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
                zero   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 only comas → tuple
        str bytes  (ordered sequences of chars / bytes)       ""
                                                              b""
```

■ **key containers**, no *a priori* order, fast key access, 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

=

☝ assignment ⇔ **binding** of a *name* with a *value*
1) evaluation of right side expression value
2) assignment in order with left side names

```
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
                                          and
x+=3     increment ⇔ x=x+3                *=
x-=2     decrement ⇔ x=x-2                /=
x=None   « undefined » constant value     %=
del x    remove name x                    …
```

Conversions

```
int("15") → 15                     type(expression)
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. formatting 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 list comprehension)
   [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

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

```
a and b   logical and   both simulta-
                        -neously
a or b    logical or    one 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
```

indentation !

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

Modules/Names Imports

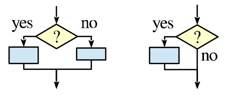
module `truc`⇔*file* `truc.py`

`from monmod import nom1,nom2 as fct`
→*direct access to names, renaming with* `as`
`import monmod` →*access 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 (…) × ÷ 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
```

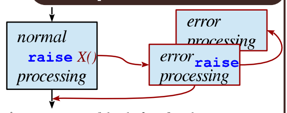
☝ *usual order of operations*

```
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 ExcClass(…)
```
Errors processing:
```
try:
    normal procesising block
except Exception as e:
    error processing block
```



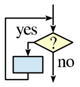
☝ `finally` *block for final processing in all cases.*

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

`-` `^` → difference/symmetric 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**	**encoding** of chars for *text files*:
		▫ `'r'` read	`utf8` `ascii`
		▫ `'w'` write	`latin1` …
		▫ `'a'` append	
		▫ …`'+'` `'x'` `'b'` `'t'`	

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

writing

`f.write("coucou")`

`f.writelines(list of lines)`

reading

☝ *read empty string if end of file*

`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([size])` resize

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

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

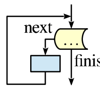
Very common: opening with a guarded block (automatic closing) and reading loop on lines of a text file:

```
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*

```
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.

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

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

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

Integer Sequences

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

☝ *start* default 0, *end* not included in sequence, *step* 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*

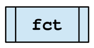
☝ *range provides an immutable sequence of int constructed as needed*

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`*)*

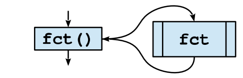
Function Call

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

storage/use of returned value *one argument per parameter*

☝ this is the use of function name *with parentheses* 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)`

Formatting

formating directives values to format

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

`"{selection:formatting!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"'
```

▫ **Formatting** :

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 text) or `r` (literal representation)