Python 3 Cheat Sheet

Base Types

integer, float, boolean, string

```
  int 783  0 -192
           zero
float 9.23 0.0   -1.7e-6
                       ×10⁻⁶
 bool True  False
  str "One\nTwo"
        escaped new line
      'I\'m'
      escaped '
```

Multiline string:

```
"""X\tY\tZ
1\t2\t3"""
```

escaped tab

Container Types

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

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

Non modifiable values (immutables) → `tuple`, `str`

☝ *expression with only commas* → `tuple`

`str` *(ordered sequences of chars)* `""`

▪ **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"}`

☝ *keys=hashable values (base types, immutables…)*

empty

Identifiers

for variables, functions, modules, classes… names

`a…zA…Z_` followed by `a…zA…Z_0…9`

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

and `*=` `/=` `%=` …

Conversions

`type(`*expression*`)`

`int("15") → 15`	
`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)*
`list("abc") → ['a','b','c']`	
`dict([(3,"three"),(1,"one")]) → {1:'one',3:'three'}`	

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…

```
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 simultaneously*

`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 `thing`⇔*file* `thing.py`

`from mymod import name1,name2 as fct`
→*direct access to names, renaming with* `as`

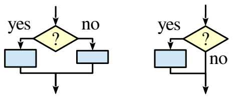
`import mymod` →*access via* `mymod.name1` …

☝ 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)

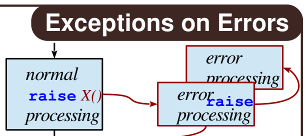
Exceptions on Errors

Signaling an error:

`raise` *ExcClass(…)*

Errors processing:

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

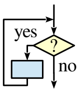


☝ `finally` *block for final processing in all cases.*

Conditional Loop Statement

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

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



```
s = 0 } 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: $s=\sum_{i=1}^{i=100} i^2$

☜ *beware of infinite loops!*

Loop Control

break *immediate exit*

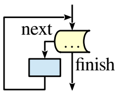
continue *next iteration*

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

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.*

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

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

☜ good habit : don't modify loop variable

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

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, 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)

`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*

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*

Operations on Strings

```
s.startswith(prefix[,start[,end]])
s.endswith(suffix[,start[,end]])  s.strip([chars])
s.count(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.split([sep])   s.join(seq)
```

Formatting

formating directives values to format

```
"model {} {} {}".format(x,y,r) ——→ str
f"model {x} {y} {r}"           ——→ str
"{selection:formatting!conversion}"
```

- **Selection** :
  `2`
  `name`
  `0.name`
  `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
  `< > ^ =` `+ -` *space* `0` at start for filling with 0
- **Conversion** : `s` (readable text) or `r` (literal representation)

Operations on Lists

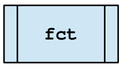
☝ modify original list

`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 list *in place*

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
```



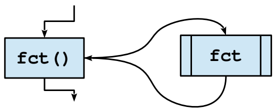
☝ parameters and all variables of this block exist only *in* the block and *during* the function call (think of a “black box”)

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



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()`