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

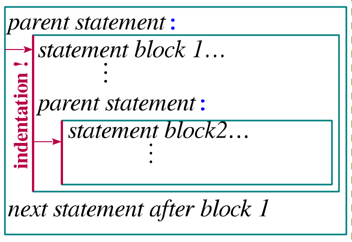
Comparators: `< > <= >= == !=`
(boolean results) ≤ ≥ = ≠

```
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



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

Modules/Names Imports

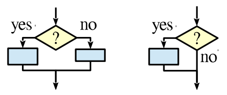
module `truc`*⇔file* `truc.py`

```
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*   *angles in radians*

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

`@` → matrix × *python3.5+*`numpy`

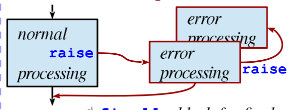
```
(1+5.3)*2→12.6
abs(-3.2)→3.2
round(3.57,1)→3.6
pow(4,3)→64.0
```
☝ *usual priorities*

```
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
```



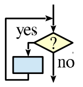
☝ `finally` *block for final processing in all cases.*

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

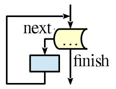
```
with open(…) as f:
    for line in f :
        # processing of line
```

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

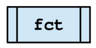
range(5) → 0 1 2 3 4 **range(2,12,3)** → 2 5 8 11
range(3,8) → 3 4 5 6 7 **range(20,5,-5)** → 20 15 10
range(len(*seq***))** → *sequence of index of values in seq*

☝ *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
```



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***)*

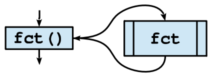
Function Call

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

$\underbrace{\texttt{"modele\{\} \{\} \{\}"}}_{\text{formating directives}}\texttt{.format}(\underbrace{x,y,r}_{\text{values to format}}) \longrightarrow \texttt{str}$

"{*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)