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
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. 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 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
```

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`

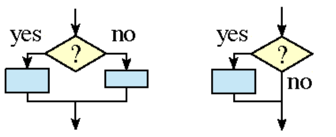
`import monmod` *→access via* `monmod.nom1` *…*

☝ 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)*

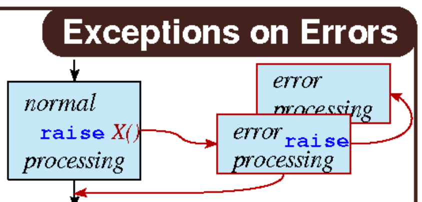
Exceptions on Errors

Signaling an error:

```
    raise ExcClass(…)
```

Errors processing:

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

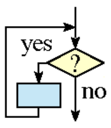


☝ `finally` *block for final processing in all cases.*

Conditional Loop Statement

statements block executed ***as long as*** *condition is true*

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



```
s = 0
i = 1
```
initializations ***before*** *the loop*

condition with a least one variable value (here ***i****)*

```
while i <= 100:
    s = s + i**2
    i = i + 1
print("sum:",s)
```

☝ *make condition variable change !*

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

☝ *beware of infinite loops!*

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
- `-` `^` → 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**
- □ `'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*`)`

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]*`)`

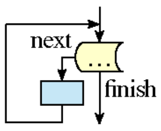
Very common: opening with a guarded block (automatic closing) and reading loop on lines of a text file:

```
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"
cnt = 0
```
initializations ***before*** *the loop*

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*

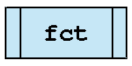
☝ *range provides an immutable sequence of int constructed as needed*

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

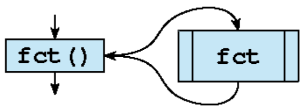
```
r = fct(3,i+2,2*i)
```

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)