `in` (absence `not in`)

`enumerate(c)` → *iterator* on (index, value)

`zip(c1,c2…)` → *iterator* on tuples containing c_i items at same index

`all(c)` → `True` if **all** `c` items evaluated to true, else `False`

`any(c)` → `True` if **at least one** item of `c` evaluated true, else `False`

Specific to ***ordered sequences containers*** *(lists, tuples, strings, bytes…)*

`reversed(c)` → *inversed iterator* `c*5` → duplicate `c+c2` → concatenate

`c.index(`*val*`)` → *position* `c.count(`*val*`)` → *events count*

`import copy`

`copy.copy(c)` → shallow copy of container

`copy.deepcopy(c)` → deep copy of container

Operations on Lists

☝ modify original list

`lst.append(`*val*`)`	add item at end
`lst.extend(`*seq*`)`	add sequence of items at end
`lst.insert(`*idx*`,`*val*`)`	insert item at index
`lst.remove(`*val*`)`	remove first item with value *val*
`lst.pop(`*[idx]*`)` → *value*	remove & return item at index *idx* (default last)
`lst.sort()` `lst.reverse()`	sort / reverse liste *in place*

Operations on Dictionaries

`d[`*key*`]=`*value* `d.clear()`

`d[`*key*`]` → *value* `del d[`*key*`]`

`d.update(`*d2*`)` } update/add associations

`d.keys()`
`d.values()`
`d.items()` } →iterable views on keys/values/associations

`d.pop(`*key[,default]*`)` → *value*

`d.popitem()` → *(key,value)*

`d.get(`*key[,default]*`)` → *value*

`d.setdefault(`*key[,default]*`)` →*value*

Operations on Sets

Operators:

`|` → union (vertical bar char)

`&` → intersection

`-` `^` → différence/symetric diff.

`<` `<=` `>` `>=` → inclusion relations

Operators also exist as methods.

`s.update(`*s2*`)` `s.copy()`

`s.add(`*key*`)` `s.remove(`*key*`)`

`s.discard(`*key*`)` `s.clear()`

`s.pop()`

Files

storing data on disk, and reading it back

```
f = open("file.txt","w",encoding="utf8")
```

file variable for operations

name of file on disk (+path…)

opening **mode**
□ `'r'` read
□ `'w'` write
□ `'a'` append
□ …`'+'` `'x'` `'b'` `'t'`

encoding of chars for *text files*:
`utf8` `ascii`
`latin1` …

cf. modules `os`, `os.path` and `pathlib`

writing

`f.write("coucou")`

`f.writelines(`*list of lines*`)`

read empty string if end of file **reading**

`f.read(`*[n]*`)` → *next chars*

if n not specified, read up to end !

`f.readlines(`*[n]*`)` → `list` *of next lines*

`f.readline()` → *next line*

☝ *text mode* `t` *by default (read/write* `str`*), possible binary mode* `b` *(read/write* `bytes`*).* ***Convert from/to required type !***

`f.close()` ☝ dont forget to **close the file** after use !

`f.flush()` write cache `f.truncate(`*[taille]*`)` resize

reading/writing progress sequentially in the file, modifiable with:

`f.tell()` →*position* `f.seek(`*position[,origin]*`)`

Very common: opening with a guarded block (automatic closing) and reading loop on lines of a text file:

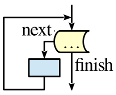
```
with open(…) as f:
    for line in f :
        # processing of line
```

Iterative Loop Statement

statements block executed *for each* item of a container or iterator

☝ *good habit : don't modify loop variable*

```
for var in sequence:
    statements block
```



Go over sequence's **values**

```
s = "Some text"  } initializations before the loop
cnt = 0
                 loop variable, assignment managed by for statement
for c in s:
    if c == "e":
        cnt = cnt + 1
print("found",cnt,"'e'")
```

Algo: count number of `e` *in the string.*

loop on dict/set ⇔ loop on keys sequences

use *slices* to loop on a subset of a sequence

Go over sequence's **index**

□ modify item at index

□ access items around index (before / after)

```
lst = [11,18,9,12,23,4,17]
lost = []
for idx in range(len(lst)):
    val = lst[idx]
    if val > 15:
        lost.append(val)
        lst[idx] = 15
print("modif:",lst,"-lost:",lost)
```

Algo: limit values greater than 15, memorizing of lost values.

Go simultaneously on sequence's **index** and **values**:

`for idx,val in enumerate(lst):`

Integers Sequences

`range(`*[start,] end [,step]*`)`

☝ *start* default 0, *fin* not included in sequence, *pas* signed default 1

`range(5)` → 0 1 2 3 4 `range(2,12,3)` → 2 5 8 11

`range(3,8)` → 3 4 5 6 7 `range(20,5,-5)` → 20 15 10

`range(len(`*seq*`))` → *sequence of index of values in seq*

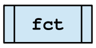
☝ *range provides an immutable sequence of int constructed as needed*

Function Definition

function name (identifier)

named parameters

```
def fct(x,y,z):
    """documentation"""
    # statements block, res computation, etc.
    return res
```



result value of the call, if no computed result to return: `return None`

☝ parameters and all variables of this block exist only *in* the block and *during* the function call (think of a "black box")

Advanced: `def fct(x,y,z,*args,a=3,b=5,**kwargs):`

**args variable positional arguments (→*`tuple`*), default values, **kwargs variable named arguments (→*`dict`*)*

Function Call

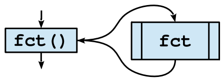
```
r = fct(3,i+2,2*i)
```

storage/use of returned value

one argument per parameter

☝ this is the use of function name *with parenthesis* which does the call

*Advanced: *sequence **dict*



Operations on Strings

`s.startswith(`*prefix[,start[,end]]*`)`

`s.endswith(`*suffix[,start[,end]]*`)` `s.strip(`*[chars]*`)`

`s.count(`*sub[,start[,end]]*`)` `s.partition(`*sep*`)` → *(before,sep,after)*

`s.index(`*sub[,start[,end]]*`)` `s.find(`*sub[,start[,end]]*`)`

`s.is…()` *tests on chars categories (ex.* `s.isalpha()`*)*

`s.upper()` `s.lower()` `s.title()` `s.swapcase()`

`s.casefold()` `s.capitalize()` `s.center(`*[width,fill]*`)`

`s.ljust(`*[width,fill]*`)` `s.rjust(`*[width,fill]*`)` `s.zfill(`*[width]*`)`

`s.encode(`*encoding*`)` `s.split(`*[sep]*`)` `s.join(`*seq*`)`

Formating

formating directives values to format

`"modele{} {} {}".format(x,y,r)` → `str`

`"{`*selection*`:`*formating*`!`*conversion*`}"`

□ **Selection** :
`2`
`nom`
`0.nom`
`4[key]`
`0[2]`

Examples

```
"{:+2.3f}".format(45.72793)
→'+45.728'
"{1:>10s}".format(8,"toto")
→'      toto'
"{x!r}".format(x="I'm")
→'"I\'m"'
```

□ **Formating** :

fill char alignment sign mini width.precision~maxwidth type

`<` `>` `^` `=` `+` `-` *space* `0` at start for filling with 0

integer: `b` binary, `c` char, `d` decimal (default), `o` octal, `x` or `X` hexa…

float: `e` or `E` exponential, `f` or `F` fixed point, `g` or `G` appropriate (default),

string: `s` … `%` percent

□ **Conversion** : `s` (readable texte) or `r` (literal representation)