BIG DADDY'S PYTHON TOOLBOX

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*in this document the symbol ↳ means yields, results in, or produces

❶ For 3.6+

$

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print() is a function

print(*objects*, separator="", end='\n')

print("Hello World!") ↳ **Hello World!**

Coding Operators

\ Multiline (explicit join) Statements: Not needed within [], {}, or ()

; Multiple Statements on a Line: not used/needed with **for, if, while**

# line comment

''' block comment '''

Operators

Math: **=**(execute/assign) value swap a,b=b,a; **+**; **-**; *****; **/**; ****** (exp); **+=** a+=b ↳ a=a+b; **-=**; ***=**; ****=**; **/=**; **//=** (floor div-truncated no remainder; **%** (**mod**ulo) ↳ remainder from division;

Boolean: **False, True** (0 , 1)

Logical: **and, or, not** *modify compare*

Comparison: **==** **(same as)**; **!=** (is **not** equal); **<**; **<=**; **>**; **>=**; **is**; **is not**; all ↳ **Boolean** values **— (T/F)**

Membership: **in**; **not in**; - a list, tuple, string, dictionary, or set

Identity: **is**; **is not** the same object

Binary: **&** (and); **|** (or); **^** (xor - 1 not both); **~** inversion, = -(x+1); **<<** (shift left); **>>**(shift right) bin(0b0101 <<1) ↳ '0b1010'

Sequence Variable Operators

strings: + -concatenate, *** -** repeat; **single char** slice s**[i]**; **range slice** s **[i:j:k] from**, **to**, **step** -> *start at i, end j-1, increment by count*

Number Tools

abs(x) ↳ absolute value of x

bin(x)↳ int to binary bin(5)= '0b101' (a 4, no 2's, a 1); bin(7)[2:] = '111'

divmod(dividend,divisor) from noncomplex numbers ↳ quotient and remainder tuple

float(x) ↳ a floating point number from an integer or string; if x="1.1" print(float(x)*2) ↳ 2.2

hex(x) ↳ int to hex string hex(65536) ↳ 0x10000 or hex(65536)[2:] ↳ '10000'

oct(x) ↳ int to octal

int(x) ↳ int from float, string, hex

pow(x,y [,z]) ↳ x to y, if z is present, returns x to y, modulo z **pow(5,2)=25, pow(5,2,7)=4**

round(number [,digits]) floating point number rounded to digits or nearest integer if digits not used **round(3.14159, 4)** ↳ **3.1416**

max, **min**, **sort** - see data containers

None -> **constant** for null; x=None

String Tools

Built-In Functions

ascii(str) ↳ like repr, esc non-ascii

chr(i) ↳ character of Unicode 97= 'a'

input(prompt) ↳ user input as str

len() ↳ length of str; count of iterable items (list/dictionary/tuple/set)

ord(str)↳ value of Unicode char.

repr(object) ↳ printable string

str(object) ↳ string val of object

slice selection: **str[:*stop*]; str[*start*:*stop* [:*step*]]** ↳ a string created by the selection

String Formatting

.format() - ***see Format Toolbox!***

method: (1) substitution (2) pure format

(1) '***string* {*sub0*}{*sub1*}'.format(0, 1)**

print("Give {0} a {1}".format('me','kiss'))

(2) **'{:*format_spec*}'.format(*value*)**

function: format (***value, spec***)

format_spec: (format mini-language string)

[[fill] align] [sign] [# - alt form] [0-forced pad] [width] [,] [.precision] [type]

x= **format**(12345.678, **" =+12,.2f"**)

↳ + 12,345.68

NEW in 3.6 **f-strings:**

print(**f**"{'Pay $'}{9876.543: ,.2f}")

format strings

↳ Pay $ 9,876.54

.center(width[, fillchar]) string centered in width area using fill character 'fillchar'

.capitalize() ↳ **F**irst character capitalized

.ljust(width [, fillchar]) or **.rjust(*same args*)**

.lower()/.upper() ↳ change case

.strip; *or* **.lstrip**; *or* **.rstrip**; + **([chars])** ↳ a string with all *or* leading, *or* trailing, [chars] removed. If [chars] included, all are removed. If [chars] omitted or None, the argument removes whitespace

.swapcase() ↳ cases exchanged

.title() ↳ **F**irst **W**ords **C**apitalized

.zfill(width) - left fill with '0' to len width

String Methods

Str "**.is**" tests—(**Note**: tested here for characters 0 to 255) ↳ ***True*** if all chars in the string meet attribute condition and string =>1 character in length. ↳ False if Null

.isalnum()—True if all chars in a string are either .isalpha(), .isnumeric(), .isdigit() or .isdecimal() *Note False if your number contains a decimal point: to vet a variable v1 as a float: if (type (v1) == float): or convert in a **try/except** structure

.isalpha()—upper and lower case normal letters plus 64 printable characters between chr(170) and chr (255)

.isdecimal()—digits 0,1,2,3,4,5,6,7,8,9

.isdigit()—0 to 9 plus superscripts ² (178), ³ (179), and ¹(185)

.isidentifier()—tests a string to see if it is a valid Python identifier or keyword

.islower()—lower case ltrs plus 36 printable characters between chr(170) and chr(255)

.isnumeric()—.isdigit plus **¼** (188), **½** (189), and **¾** (190)

.isprintable()—189 of the 256 characters between 0 and 255 starting with the space chr(32) sequentially to ~ chr(126), then chr (161) to (255) except for chr(173)

.isspace()—true for chrs (9-13), (28-32), (133) and (160). Note space: " " is chr(32)

.istitle()—for all practical purposes, every word in a string begins with a capital letter

.isupper()—normal upper case plus 30 printable characters between chr(192-222)

.casefold() ↳ casefold - caseless matching

.count(sub[,start[,end]]) ↳ # of substrings

.encode(*encoding="utf-8", errors="strict"*)

.endswith *(suffix[, start[, end]])* ↳ ***T/F***

.expandtabs() replace tabs with spaces

.find(sub[, start[, end]**])** ↳ the index of **substring** start, or -1 if it is not found; print('Python'.find("th")) ↳ 2

.index(sub[,start[,end]]) = .find but failure to find sub causes *ValueError*

***seperator*.join([string list])** joins strings in iterable with **sep** char; can be null

.partition(sep) ↳ 3 tuple: **before**, **sep**, **after**

[new 3.9] .removeprefix(prefix,/) and **.removesuffix**(suffix,/)

.replace(old, new[, count]) ↳ substring old replaced by new in object; if count is given, only the count number of values are replaced

.rfind(sub[, start[, end]]) ↳ lowest index of substring in slice [start:end]. -1 on fail

.rindex()rfind but fail ↳ *ValueError*

.rsplit— like **split,** except splits from right

.split([sep] [maxsplit=]) ↳ word list, default sep is space(s)

.splitlines(keepends=False) ↳ list of lines broken at line boundaries

.startswith(prefix[,start[,end]]**)**) ↳ True/False prefix can be a tuple

.translate(table) map to table made with **.maketrans**(x,[,y[,z]])

Looping

while (*expression evaluates as True*):
process data statements; **else:**

break ends for or while loops,

for *expression to be satisfied*

```
alist=['A','B','C'];  x=iter(alist)
for i in range (len(alist)):
   print(i+1, next(x)) *can use else:
```

else: while and **for** support else:

range (start, stop [,step])

continue skips to next loop cycle

Decision Making

if elif else:

```
if somenum == 1:  # do this code
elif somenum  == 2: # do this code
else:
  # otherwise do this code
```

The ternary if: an inline **if** that can be use in formulas

print(x **if** x **in** myword **else** "", end="")

Error Management

use in error handling blocks

try: code with error potential

except *error type*: code if this error

else: otherwise do this code

finally: do this either way

assert: condition = **False** will raise an *AssertionError*

raise forces a specified exception

List Comprehensions

Make a new list with exclusions and modifications from an existing list or tuple: brackets around the expression, followed by 0 to *many* **for** or **if** clauses; clauses can be nested:

new_list = [(*modified*)item for item in old_list if some-item-attribute of (item)]

```
atuple=(1,-2,3,-4,5)
mylist=[item*2 for item in atuple if item>0]
print(atuple, mylist)
↳ (1, -2, 3, -4, 5)  [2, 6, 10]
```

***if modifying items only*:**

up1list =[x+1 for x in L]

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Data Containers
Methods & Operations

↓ Usually: i,j,k: indexes x: value or object

L / T / D / S / F / SF ↳ instances of: list, tuple, dictionary, set, frozen set, both

Unique Data Type Statements/Methods

LISTS: [ ] - Ordered, Mutable

create L=[]; L=list(L/T/S/F); L=[[x[,x]…]]; L=L[i:j:k] list from slice; list(D) ↳ list of all dictionary keys

add/remove members .append(x) where x is string or data object; L1 + L2 concatenate (lists only); insert(i^th member, as new element); .copy() duplicate list; .pop(i) return & remove i^th item, last item if no i; .clear() remove all mem-bers; .extend (iterable) adds iterable members; strings add letters as members;

query L[x] ↳ value at position x, can be multiple values: a,b=L[2:4]; L.index (x[,at/after index i][,before index j]) ↳ slice position of string or value x in list, ValueError if not in found; .count(x) find number of instances of x in list; min(L); max(L); len(L); x in L; x not in L;

manipulate .sort(key=none/function, reverse=False); sorted(L[,reverse]); L.reverse() reverse item order;

TUPLES: ( ) - Ordered, Immutable

create T=(); T=(x,[[x],(x)…]); T=tuple(T/L/S/F);

add members +=(x,[x]) add 1 or more items, note comma for 1 item; T1 + T2 concatenate (tuples only);

query =T[i:j] get slice values, end is last item + 1; .count(x) find number of instangces of x in tuple; T.index(x[,at/after index i][,before index j]) ↳ slice position of possible member x,; min(T); max(T); len(T); x in T; x not in T;

manipulate sorted (T, reverse=T/F); T[::-1] reverse order ;

DICTIONARIES: { } Mutable, Mapped, Unordered, Unique keys in Pairs

k ↳ 'key', v ↳ 'value':

create D={k:v, [,k:v]}; =dict(i=j[,k=l]); =dict(zip(L1, L2)); D2=D1.copy(); =dict.fromkeys (L/T/F , pair members with v/None/ iterable);

add/remove members D[k]=new_value; D.update(D2) add D2 items to D replacing dup values; D=(**D|**D2); D.setdefault(k[,default]) return value if k in dict, if not, insert and return default; D.clear(); del D[k] remove member; D.pop(k) ↳ v and removes k; new [3.9]: D=D2|D3; D|=k/v pairs;

query see setdefault also; x=D[k] ↳ v or keyerror if no k; x=D.get(k[,x]) like D[k] but ↳ x if no k; len(D); Dictionary views: D.keys(); D.values(); D.items(); for item view, x ↳ a (key, value) tuple; keys, values, items can all be iterated x in D.view; x not in D.view;

manipulate D[existing k]=value change value; [new in 3.8] where ri is a reversed iterator ri=reversed(D.view) iterate with next(ri); output sorted using sorted(D.items())

SETS: Unique, Mutable, Unordered

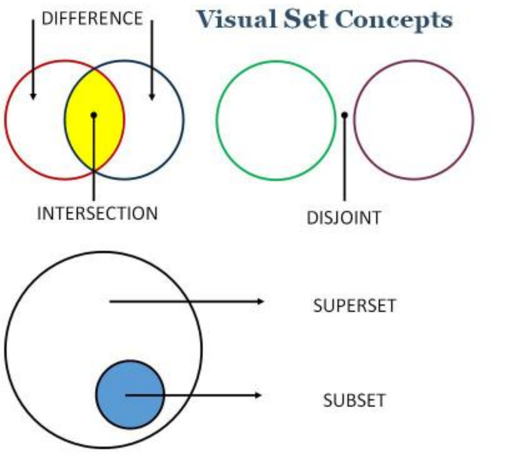
FROZENSETS: immutable after creation;

create S={x,x,x}; S=set(L/T/F); S='string' ↳ unique letters

create F=frozenset([iterable]) ☛ only

add/remove members

Set only S.add(i); S.remove(element) Key Error if missing; S.discard(element) no error if missing; S.pop() remove/return random element; S.clear(); S.update(iterable); or S1 |= S2; These add members from iterable(s) or set(s). S.intersection_update(other iterables); or S1 &= S2; Keep universal elements. S.difference_update(iterable) or S1 -= S2 Remove members found in others. S.symmetric_difference_update(iterable) S1 ^= S2; keep unique elements only



Sets & Frozensets

SF.copy() Return a shallow copy.

SF.union(SF2) or SF3=SF1|SF2[|…] merge the sets

SF.intersection(SF2) or SF1 & SF2 intersection of S1 & S2

SF.difference(S2) or SF-SF2 unique in SF

SF.symmetric_difference(SF2) or SF^SF2 elements in either but not both

query (Sets & Frozensets) len(SF); Boolean Tests: x in SF; x not in SF;

SF.isdisjoint(SF2) T if no common items

SF.issubset(SF2) & SF1<=SF2 One set is contained by the other

SF1<SF2 set is a proper subset

SF1.issuperset(SF2) or SF1=>SF2 Every element of SF1 in SF2

SF1>SF2 set is a proper superset

*/** for iterable (argument) unpack

* for list/tuples, ** for dictionaries; Ex:

a,*b,c = [1,2,3,4,5]; ↳ a=1, c=5, b=[2,3,4]

d1={1:'a', 2:'b'}; d2={2:'c', 3:'d'} ;

d1={**d1, **d2} or new in [3.9] d1|=d2

↳ d1={1:'a',2:'c',3:'d'}

More Data/Iterable Tools

all(iterable) ↳ True if all elements are True

any(iterable) ↳ True if any element is True *all and any are both FALSE if empty

del(iterable instance) - delete

enumerate(iterable, start = 0) ↳ tuples list

```
alist = ['x','y','z'];  l1 = list(enumerate(alist));  print(l1)
↳ [(0,'x'), (1,'y'), (2,'z')]
```

Use enumerate to make a dictionary. ex: mydict = dict(enumerate(mylist))

filter(function, iterable) selector for elements for which function is True

iter and next(iterator ,default]) create iterator with iter; fetch items with next ; default returned if iterator exhausted, or StopIteration ↲

```
team = ['Amy', 'Bo', 'Cy'];   it1 = iter
(team);   myguy = ""
while myguy is not "Cy":
    myguy = next(it1, "end")
    print(myguy)
```

↳
```
Amy
Bo
Cy
```

map(function, iterable) can take multiple iterables - function must take just as many

```
alist=[5,9,13,24];  x = lambda z: (z+2)
list2 = list(map(x, alist));  print(list2)
↳ [7, 11, 15, 26]
```

range ([start,] stop [,step])

```
alist=["Amy","Bo","Cy"]
for i in range (0, len(alist)):
  print(str(i), alist[i])   # note slice
```

↳
```
0 Amy
1 Bo
2 Cy
```

reversed() reverse iterator: list or tuple

```
alist=["A","B","C"]; print(alist)
alist.reverse(); print(alist);
rev_iter = reversed(alist)
for letter in range(0, len(alist)):
   print(next(rev_iter), end=", ")
```

```
['A', 'B', 'C']
['C', 'B', 'A']
A, B, C,
```

sum(iterable [, start]) all numeric ex: if a=[8,7,9] then sum(a) ↳ 24

type([iterable]) ↳ object datatype

zip() creates aggregating iterator from multiple iterables, ↳ iterator of tuples of i^th iterable elements from each sequence or iterable

Other Object Commands

Working with object attributes (most useful for created class objects)

getattr(object, 'name' [, default])

```
listatr = getattr(list, '__dict__')
for item in listatr:
   print(item, listatr[item], sep="   |   ")
```

setattr(object, 'name', value)

hasattr(object, 'name')

delattr(object, 'name')

exec(string or code obj[, globals [, locals]]) dynamic code execution

compile(source, filename, mode, flags=0, don't_inherit=False, optimize=-1) create a code object that exec() or eval() can execute

hash(object) ↳ integer hash value if available

dir() ↳ names in current local scope

dir(object) ↳valid object attributes

*args and *kwargs:

used to pass an unknown number of arguments to a function.

*args is a list

```
def testargs (a1, *argv):
  print('arg#1: ', a1)
  for ax in range(0, len(argv)):
     print ("arg#"+str(ax+2)+" is "+argv[ax])
testargs('B', 'C', 'T', 'A')
```

↳
```
arg#1:  B
arg#2 is C
arg#3 is T
arg#4 is A
```

*kwargs is a keyword -> value pair keyword is not an expression

```
def testkwargs(arg1, **kwargs):
   print ("formal arg:", arg1)
   for key in kwargs:
      print ((key, kwargs[key]))
testkwargs(arg1=1, arg2="two",
dog='cat')
```

```
formal arg: 1
('dog', 'cat')
('arg2', 'two')
```

Example of: function, *, *args

```
def myfunc(*args): # function unknown # args
    print(*args)
my_list = ['a1','b2','x','c3']  # create list
myfunc(*my_list)  # new list expanding old
del my_list[2]         # remove 2nd item
myfunc(*my_list)    # reprint to prove
```

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User Functions

def create function: def functName(args):
return(variable object) - return the value a function derived ***- or -***
yield/next; in a generator function, returns a **generator** with sequential results called by **next**
global x creates global variable - defined inside a function
nonlocal a variable in a nested function is valid in an outer function

Creating a Function

(required in red, optional in green)
(*examples: return & generator functions)*

☞*command key word* ☞*arguments*

1** **def** ***name (input or defined params):

↰ *new **function name*** *colon*☞

***2** """a docstring""" (can be multiline)

***2-x or 3-x** **code block**

***last** **return**(expression to pass back)
or a ***generator*** passed using **yield**:

```
vowels, myword = 'aeiouy','idea'
def gen1(wordin):
   for letter in wordin:
      yield(letter)
for x in gen1(vowels):
   print(x if x in myword else "", end="")
   next
```

↳ **aei**

Lambda: unnamed inline function

lambda [parameters]**:** expression
z = lambda x: format(x**3,",.2f");
print(**z**(52.1)) ↳ **141,420.76**

CLASS - an object **blueprint** or **template**

(required in red, optional in green)
Common components of a class include:

***1** *inheritance creates a "derived class"*
☞*command key word* colon ☞
class class-name (inheritance):
your class name ↰ *class **definition header***
Class creates a namespace and provides **instantiation** and **attribute reference**
***2** a **docstring**, '''Docstring example'''
***3** **instantiation** with **special method:**
def __init__(self, arguments):
autoinvoked when class is created; Arguments are passed when a class instantiation is called. Includes variable name assignments, etc.
***4** **function definitions and local variable assignments** example:

```
❶ class mammalia(object):
❷    "A class for mammal classification"
❸    def __init__(self, order, example):
        self.ord = order
        self.ex = example
        self.cls="mammal"
❹    def printInfo(self):
        info="class/order: " + self.cls + "/"+\
             self.ord +", Example:" + self.ex
        print(info)
mam_instance = mammalia("cetacea","whales")
mam_instance.printInfo()
```

↳ **class/order: mammal/cetacea, Example: whales**

File Access

wholefilepath="C:\\file\\mytest.txt"
open(file[,mode],buffering])
helpful methods: **.readline(), read(size), .readlines(), .write (string), .close(), list(openfile), .splitlines([keepends]),**
with open(wholefilepath) [as textfile]:
textfile=mytest.read().splitlines()
WITH structure closes a file automatically
**Many other functions not shown here*

Functions * **boldface** not in this basic toolbox

abs()
all()
any()
ascii()
bin()
bool()
breakpoint()
bytearray()
bytes()

callable()
chr()
classmethod
compile()
complex()
delattr()
dict()
dir()
divmod()

enumerate()
eval()
exec()
filter()
float()
format()
frozenset()
getattr()
globals()

hasattr()
hash()
help()
hex()
id()
input()
int()
isinstance()
issubclass()
iter()
len()

list()
locals()
map()
max()
memoryview
min()
next()
object()
oct()
open()
ord()

pow()
print()
property()
range()
repr()
reversed()
round()
set()
setattr()
slice()
sorted()

staticmethod
str()
sum()
super()
tuple()
type()
vars()
zip()
__import__()

Other Built-in Functions

definition: ITERABLE: an object that can return members 1 at a time
pass (placeholder – no action)
del deletes variables, data containers, items in iterables: del mylist[x]
breakpoint enters debugger - **with** wrapper ensures **_exit_** method
eval(Python expression) ↳ value
bool(expression) ↳**T/F**(F default)
callable(object) ↳True if it is
help(object) invokes built-in help system, (for interactive use)
id(*object*) ↳ unique identifier
:= (**New [3.8]**) - assignment expression operator assigns values to variables inside a larger expression
bytearray([source[, encoding [, errors]]]) ↳ a new bytearray; source can be an iterable of integers 0 to 255, an integer defining array size, or a string witn encoding which will be converted to bytes using **str.encode()**
globals() ↳ a dictionary of current global symbols of the current module
isinstance(object, classinfo) ↳ True if object is an instance of classinfo
issubclass(object, classinfo) ↳ True if object is a subclass of classinfo
locals() ↳ a dictionary of the current local symbol table
vars([object]) ↳ the **__dict__** attribute for a module, class, instance or object

Operators and Precedence

lambda
if – else
or · **and** · **not x** Boolean OR, AND, NOT
in · **not in** · **is** · **is not**
< · **<=** · **>** · **>=** · **!=** · **==**
| · **^** · **&** bitwise OR, XOR, AND
<< · **>>**
+ · **-**
***** · **@** · **/** · **//** · **%** (Multiplication, matrix multiply, division, floor div, remainder)
+x · **-x** · **~x** (pos, neg, bitwise NOT)
****** (exponentiation)
await x (Await expression)
x[index] · **x[index:index]** · **x(argu-ments...)** · **x.attribute** (subscription, slicing, call, attr ref)

Basic Open File Modes: *open for*

'r'	reading (default)
'w'	writing, truncating the file first
'x'	exclusive creation, fails if it already exists
'a'	writing, appending to the end of the file **if** it exists
'b'	binary mode
't'	text mode (default)
'+'	for updating (reading and writing), ie. "r+" or "w+"

Built-in Types numerics, sequences, mappings, classes, instances, exceptions

Numeric Types

int float complex constructors:
complex(real, imaginary) *imaginary defaults to 0*

Numeric Operations

x + y	sum of *x* and *y*	**x - y**	difference of *x* and *y*
x * y	product of *x* and *y*	**x / y**	quotient of *x* and *y*
x // y	floored quotient of *x* and *y*		
x % y	remainder of x / y	**-x**	*x* negated
+x	*x* unchanged	**abs(x)**	absolute value *x*

int(x) *x* converted to integer
float(x) *x* converted to floating point
complex (real, imaginary) imaginary defaults to 0
c.conjugate() conjugate of complex number *c*
divmod(x, y) the pair (x // y, x % y)
pow(x, y) *x* to the power *y*
x ** y *x* to the power *y*
round(x[,n]) round to n digits, half to even
math module (import math) adds these operations:
math.trunc(x); math.floor(x); math.ceil(x)

Sequence Operations (4.6.1)

x in s True if an item of s is equal to x
x not in s False if an item of s is equal to x
s + t the concatenation of s and t
s * n or n * s concatenate s n times
s[i] ith item of s, origin 0
s[i:j] slice of s from i to j
s[i:j:k] slice of s from i to j with step k
len(s) length of s
min(s) smallest item of s
max(s) largest item of s
s.index(x[, i[, j]]) index of the first occurrence of x in s (at or after index i and before index j)
s.count(x) number of occurrences of x in s

Mutable Sequence Operations

s[i] = x item i of s is replaced by x
s[i:j] = t slice of s from i to j is replaced by the contents of the iterable t
del s[i:j] removes i to j; same as ***s[i:j] = []***
s[i:j:k] = t the elements of s[i:j:k] are replaced by those of t; start, stop, step
del s[i:j:k] removes the elements of s[i:j:k] from the list
s.append(x) appends x to the end of the sequence
s.clear() removes all items from s (same as ***del[:]***)
s.copy() creates a shallow copy of s (same as ***s[:]***)
s.extend(t) or ***s += *** extends s with the contents of t (for the most part the same as***[len(s):len(s)] = t)***
s *= n updates s with its contents repeated n times
s.insert(i, x) inserts x into s at the index given by i(same as *s[i:i] = [x]*)
s.pop([i]) retrieves the item at i and removes it from s
s.remove(x) remove the first item from s where s[i]== x
s.reverse() reverses the items of s in place
**** see: https://docs.python.org/3.6/library/stdtypes.html**

Keywords (reserved)

and, as, assert, async, await, break, class, continue, def, del, elif, else, except, False, finally, for, from, global, if, import, in, is, lambda, nonlocal, None, not, or, pass, raise, return, True, try, while, with, yield

Built-in Constants

False, True, None, NotImplemented, Ellipsis (same as literal '…'), __debug__, quit(), exit(), copyright, credits, license

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www.wikipython.com *in this document the symbol ↳ means yields, results in, or produces

PYTHON ❹ TOOLBOX For 3.5

f-string Formatting : [new 3.6]

conversion types

'd'	Signed integer decimal.
'i'	Signed integer decimal.
'o'	Signed octal value.
'u'	Obsolete type – it is identical to 'd'.
'x'	Signed hexadecimal (lowercase).
'X'	Signed hexadecimal (uppercase),
'e'	Floating point exponential format (lowercase).
'E'	Floating point exponential format (uppercase).
'f'	Floating point decimal format.
'F'	Floating point decimal format.
'g'	Floating point format. Uses lowercase exponential format if exponent is less than -4 or not less than precision, decimal otherwise
'G'	Floating point format. Uses uppercase exponential format if exponent is less than -4 or not less than precision, decimal format otherwise.
'c'	Single character - accepts integer or single character str
'r'	String - uses repr() to convert object
's'	String - uses str() to convert object
'a'	String - uses ascii() to convert object
'%'	Puts '%' character before result

conversion flags

'#'	conversion will use "alternate form"
'0'	conversion zero padded for numerics
'-'	value is left adjusted (overrides '0')
' '	(space) Leave a space before a + or #
'+'	A sign character ('+' or '-') will precede conversion (overrides "space" flag).

Boolean Operations

Operation / Result (ascending priority)	
x or y	if *x* is false, then *y*, else *x*
x and y	if *x* is false, then *x*, else *y*
not x	if *x* is false, True, else False

Integer Bitwise Operations

Operation /	**Result**
x | y	bitwise *or* of *x* and *y*
x ^ y	bitwise *exclusive or x* and *y*
x & y	bitwise *and* of *x* and *y*
x << n	*x* shifted left by *n* bits
x >> n	*x* shifted right by *n* bits
~x	the bits of *x* inverted

Bytes and Bytearray Operations

x. = means this method can be used with "bytes." or "bytearray." i.e.,
x.count(*sub*[, *start*[, *end*]]) is same as *bytes.count(sub[, start[, end]])* or *bytearray.count(sub[, start[, end]])*
x.decode(encoding="utf-8", errors="strict")
x.endswith(suffix[, start[, end]])
x.find(sub[, start[, end]])
x.index(sub[, start[, end]])
x.join(iterable)
static bytes.maketrans(from, to)
static bytearray.maketrans(from, to)
x.partition(sep)
x.replace(old, new[, count])
x.rfind(sub[, start[, end]])
x.rindex(sub[, start[, end]])
x.rpartition(sep)
x.startswith(prefix[, start[, end]])
x.translate(table, /, delete=b'')
x.center(width[, fillbyte])
x.ljust(width[, fillbyte])
x.lstrip([chars])
x.rjust(width[, fillbyte])
x.rsplit(sep=None, maxsplit=-1)
x.rstrip([chars])
x.split(sep=None, maxsplit=-1)
x.strip([chars]) ⇒

x.capitalize()
x.expandtabs (tabsize=8)
x.isalnum()
x.isascii()
x.isalpha()

x.isdigit()
x.islower()
x.isspace()
x.istitle()
x.isupper()
x.lower()

x.splitlines (keepends=False)
x.swapcase()
x.title()
x.upper()
x.zfill(width)

Errors

ArithmeticError
AssertionError
AttributeError
BaseException
BlockingIOError
BrokenPipeError
BufferError
BytesWarning
ChildProcessError
ConnectionAbortedError
ConnectionError
ConnectionRefusedError
ConnectionResetError
DeprecationWarning
EOFError
EnvironmentError
FileExistsError
FileNotFoundError
FloatingPointError
IOError
ImportError
IndentationError
IndexError
InterruptedError
IsADirectoryError
KeyError
KeyboardInterrupt
LookupError
MemoryError
ModuleNotFoundError
NameError
NotADirectoryError
NotImplementedError
OSError
OverflowError
PermissionError
ProcessLookupError
RecursionError
ReferenceError
RuntimeError
SyntaxError
SystemError
TabError
TimeoutError
TypeError
UnboundLocalError
UnicodeDecodeError
UnicodeEncodeError
UnicodeError
UnicodeTranslateError
ValueError
WindowsError
ZeroDivisionError

The Python Standard Library

Content: docs.python.org/3/py-modindex.html
Text Processing Services - 7 modules including:
string — Common string operations
re — Regular expression operations
textwrap — Text wrapping and filling
Binary Data Services - 2 modules
Data Types – 13 modules including:
datetime — Basic date and time types
calendar — Calendar-related functions
copy — Shallow and deep copies
enum — Support for enumerations
pprint — Data pretty printer
Numeric and Mathematical Modules – 7 modules including:
numbers — Abstract base classes
math — Mathematical functions
cmath - complex #; decimal - accurate
random — Generate pseudo-random #s
statistics — Statistical functions
fractions — Rational numbers
Functional Programming – 3 modules
File and Directory Access – 11 modules including:
pathlib — Object-oriented file paths
os.path — Common path functions
fileinput — iterate lines—multiple inputs
filecmp — File and directory compare
shutil — High-level file operations
Data Persistence – 6 modules including:
pickle — Python object serialization
marshal — Internal Python object serialization
sqlite3 — DB-API 2.0 interface for SQLite databases
Data Compression and Archiving – 6 modules including:
zipfile — Work with ZIP archives
tarfile — Read and write tar archive files
File Formats – 5 modules including:
csv — CSV File Reading and Writing
Cryptographic Services – 3 modules:
Generic Operating System Services – 16 modules inc:
os — Miscellaneous operating system interfaces
time — Time access and conversions
io — Core tools working with streams
platform — Accesss to platform identifying data
Concurrent Execution – 10 modules including:
threading — Thread-based parallelism
multiprocessing — Process-based parallelism
Interprocess Communication and Networking - 9 mods **Internet Data Handling –** 10 modules:
Structured Markup Processing Tools – 13 modules:
Internet Protocols and Support - 21 modules
Multimedia Services – 9 modules including:
wave — Read and write WAV files
Internationalization – 2 modules:
Program Frameworks – 3 modules including:
turtle — Turtle graphics
Graphical User Interfaces with Tk – 6 modules including:
tkinter — Python interface to Tcl/Tk
IDLE
Development Tools – 9 modules:
Debugging and Profiling – 7 modules:
Software Packaging and Distribution – 4 modules including: distutils — Building and installing modules
ensurepip — bootstrapping pip installer
Python Runtime Services – 14 modules including:
sys — System-specific parameters and functions
sysconfig — Access to Python's config information
__main__Top-level script environ.
inspect — Inspect live objects
Custom Python Interpreters – 2 mods
Importing Modules – 5 modules including
zipimport — Import modules from Zip archives
runpy — Locating and executing Python modules
Python Language Services – 13 mods :
keyword — Testing for Py keywords
py_compile — Compile Python source files
Miscellaneous Services – 1 module:
MS Windows Specific Services – 4 modules
Unix Specific Services - 13 modules:
Superseded Modules – 2;
Undocumented Modules – 1
pypi.org another 257M+ modules including: RPI.GPIO, Pillow, pandas, fuzzywuzzy, Anaconda, miniconda, conda, playsound, Poetry, Numpy, etc.
To find installed modules from Python: **>>> help('modules')**

Selected Standard Library Module Constants and Methods for New Users

calendar import calendar
a couple of fun examples:
c=calendar.**TextCalendar**(calendar.SUNDAY)
c.pryear(2021,w=2,l=1,c=6,m=3) **or try**
c=calendar.**TextCalendar**(calendar.MONDAY)
c.setfirstweekday(calendar.SUNDAY)
print(c.formatmonth(2021,1,w=0,l=0))
many functions - **see: www.wikipython.com** -> OTHER MODULES -> calendar

cmath **-** A suite of functions for complex #

copy - import copy relevant for compound objects, (objects containing other objects)
.**copy**(x) <-relies on references to objects
.**deepcopy**(x[, memo]) <-copies objects (so you can change the copy and not the original)

csv import csv comma separated values
.reader(csvfile, dialect='excel',**fmtparams) file and list objects ; file obj opens with newline=""
.reader objects: **csv.reader(file path). +** __next__() , dialect , line_num , or fieldnames
.writer(csvfile, dialect='excel',**fmtparams)
writer objects: csv.writer(file path). + writerow(row) , writerows(rows) , dialect , or writeheader()
.**list_dialects**() - *return registered dialect names*
includes classes to read/write dictionary objects
Constants: .QUOTE_ALL, .QUOTE_MINIMAL, .QUOTE_NONNUMERIC, .QUOTE_NONE

datetime import datetime
Constants: MINYEAR, MAXYEAR
From datetime import timedelta: tools for duration and difference between dates and times.
Supports functions for the following **types: .date, .time, .datetime, .timedelta., .tzinfo, .timezone**
Minimum constructor:datetime.datetime(year,month,day);
To create today's date object: datetime.date.**today**();

Contd Nexte Page

Escapes

\ newline
\\ backslash
\' \"quote sgl/db
\a ascii bell
\000 octal val 000
\xhh hex value hh

Module Management

import get module, ex: import math
from get a single module function: from math import cos; print (cos(9))
as creates an alias for a function

object attributes: .year, .month, .day (iyr=idte.year)

Get a time tuple: datetime.datetime.timetuple(arg)

ex: ↳ time.struct_time(tm_year=2020, tm_mon=7, tm_mday=26, tm_hour=11, tm_min=10, tm_sec=0, tm_wday=6, tm_yday=208, tm_isdst=-1)

ex: Using timedelta to find a future date:

*start = **datetime.date(2019, 1, 1)***

*duration = **datetime.timedelta**(days=180)*

enddate = start + duration

print(enddate) ↳ ***2019-06-30***

***with** idte=datetime.datetime.**today**(), instance attributes are: .year, .month, .day, .hour, .minute, .second, .microsecond, .tzinfo, .fold ex: idte.minute*

*much more - *also in **PyPi** see new **python-dateutil** module*

decimal fast, correctly rounded fp math with a gazillion functions and pages of instruction

ensurepip - boostrap pip into an existing Python environment - pip is the installer for modules **not in the Standard Library**

Windows **command line invocation**:

python –m ensurepip -- upgrade

enum - from enum import enum

mimicks enum in C, fast integer access and iter.

filecmp import filecmp

.cmp(f1, f2, shallow=True) Compare f1 and f2, returning True if they seem equal

fileinput import fileinput

```
 for line in fileinput.input():
    process(line)
```

.**input** (files=None, inplace= False, backup="", *, mode='r', openhook=None)

.filename() ↳ file being read

.fileno() ↳ file descriptor (-1 is none open)

.**lineno**() ↳ cumlatiave # of last line read

.**filelineno**() ↳ line # in current

.**isfirstline**() ↳ True if first line of its file

.**isstdin**() ↳ True if last line was read from sys.stdin

.**nextfile**() close file, read next line from next file

.**close**() close

fractions.py import fractions

.Fraction (numerator=0, denominator=1)

.Fraction(other_fraction)

.Fraction(float)

.Fraction(decimal)

.Fraction(string)

a= '22' ; print(fractions.Fraction(a)) ↳ 11/50

print(fractions.Fraction(math.pi))

↳ 884279719003555/281474976710656

idlelib IDLE is Python's native IDE see:

https://docs.python.org/3.6/library/idle.html

io import io *three types: text, binary, raw*

for example:

continued next page

f = open("myfile.txt", "r", encoding="utf-8")

f = open("myfile.jpg", "rb")

f = open("myfile.jpg", "rb", buffering=0)

json - import json **methods include:**

.loads(str,...) - json str to Python dict and objects

.dumps(obj,…) - Py dictionary and nested objects converted to json string for storage

.load(fp,...) - json obj from file converted to Python dict and other obj(s)

.dump(obj, fp,...) - encode Py obj(s), save to file

keyword import keyword

.**iskeyword**(str) .**kwlist** *(note no prens)*

math - import math functions include:

.**ceil(x)** *smallest int >= x*

.comb(n,k) *ways to choose k items from n*

.copysign(x,y) *absolute value of x, sign of y*

.fabs(x) ↳ *absolute value of x*

.factorial(x) ↳ *x factorial as integer*

.floor(x) ↳ *largest int <= x*

.fmod(x,y) *mathematically precise ver of x%y*

.frexp(x) ↳ *mantissa and exponent of x (m,e)*

.fsum(iterable) *returns fp sum of values*

.gcd(a,b) ↳ *greatest common divisor of a & b*

.isclose(a, b, *, rel_tol=1e-09, abs_tol=0.0) *True if a & b are close, otherwise False, relative or abs tolerance*

.**isfinite**(x) ↳*True if x not infinity or a NaN*

.isinf(x) *True if x is a positive or negative infinity*

math.isnan(x) ↳ True if x is a NaN (not a number), False otherwise.

[new 3.8] .**isqrt**(n) ↳*the integer square root of the nonnegative integer n. This is the floor of the exact square root of n, or equivalently the greatest integer such that a² ≤ n. To compute the ceiling of the exact square root of n, a positive number, use a = 1+ isqrt(n - 1).*

.ldexp(x, i) ↳ *x * (2**i); inverse of **frexp**()*

.modf(x) ↳ fractional and integer parts of x

.trunc(x) ↳Real value of x truncated to integral

.exp(x) ↳ e**x.

.expm1(x) ↳ e**x - 1

.log(x[, base]) 1 argument, ↳ natural logarithm of x (to base e). 2 arguments, ↳ the logarithm of x to the given base, calculated as log(x)/log(base).

.log1p(x) ↳ the natural logarithm of 1+x (base e). *accurate for x near zero*

.log2(x) ↳ the base-2 logarithm of x

.log10(x) ↳ base 10 log of x

.pow(x,y) ↳ x raised to y

.**sqrt**(x) ↳ square root of x

Trigonometric Functions: ↳**radians** **.atan2**(y,x)

.hypot(x,y) ↳ sqrt(x*x + y*y) **.acos**(x) **.asin**(x)

.atan(x) **.cos**(x) **.sin**(x) **.tan**(x)

.degrees(x) anglex from radians to degrees

.radians(x) anglex from degrees to radians

Hyperbolic Functions: ↳**radians**

.acosh(x) ↳ the inverse hyperbolic cosine of x

.asinh(x) ↳ the inverse hyperbolic sine of x

.atanh(x) ↳ the inverse hyperbolic tangent of x

.cosh(x) ↳ the hyperbolic cosine of x

.sinh(x) ↳ the hyperbolic sine of x

.tanh(x) ↳ the hyperbolic tangent of x

Constants:

math.pi π = 3.141592… **math.e** e = 2.718281…

math.nan A floating-point “not a number” (NaN)

[New 3.6] math.tau τ = 6.283185…

[New 3.5]math.inf A floating-point positive infinity. (For negative infinity, use -math.inf.)

numbers - operations from abstract base classes - four classes defined: Complex(components: real, imaginary), Real, Rational (adds numerator and denominator properties), Integral

os import os ****hundreds of functions, many os specific; a few universal**

.**environ**['HOME'] *home directory*,

.**chdir**(path) change working dir

.**getcwd**() current working dir

.**listdir**(path) .**mkdir**(path) .**mkdirs**(path) *make all intermediate directories* .**remove**(path)

.**strerror**() translate error code to message

.**curdir**() .**rename**(src, dst) .**rmdir**(path)

.**walk**(start directory, topdown=True) produces a generator of filenames in a directory tree

.**system**(command) Unix and Windows, execute the command in a subshell

os.path ***Lib/posisxpath** or **Lib/ntpath** (windows)*

import os.path [as osp]

.**abspath**(*path*) normalized absolutized version of the pathname *path*.

.**basename**(*path*) base name of pathname *path*.

.**commonpath**(*paths*) longest common sub-path.**commonprefix**(*list*) ↳ the longest prefix

.**dirname**(*path*) ↳ directory name of *path*

.expandvars*(path)* ↳ *environment variables expanded*

.**exists**(*path*) ↳ True if *path* exists

.**getsize**(*path*) ↳ n the size, in bytes, of *path*.

.**isabs**(*path*) ↳True if *path* is absolute pathname

.**isfile**(*path*) ↳ True if *path* is existing file

.**isdir**(*path*) ↳ True if *path* is existing directory

.**islink**(*path*) ↳True if ref is an existing directory

.**join**(*path*, **paths*) Join one or more path components intelligently.

.**normcase**(*path*) Normalize case of a pathname

.**normpath**(*path*) On Windows, converts forward slashes / to backward slashes \.

.**relpath**(*path*, *start=os.curdir*) ↳ relative filepath from the current directory or an optional start

.**samefile**(*path1*, *path2*) ↳ True if both pathname arguments refer to the same file or directory.

.**sameopenfile**(*fp1\fp2)* ↳ True if the same

.**samestat**(*stat1*, *stat2*) Return True if the stat tuples *stat1* and *stat2* refer to the same file.

.**split**(*path*) Split *path* into a pair, (head, tail)

pathlib (3.5) from pathlib import Path [as pt]

(For PurePath objects see online documentation.)

For MOST of the following concrete **methods** use:

.cwd() ex: my_current_dir = pt.cwd(); **.home**()

For a user defined file the following functions require that the file variable first be instantiated with the Path class; i.e., for "myfile" holding "C:\temp.txt": test_file = **pt**(myfile), then, **pt.exists** (test_file) is noted just as: **.exists (test_file)**

is_dir(test_dir) **.is_file**(test_file)

*** ***.glob**—in our testing .glob does NOT work outside the **sorted()** wrapper:*

```
      print(sorted(p.glob(test_file, "*.py")))
```

.iterdir() - creates an iterator; for directory x: for dir in x.iterdir(): print(dir)

.mkdir (mode=0o777, parents=False, exist_ok=False) create new directory F

.open(mode='r', buffering=-1, encoding= None, errors=None, newline=None)

.read_text(); **.rename(target)**; **.rmdir()** - remove empty directory **(file_path).resolve (strict=False)** - make absolute path

.write_text(data, encoding=None, errors=None) - *open, write, close - all in one fell swoop*

pickle import pickle - non-human-readable object serialization (**json** is text strings only)

.**dump**(obj.file, protocol=None, *,fix_imports=True, buffer_callback=None)

.**dumps**(obj, protocol=None, *, fix_imports=True, buffer_callback=None)

.**load**(file, *, fix_imports=True, encoding="ASCII", errors="strict", buffers=None)

.**loads**(data, *, fix_imports=True, encoding="ASCII", errors="strict", buffers=None)

platform import platform

.**machine**() ↳ *machine type*

.**node**() ↳ *network name*

.**processor**() ↳ *real processor name*

.**python**_version ↳ *version as string*

.**system**() ↳ *'Linux', 'Darwin', 'Java', 'Windows'*

pprint import pprint

allows output of objects, including objects holding other objects in a reasonably readable format. Begin by creating an instance: (assume "mylist")

pp = **pprint.PrettyPrinter**(indent=3) *set indent*

then use your instance ("pp" above) to output:

pp.**pprint**(mylist)

some PrettyPrinter objects new/changed in **[3.8]** .pformat(obj), .pprint(obj), pp.isreadable(obj), more

ex: print(pp.**isreadable**(mylist))

py_compile.py import py_compile

.**compile**(file) - the compiled file is placed on file path in added directory "/__pycache__/ "

random import random

only for non-cryptographic applications

.seed initialize the random number generator

.getstate() ret object with internal generator state

.setstate() restores internal state to getstate value

.getrandbits(k) ret integer with k random bits

For integers:

.randrange(stop) **.randrange**(start, stop[, step])

.randint(a, b) fileinput.filename() a random integer N such that a <= N <= b. Alias

for randrange(a, b+1).
For sequences:
.choice(sequence) ↳ random element
.shuffle(x [,random]) shuffle sequence in place
.random() ↳ the next random floating point number in the range (0.0, 1.0).
.uniform(a, b) ↳ fp between a and b

re   import re   complex search and match

re.**search**(pattern, string, flags=0)
re.**match**(pattern, string, flags=0)
re.**ignorecase**

shutil   import shutil

.copyfileobj(fsrc, fdst[, length])
.copyfile(src, dst, *, follow_symlinks=True)
.copymode(src, dst, *, follow_symlinks=True)
Copy the permission bits from src to dst.
.copystat(src, dst, *, follow_symlinks=True)
Copy the permission bits, last access time, last modification time, and flags from src to dst
.copy(src, dst, *, follow_symlinks=True)
Copies the file src to the file or directory dst. src and dst should be strings.
.copy2(src, dst, *, follow_symlinks=True)
copy2() also attempts to preserve file metadata
.copytree(src, dst, symlinks=False, ignore=None, copy_function=copy2, ignore_dangling_symlinks=False, dirs_exist_ok=False)
.disk_usage(path) ↳ disk usage stats as tuple (total, used and free) in bytes—a file or a directory

Sound

if your objective is to play a sound using a Python Standard Library module save your time - **none** of the modules listed under Multimedia Services do that. SEE: PyPi — playsound

sqlite3   import sqlite3

initialize using the Connection cursor() object:
conn = sqlite3**.connect**("'database_name'.db")
use special name **:memory** *to create in RAM*
cur = **conn.cursor**   *#create cursor object,*
connection objects: **cursor**(), **commit**()., **rollback**(), **close**(), **execute**(), **executemany**(), **backup**()**executescript**(), **create_function**(), **iterdump**(), **create_aggregate**()
cursor objects: execute(), executemany(), executescript(), fetchone(), fetchmany(), fetchall() or close()
row objects: keys()

statistics   import statistics

.mean(data) average
.harmonic_mean(data) harmonic mean
.median(data) middle value
.median_low(data) low middle value
.median_high(data) high middle value
.median_grouped(data) 50th percentile
.mode(data) most common
.pstdev(data,mu=None) population std dev
.pvariance(data,mu=None) pop variance
.stdev(data, xbar=None) sample std dev
.variance(data, xbar=None) sample variance
more...extensive normal distribution functions

string

Constants		
	string.ascii_letters,	
	string.ascii_lowercase	string.ascii_uppercase
	string. digits	string.hexdigits
	string.octdigits	string.punctuation
	string.printable	string.whitespace

string.**capwords**(str, sep=None)

sys   import sys   mostly advanced functions

.exit([arg]) - exit python
.getwindowsversion()
.path - search paths list
.version - Python version #

tarfile   import tarfile extensive archive

including gzip, bz2 and lzma compression
ex: (assumes import tarfile – to extract to cwd)
tar = tarfile.**open**("sample.tar.gz")
tar.**extractall**()
tar.**close**()

textwrap   import textwrap

textwrap.**wrap**(text,width=x,**kwargs)**Lib/Lib/**

time   import time or from time import

a new user must understand terminology found at: https://docs.python.org/3.8/library/time.html

```
print(time.time())    #seconds since the epoch
   ↳ 1596486146.111275
mytime = time.time()   #capture it
print(time.localtime(mytime))   #demo the tuple
   ↳   time.struct_time(tm_year=2020,
tm_mon=8, tm_mday=3, tm_hour=16, tm_min=22,
tm_sec=26, tm_wday=0, tm_yday=216,
tm_isdst=1)
time_tuple=time.localtime(mytime)  #capture it
print("The hour is: " + str(time_tuple[3]))  #demo
    ↳The hour is: 16
print(time.strftime("%a, %d %b %Y %H:%M:%S
+0000", time.gmtime()))
    ↳Mon, 03 Aug 2020 20:22:26 +0000
seconds=5 ; print("Wait 5 seconds!")
time.sleep(seconds)  # delay of five seconds
print(time.asctime(time.localtime()))
    ↳   Mon Aug  3 16:22:31 2020
print(time.ctime(mytime))
    ↳   Mon Aug  3 16:22:26 2020
```

tkinter   from tkinter import *

****there is a 10 page tkinter toolbox available to review at www.wikipython.com with a link to a free download on GitHub**

wave   import wave

.open(file, mode=None) If file is a string, open the file by that name, otherwise treat it as a file-like object. mode can be: 'rb' (read), 'wb' (write) ex:

```
with wave.open("D:\\aloop.wav", "rb") as tstfile:
   print(tstfile.getnframes())  # length in frames
```

once an object is returned by open(),
wave_read objects have these methods:
.close() i.e., object.close **.getnchannels**()
.getsampwidth() **.getframerate**() **.getnframes**(n)
.readframes(n) **.rewind**()
wave_write objects have these methods:
.close() Make sure nframes is correct
.setnchannels(n) **.setsampwidth**(n) -
.setframerate(n) **.setnframes**(n) Set frames to n.
.setparams(tuple) tuple should be (nchannels, sampwidth, framerate, nframes, comptype, compname), with values valid for the set*() methods. Sets all parameters.
.tell() Return current position in the file
.writeframesraw(data) Write audio frames, without correcting nframes.¶

A Few PyPi Modules https://pypi.org

Anaconda, Conda, MiniConda

- 3 related programs offering environment management at different levels. **Anaconda** manages all variations and compatibility issues unavoidable with many modules. Over 300 applications come "installed" in the base (root) environment, with thousands available. **Installation(s) can be huge.** It qualifies as a language within itself. Numerous IDEs are available in any Anaconda environment including Spyder, Visual Studio Code, IDLE, Jupyter Notebooks ... more. **Miniconda** is a lightweight version. **Conda** is similar to pip but is also an environment manager.

NumPy

- powerful **N-dimension array** objects
NumPy says installation works best with a prebuilt package, see: https://scipy.org/install.html where they suggest a "scientific distribution" but do give **pip** directions: python -m pip install --user numpy scipy matplotlib ipython jupyter pandas sympy nose obviously adding a whole bunch of other modules but violating the best advice of Jonathan Helmus at Anaconda: *"avoid all 'users' installs." so…* with conda: *from the Anaconda prompt type: conda install numpy* (did not test this)
with pip: *python –m pip install numpy* (worked ok)
import numpy as np
.array([elements list][element list][...])
.zeros(# of 0 elements)
.ones(# of 1 elements)
.empty(# of elements, values are random)
.arange(# of elements) np.arrange(5)↳([0,1,2,3,4])
.linspace(start, stop, # of elements) <-linearly spaced: .linspace(2,10,5) ↳([2,4,6,8,10])
dtype - default datatype is fp, but can specify with dtype: xarray = np.ones(3, **dtype**=np.int)
np.**sort**(array variable)
.ndim the # of axes/dimensions, of the array
.size the total number of elements of the array
.shape a tuple of integers indicating # of elements in each dimension
one zillion more functions

*For Raspberry Pi Aficionados

Rpi.GPIO

– module to control Raspberry Pi GPIO channels; see GPIO toolbox and download link at: **www.wikipython.com**

Pillow

- by Alex Clark, updated Aug 2020, a friendly version of Fredrik Lundh's **Python Imaging Library**
Pillow version 7.2 works in Python 3.5 to 3.8
install: **python3 -m pip install --upgrade Pillow**

```
from PIL import Image
im = Image.open(testfilepath)
print(im.format, im.size, im.mode)
im.show()
```

playsound

is a cross platform program pulled from **Pypi** that is very easy to use. From windows: python -m pip install playsound for example:

```
from playsound import playsound
testwave = "C:\\Windows\\Media\\Alarm09.wav"
playsound(testwave)
```

Poetry

is a smaller more efficient way to manage dependencies for 3.4+ but it's a little complicated. Start with: https://pypi.org/project/poetry/

pandas

for tabular data — "aims to be the fundamental" module for "real world data analysis" - it is part of the Anaconda distribution (also installs with Miniconda) but can be installed with pip:
pip install pandas then **import pandas as pd**
tables are **DataFrame**(s) and columns are **Series**
see the docs @: https://pandas.pydata.org/

finance)   import yfinance as yf

*NOTE—a few functions no longer work
create stock instance with **.Ticker**(stock symbol)
ex: jnj = yf.Ticker("JNJ") *i.e.[Johnson & Johnson]*
.history(period ="short cut symbol") valid periods 1d,5d,1mo,3mo,6mo,1y,2y,5y,10y,ytd,max **or**
.history(start="yyyy-mm-dd", end="yyyy-mm-dd")
.actions - dividends, splits
.dividends or **.splits** - show dividends or splits
.financials or **.quarterly_financials**
.major_holders **.institutional_holders**
.calendar **.recommendations**

plotly.express and Kaleido

- **plotly.express** is built-in to the **plotly** library and is considered a "starting point" but may be all you ever need. *Plotly is an MIT Licensed module.* plotly.express requires a determined effort to learn because it creates more than 35 types of graph images. It does **not** export your graph as a static image—which is why you need **Kaleido**. plotly has many dependencies, kaleido has none. pip install kaleido.

What is not mentioned in this General Toolbox?

About 99.83% of Python capability now available has no mention in this toolbox. Happy Coding!

Can methods of your favorite module be briefly summarized?
Please send your suggestion(s)!
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