Python 3.2 Reference Card

Summary necessarily incomplete to keep on one paper sheet, see http://docs.python.org/py3k.

Cheat Sheet Symbols

♂ optional instructions , ↻ repeatable instructions, ⚷ immutable data, ⇢ ordered container (⇝ non ordered), `constant`, *variable*, `type`, `function` & `.method`, *parameter*, *[,optional parameter]*, `keyword`, `literal`, *module*, *file*.

Introspection & Help

`help`(*[objet or "subject"]*)
`id`(*objet*) `dir`(*[object]*) `vars`(*[object]*)
`locals`() `globals`()

Qualified Access

Separator `.` between a **namespace** and a **name** in that space. Namespaces : object, class, function, module, package…. Examples :

```
math.sin(math.pi)        f.__doc__
MyClasse.nbObjects()
point.x          rectangle.width()
```

Base Types

undefined ⚷ : `None`

Boolean ⚷: `bool` `True` / `False`
`bool`(*x*) ➙ `False` if *x* nul or empty

Integer ⚷: `int` `0` `165` `-57`
binary:`0b101` octal:`0o700` hexa:`0xf3e`
`int`(*x[,base]*) `.bit_length`()

Floating ⚷: `float` `0.0` `-13.2e-4`
`float`(*x*) `.as_integer_ratio`()

Complex ⚷: `complex` `0j` `-1.2e4+9.4j`
`complex`(*re[,img]*) `.real` `.imag`
`.conjugate`()

String ⚷⇢: `str` `''` `'toto'` `"toto"`
`"""multiline toto"""`
`str`(*x*) `repr`(*x*)

Identifiers, Variables & Assignment

Identifiers : `[a-zA-Z_]` followed by or one or multiple `[a-zA-Z0-9_]`, accent and non-latin alphabetical chars allowed (but should be avoided).

name `=` *expression*
name1`,`*name2*…`,`*nameN* `=` *sequence*
sequence containing N items
name1 `=` *name2*… `=` *nameX* `=` *expression*
☞ unpacking sequence: *first*`,*`*remain*`=`*sequence*
☞ increment : *name*`=`*name*`+`*expression*
↔ augmented assignment : *name*`+=`*expression* (with other operators too)
☞ deletion : `del` *nom*

Identifiers Conventions

Details in PEP 8 “Style Guide for Python”

`A_CONSTANT`	uppercase
`alocalvar`	lowercase without _
`a_global_var`	lowercase with _
`a_function`	lowercase with _
`a_method`	lowercase with _
`AClass`	title
`AnExceptionError`	title with Error at end
`amodule`	lowercase rather without _
`apackage`	lowercase rather without _

Avoid `l O I` (l min, o maj, i maj) alone.

`_xxx`	internal usage
`__xxx`	modified _Class__xxx
`__xxx__`	spécial reserved name

Logical Operations

a`<`*b* *a*`<=`*b* *a*`>=`*b* *a*`>`*b* a=b➙*a*`==`*b* a≠b➙*a*`!=`*b*
`not` *a* *a* `and` *b* *a* `or` *b* (*expr*)
☞ combined : `12<`*x*`<=34`

Maths

`-`*a* *a*`+`*b* *a*`-`*b* *a*`*`*b* *a*`/`*b* a^{b}➙*a*`**`*b* (*expr*)
euclidian division a=b.q+r ➙ *q*`=`*a*`//`*b* et *r*`=`*a*`%`*b*
et *q,r*=`divmod`(*a,b*)
|x|➙`abs`(*x*) x^{y}%z➙`pow`(*x,y[,z]*) `round`(*x[,n]*)
☞ following functions/data in module ***math***
e *pi* `ceil`(x) `floor`(*x*) `trunc`(*x*)
e^{x}➙`exp`(*x*) `log`(*x*) √➙`sqrt`(*x*)
`cos`(*x*) `sin`(*x*) `tan`(*x*) `acos`(*x*) `asin`(*x*)
`atan`(*x*) `atan2`(*x,y*) `hypot`(*x,y*)
`cosh`(*x*) `sinh`(*x*)…
☞ following functions in module ***random***
`seed`(*[x]*) `random`() `randint`(*a,b*)
`randrange`(*[start],end[,step]*) `uniform`(*a,b*)
`choice`(*seq*) `shuffle`(*x[,rnd]*)
`sample`(*pop,k*)

Bits Manipulations

(with integers) *a*`<<`*b* *a*`>>`*b* *a*`&`*b* *a*`|`*b* *a*`^`*b*

String

Escape : `\`
`\\` ➙ `\` `\'` ➙ `'` `\"` ➙ `"`
`\n` ➙ new line `\t` ➙ tab
`\N{`*name*`}` ➙ unicode *name*
`\x`*hh* ➙ *hh* hexa `\0`*oo* ➙ *oo* octal
`\u`*hhhh* et `\U`*hhhhhhhh* ➙ unicode hexa *hhhh*
☞ prefix `r`, disable `\` : `r"\n"` ➙ `\n`

Formating : `"{`*model*`}".format`(*data…*)

```
"{} {}".format(3,2)
"{1} {0} {0}".format(3,9)
"{x} {y}".format(y=2,x=5)
"{0!r} {0!s}".format("text\n")
"{0:b}{0:o}{0}{0:x}".format(100)
"{0:0.2f}{0:0.3g}{0:.1e}".format(1.45)
```

Operations
s`*`*n* (repeat) *s1*`+`*s2* (concatenate) `*= +=`
`.split`(*[sep[,n]]*) `.join`(*iterable*)
`.splitlines`(*[keepend]*) `.partition`(*sep*)
`.replace`(*old,new[,n]*) `.find`(*s[, start[,end]]*)
`.count`(*s[, start[,end]]*) `.index`(*s[, start[,end]]*) `.isdigit`() & Co `.lower`()
`.upper`() `.strip`(*[chars]*)
`.startswith`(*s[,start[,end]]*)
`.endsswith`(*s[,start[,end]]*)
`.encode`(*[enc[, err]]*)
`ord`(*c*) `chr`(*i*)

Conditional Expression

Evaluated as a value.
expr1 `if` *condition* `else` *expr2*

Flow Control

☞ statements blocs delimited by indentation (idem functions, classes, methods). Convention 4 spaces - tune editor.

Alternative If

```
if condition1:
    # block executed if condition1 is true
elif condition2: ♂↻
    # block executed if condition2 is true
else: ♂
    # block executed if all conditions are false
```

Loop Over Sequence

```
for var in iterable:
    # block executed with var being successively
    # each of the values in iterable
else: ♂
    # executed after, except if exit for loop by break
```

☞ *var* with multiple variables : `for` *x,y,z* `in`…
☞ *var* index,valuer : `for` *i,v* `in` `enumerate`(…)
☞ *iterable : see Containers & Iterables*

Loop While

```
while condition:
    # block executed while condition is true
else: ♂
    # executed after, except if exit while loop by break
```

Loop Break : `break`
Immediate exit of the loop, without going through else block.

Loop Jump : `continue`
Immediate jump at loop start with next iteration.

Errors Processing: Exceptions

```
try:
    # block executed in normal case
except exc as e: ↻
    # block executed if an error of type exc is detected
else:
    # block executed in case of normal exit from try
finally:
    # block executed in all case
```

☞ *exc* for n types : `except` (*exc1*`,`*exc2*…`,`*excn*)
☞ `as` *e* optional, fetch exception
⚠ detect specific exceptions (ex. ValueError) and not generic ones (ex. Exception).

Raising Exeptions (error situation)
`raise` *exc* (*[args]*)
`raise` ➙ ⚠ propagate exception
Some exception classes : `Exception` - `ArithmeticError` - `ZeroDivisionError` - `IndexError` - `KeyError` - `AttributeError` - `IOError` - `ImportError` - `NameError` - `SyntaxError` - `TypeError` - `NotImplementedError`…

Managed Context

```
with managed() as v ♂:
    # Block executed in a managed context
```

Function Definition and Call

```
def fname(x,y=4,*args,**kwargs):
    # function block or, if no code, pass
    return ret_expression ♂
```

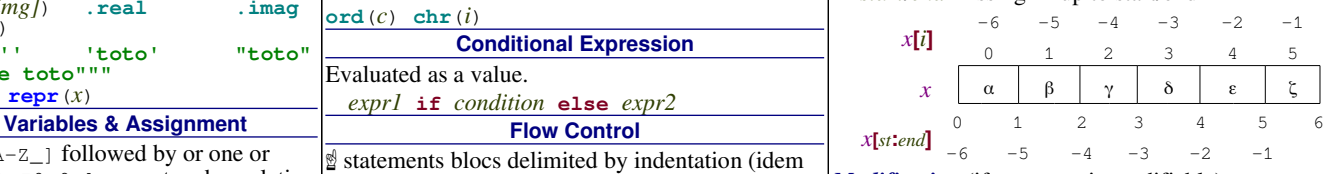
x: simple parameter
y: parameter with default value
args: variable parameters by order (`tuple`)
kwargs: named variable parameters (`dict`)
ret_expression: `tuple` ➙ return multiple values

Call
res = *fname*(*expr*`,` *param*`=`*expr*`,` *`tuple`, **`dict`)

Anonymous Functions
`lambda` *x,y*`:` *expression*

Sequences & Indexation

↻ for any direct access ordered container.
ith ***Item*** : *x*`[`*i*`]`
Slice : *x*`[`*start*`:`*end*`]` *x*`[`*start*`:`*end*`:`*step*`]`
↻ *i*, *start*, *end*, *step* integers positive or negative
☞ *start*/*end* missing ➙ up to start/end



Modification (if sequence is modifiable)
x`[`*i*`]=`*expression* *x*`[`*start*`:`*end*`]=`*iterable*
`del` *x*`[`*i*`]` `del` *x*`[`*start*`:`*end*`]`

Containers & Iterables

An *iterable* provide values one after the other. Ex : containers, dictionary views, iterable objets, generator functions…

Generators (calculate values when needed)
`range`(*[start,]end[,step]*)
`(` *expr* `for` *var* `in` *iter* ↻ `if` *cond* ♂ `)`

Generic Operations
v `in` *containeur* *v* `not in` *containeur*
`len`(*containeur*) `enumerate`(*iter[,start]*)
`iter`(*o[,sent]*) `all`(*iter*) `any`(*iter*)
`filter`(*fct,iter*) `map`(*fct,iter,…*)
`max`(*iter*) `min`(*iter*) `sum`(*iter[,start]*)
`reversed`(*seq*) `sorted`(*iter[,k][,rev]*)
On sequences : `.count`(*x*) `.index`(*x[,i[,j]]*)

String ⚷⇢ : (sequence of chars)
☞ cf. types `bytes`, `bytearray`, `memoryview` to directly manipulate bytes (+notation `b"bytes"`).

List ⇢ : `list` `[]` `[1,'toto',3.14]`
`list`(*iterable*) `.append`(*x*)
`.extend`(*iterable*) `.insert`(*i,x*) `.pop`(*[i]*)
`.remove`(*x*) `.reverse`() `.sort`()
`[` *expr* `for` *var* `in` *iter* ↻ `if` *cond* ♂ `]`

Tuple ⚷⇢ : `tuple` `()` `(9,'x',36)` `(1,)`
`tuple`(*iterable*) `9,'x',36` `1,`

Set ⇝ : `set` `{1,'toto',42}`
`set`(*iterable*) ⚷⇝ ➙ `frozenset`(*iterable*)
`.add`(*x*) `.remove`(*x*) `.discard`(*x*)
`.copy`() `.clear`() `.pop`()
∪➙`|`, ∩➙`&`, diff➙`-`, sym.diff➙`^`, ⊂…➙`<`…
`|= &= -= ^=` …

Dictionnary (associative array, map) ⇝ : `dict`
`{}` `{1:'one',2:'two'}`
`dict`(*iterable*)
`dict`(*a*`=`2`,`*b*`=`4)
`dict.fromkeys`(*seq[,val]*)
d`[`*k*`]=`*expr* *d*`[`*k*`]` `del` *d*`[`*k*`]`
`.update`(*iter*) `.keys`() `.values`()
`.items`() `.pop`(*k[,def]*) `.popitem`()
`.get`(*k[,def]*) `.setdefault`(*k[,def]*)
`.clear`() `.copy`()
☞ `items`, `keys`, `values` iterable “views”.

Input/Output & Files

`print("x=",x[,y...][,sep=...][,end=...][,file=...])`
`input("Age ? ")` ➞ `str`
☞ explicit cast to `int` or `float` if needed.
File : `f=open(name[,mode][,encoding=...])`
mode : `'r'` read (default) `'w'` write `'a'` append `'+'` read write `'b'` binary mode ...
encoding : `'utf-8'` `'latin1'` `'ascii'`...
`.write(s)` `.read([n])` `.readline()`
`.flush()` `.close()` `.readlines()`
Loop in lines :`for line in f :`...
Managed context (close) : `with open(...) as f:`
☝ in module ***os*** (see also ***os.path***):
`getcwd()` `chdir(path)` `listdir(path)`
Command line parameters in ***sys.argv***

Modules & Packages

Module : script file extension *.py* (and C compiled modules). File *toto.py* ➞ module `toto`.
Package : directory with file *__init__.py*. Contains module files.
Searched in the PYTHONPATH, see ***sys.path*** list.

Module Sample :

```
#!/usr/bin/python3
# -*- coding: utf-8 -*-
"""Module documentation - cf PEP257"""
# File: mymodule.py
# Author: Joe Student
# Import other modules, functions…
import math
from random import seed,uniform
# Definition of constants and globals
MAXIMUM = 4
lstFiles = []
# Definition of functions and classes
def f(x):
    """Function documentation"""
    …
class Converter(object):
    """Class documentation"""
    nb_conv = 0 # class var
    def __init__(self,a,b):
        """init documentation"""
        self.v_a = a # instance var
        …
    def action(self,y):
        """Method documentation"""
        …
# Module auto-test
if __name__ == '__main__':
    if f(2) != 4: # problem
    …
```

Modules / Names Imports

```
import mymondule
from mymodule import f,MAXIMUM
from mymodule import *
from mymodule import f as fct
```

To limit `*` effect, define in ***mymodule*** :

```
__all__ = [ "f", "MAXIMUM"]
```

Import via package :

```
from os.path import dirname
```

Class Definition

Special methods, reserved names `__xxxx__`.

```
class ClassName([superclass]) :
    # class block
    class_variable = expression
    def __init__(self[,params...]) :
        # initialization block
        self.instance_variable = expression
    def __del__(self) :
        # destruction block
    @staticmethod       # @↔"decorator"
    def fct([,params...]) :
        # static method (callable without object)
```

Membership Tests

```
isinstance(obj,class)
isssubclass(subclass,parentclass)
```

Objects Creation

Use the class as a function, parameters are passed to constructor `__init__`.

```
obj = ClasseName(params...)
```

Special Conversion Methods

```
def __str__(self) :
    # return display string
def __repr__(self) :
    # return representation string
def __bytes__(self) :
    # return bytes string object
def __bool__(self) :
    # return a boolean
def __format__(self,format_spec) :
    # return a string following specified format
```

Special Comparison Mehods

Return `True`, `False` or `NotImplemented`.

```
x<y  ➞ def __lt__(self,y) :
x<=y ➞ def __le__(self,y) :
x==y ➞ def __eq__(self,y) :
x!=y ➞ def __ne__(self,y) :
x>y  ➞ def __gt__(self,y) :
x>=y ➞ def __ge__(self,y) :
```

Special Operations Methods

Return a new object of the class, containing the operation result, or `NotImplemented` if cannot work with given *y* argument.

```
x ➞ self
x+y ➞ def __add__(self,y) :
x-y ➞ def __sub__(self,y) :
x*y ➞ def __mul__(self,y) :
x/y ➞ def __truediv__(self,y) :
x//y ➞ def __floordiv__(self,y) :
x%y ➞ def __mod__(self,y) :
divmod(x,y) ➞ def __divmod__(self,y) :
x**y ➞ def __pow__(self,y) :
pow(x,y,z) ➞ def __pow__(self,y,z) :
x<<y ➞ def __lshift__(self,y) :
x>>y ➞ def __rshift__(self,y) :
x&y ➞ def __and__(self,y) :
x|y ➞ def __or__(self,y) :
x^y ➞ def __xor__(self,y) :
-x ➞ def __neg__(self) :
+x ➞ def __pos__(self) :
abs(x) ➞ def __abs__(self) :
~x ➞ def __invert__(self) :
```

Following methods called after, on *y* if *x* don't support required operation.

```
y ➞ self
x+y ➞ def __radd__(self,x) :
x-y ➞ def __rsub__(self,x) :
x*y ➞ def __rmul__(self,x) :
x/y ➞ def __rtruediv__(self,x) :
x//y ➞ def __rfloordiv__(self,x) :
x%y ➞ def __rmod__(self,x) :
divmod(x,y) ➞ def __rdivmod__(self,x) :
x**y ➞ def __rpow__(self,x) :
x<<y ➞ def __rlshift__(self,x) :
x>>y ➞ def __rrshift__(self,x) :
x&y ➞ def __rand__(self,x) :
x|y ➞ def __ror__(self,x) :
x^y ➞ def __rxor__(self,x) :
```

Special Augmented Assignment Methods

Modify *self* object on which they are applied.

```
x ➞ self
x+=y ➞ def __iadd__(self,y) :
x-=y ➞ def __isub__(self,y) :
x*=y ➞ def __imul__(self,y) :
x/=y ➞ def __itruediv__(self,y) :
x//=y ➞ def __ifloordiv__(self,y) :
x%=y ➞ def __imod__(self,y) :
x**=y ➞ def __ipow__(self,y) :
x<<=y ➞ def __ilshift__(self,y) :
x>>=y ➞ def __irshift__(self,y) :
x&=y ➞ def __iand__(self,y) :
x|=y ➞ def __ior__(self,y) :
x^=y ➞ def __ixor__(self,y) :
```

Special Numerical Conversion Methods

Return the converted value.

```
x ➞ self
complex(x) ➞ def __complex__(self,x) :
int(x) ➞ def __int__(self,x) :
float(x) ➞ def __float__(self,x) :
round(x,n) ➞ def __round__(self,x,n) :
def __index__(self) :
    # return an int usable as index
```

Special Attribute Access Methods

Access with *obj.name*. Exception `AttributeError` if attribute not found.

```
obj ➞ self
def __getattr__(self,name) :
    # called if name not found as existing attribute
def __getattribute__(self,name) :
    # called in all case of name access.
def __setattr__(self,name,valeur) :
def __delattr__(self,name) :
def __dir__(self) : # return a list
```

Accessors

Property

```
class C(object) :
  def getx(self) : …
  def setx(self,value) : …
  def delx(self) : …
  x = property(getx,setx,delx,"docx")
  # Simpler, accessor to y, with decorators
  @property
  def y(self) :    # read
    """docy"""
  @y.setter
  def y(self,valeur) :    # modification
  @y.deleter
  def y(self) :    # deletion
```

Descriptors Protocol

```
o.x ➞ def __get__(self,o,classe_de_o) :
o.x=v ➞ def __set__(self,o,v) :
del o.x ➞ def __delete__(self,o):
```

Special Function Call Method

Use an object as if it was a function (callable) :

```
o(params) ➞ def __call__(self[,params...]):
```

Hash Special Method

For efficient storage in `dict` and `set`.

```
hash(o) ➞ def __hash__(self) :
```

Define to `None` if object not *hashable*.

Special Container Methods

```
o ➞ self
len(o) ➞ def __len__(self) :
o[key] ➞ def __getitem__(self,key) :
o[key]=v ➞ def __setitem__(self,key,v) :
del o[key] ➞ def __delitem__(self,key) :
for i in o: ➞ def __iter__(self) :
    # return a new iterator on the container
reversed(o) ➞ def __reversed__(self) :
x in o ➞ def __contains__(self,x) :
```

For notation `[start:end:step]`, a `slice` object is given to container methods as value for *key* parameter.
Slice : `slice(start,end,step)`
`.start` `.stop` `.step` `.indices(lentgh)`

Special Iterator Methods

```
def __iter__(self) :# return self
def __next__(self) :# return next item
```

If no more item, raise exception `StopIteration`.

Special Managed Context Methods

Used for `with` statement.

```
def __enter__(self) :
    # called at entry in the managed context
    # return value used for context' as variable
def __exit__(self,etype,eval,tb) :
    # called at exit of managed context
```

Special Metaclass Methods

```
__prepare__ = callable
def __new__(cls[,params...]) :
    # allocation and return a new cls object
isinstance(o,cls)
  ➞ def __instancecheck__(cls,o):
isssubclass(subclass,cls)
  ➞ def __subclasscheck__(cls,subclass):
```

Generators

Calculate values when needed (ex.: `range`).
Generator functions, contains a statement `yield`.

```
yield expression
yield from séquence
variable = (yield expression) transmission of values to the generator.
```

If no more item, raise exception `StopIteration`.

Generator Function Control

```
generator.__next__()
generator.send(value)
generator.throw(type[,value[,traceback]])
generator.close()
```