Python For Data Science *Cheat Sheet*

Python Basics

Learn More Python for Data Science Interactively at www.datacamp.com

Variables and Data Types

Variable Assignment

```
>>> x=5
>>> x
 5
```

Calculations With Variables

`>>> x+2`
`7`
	Sum of two variables

`>>> x-2`
`3`
	Subtraction of two variables

`>>> x*2`
`10`
	Multiplication of two variables

`>>> x**2`
`25`
	Exponentiation of a variable

`>>> x%2`
`1`
	Remainder of a variable

`>>> x/float(2)`
`2.5`
	Division of a variable

Types and Type Conversion

`str()`	`'5', '3.45', 'True'`	Variables to strings
`int()`	`5, 3, 1`	Variables to integers
`float()`	`5.0, 1.0`	Variables to floats
`bool()`	`True, True, True`	Variables to booleans

Asking For Help

```
>>> help(str)
```

Lists

Also see NumPy Arrays

```
>>> a = 'is'
>>> b = 'nice'
>>> my_list = ['my', 'list', a, b]
>>> my_list2 = [[4,5,6,7], [3,4,5,6]]
```

Selecting List Elements

Index starts at 0

Subset	
`>>> my_list[1]`	Select item at index 1
`>>> my_list[-3]`	Select 3rd last item
Slice	
`>>> my_list[1:3]`	Select items at index 1 and 2
`>>> my_list[1:]`	Select items after index 0
`>>> my_list[:3]`	Select items before index 3
`>>> my_list[:]`	Copy my_list
Subset Lists of Lists	
`>>> my_list2[1][0]`	my_list[list][itemOfList]
`>>> my_list2[1][:2]`	

List Operations

```
>>> my_list + my_list
['my', 'list', 'is', 'nice', 'my', 'list', 'is', 'nice']
>>> my_list * 2
['my', 'list', 'is', 'nice', 'my', 'list', 'is', 'nice']
>>> my_list2 > 4
True
```

List Methods

`>>> my_list.index(a)`	Get the index of an item
`>>> my_list.count(a)`	Count an item
`>>> my_list.append('!')`	Append an item at a time
`>>> my_list.remove('!')`	Remove an item
`>>> del(my_list[0:1])`	Remove an item
`>>> my_list.reverse()`	Reverse the list
`>>> my_list.extend('!')`	Append an item
`>>> my_list.pop(-1)`	Remove an item
`>>> my_list.insert(0,'!')`	Insert an item
`>>> my_list.sort()`	Sort the list

Strings

```
>>> my_string = 'thisStringIsAwesome'
>>> my_string
'thisStringIsAwesome'
```

String Operations

```
>>> my_string * 2
 'thisStringIsAwesomethisStringIsAwesome'
>>> my_string + 'Innit'
 'thisStringIsAwesomeInnit'
>>> 'm' in my_string
 True
```

String Operations

Index starts at 0

```
>>> my_string[3]
>>> my_string[4:9]
```

String Methods

`>>> my_string.upper()`	String to uppercase
`>>> my_string.lower()`	String to lowercase
`>>> my_string.count('w')`	Count String elements
`>>> my_string.replace('e', 'i')`	Replace String elements
`>>> my_string.strip()`	Strip whitespaces

Libraries

Import libraries

```
>>> import numpy
>>> import numpy as np
```

Selective import

```
>>> from math import pi
```

pandas Data analysis	learn Machine learning
NumPy Scientific computing	matplotlib 2D plotting

Install Python

ANACONDA	spyder	jupyter
Leading open data science platform powered by Python	Free IDE that is included with Anaconda	Create and share documents with live code, visualizations, text, ...

Numpy Arrays

Also see Lists

```
>>> my_list = [1, 2, 3, 4]
>>> my_array = np.array(my_list)
>>> my_2darray = np.array([[1,2,3],[4,5,6]])
```

Selecting Numpy Array Elements

Index starts at 0

Subset	

`>>> my_array[1]`
`2`
	Select item at index 1

Slice	

`>>> my_array[0:2]`
`array([1, 2])`
	Select items at index 0 and 1

Subset 2D Numpy arrays	

`>>> my_2darray[:,0]`
`array([1, 4])`
	my_2darray[rows, columns]

Numpy Array Operations

```
>>> my_array > 3
  array([False, False, False,  True], dtype=bool)
>>> my_array * 2
  array([2, 4, 6, 8])
>>> my_array + np.array([5, 6, 7, 8])
  array([6, 8, 10, 12])
```

Numpy Array Functions

`>>> my_array.shape`	Get the dimensions of the array
`>>> np.append(other_array)`	Append items to an array
`>>> np.insert(my_array, 1, 5)`	Insert items in an array
`>>> np.delete(my_array,[1])`	Delete items in an array
`>>> np.mean(my_array)`	Mean of the array
`>>> np.median(my_array)`	Median of the array
`>>> my_array.corrcoef()`	Correlation coefficient
`>>> np.std(my_array)`	Standard deviation

DataCamp

Learn Python for Data Science Interactively

Python 3 Cheat Sheet

Latest version on :
https://perso.limsi.fr/pointal/python:memento

Base Types

integer, float, boolean, string, bytes

```
  int 783  0 -192  0b010  0o642  0xF3
          zero      binary  octal  hexa
float 9.23 0.0  -1.7e-6
                     ×10⁻⁶
 bool True  False
  str "One\nTwo"        Multiline string:
      escaped new line   """X\tY\tZ
     'I\'m'              1\t2\t3"""
      escaped '           escaped tab
bytes b"toto\xfe\775"
        hexadecimal octal           ☝ immutables
```

Container Types

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

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

Non modifiable values (immutables) ☝ *expression with only comas →* `tuple`

`str bytes` *(ordered sequences of chars / bytes)* `""` `b""`

■ **key containers**, no *a priori* order, fast key access, each key is unique

```
dictionary      dict {"key":"value"}    dict(a=3,b=4,k="v")   {}
(key/value associations) {1:"one",3:"three",2:"two",3.14:"π"}
collection      set {"key1","key2"}     {1,9,3,0}          set()
```

☝ *keys=hashable values (base types, immutables…)* `frozenset` *immutable set* *empty*

Identifiers

for variables, functions, modules, classes… names

`a…zA…Z_` followed by `a…zA…Z_0…9`

□ diacritics allowed but should be avoided
□ language keywords forbidden
□ lower/UPPER case discrimination

☺ `a toto x7 y_max BigOne`
☹ ~~`8y and for`~~

Variables assignment

=

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

```
x=1.2+8+sin(y)
a=b=c=0       assignment to same value
y,z,r=9.2,-7.6,0   multiple assignments
a,b=b,a       values swap
a,*b=seq   } unpacking of sequence in
*a,b=seq   } item and list
                                   and
x+=3     increment ⇔ x=x+3          *=
x-=2     decrement ⇔ x=x-2          /=
x=None   « undefined » constant value %=
del x    remove name x               …
```

Conversions

`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 simultaneously*

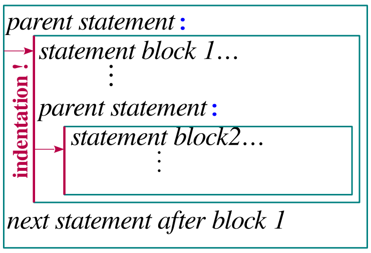
`a or b` logical or *one or other or both*

☝ 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

☝ *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`

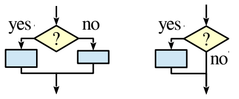
`import monmod` *→access via* `monmod.nom1` *…*

☝ 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*

Operators: `+ - * / // % **`
Priority `(…)` × ÷ ↑ ↑ a^b
integer ÷ ÷ remainder

`@` → 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*

angles in radians

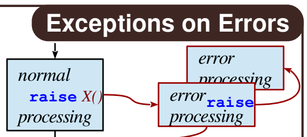
```
from math import sin,pi…
sin(pi/4)→0.707…
cos(2*pi/3)→-0.4999…
sqrt(81)→9.0     √
log(e**2)→2.0
ceil(12.5)→13
floor(12.5)→12
```

modules `math`, `statistics`, `random`, `decimal`, `fractions`, `numpy`, *etc. (cf. doc)*

Exceptions on Errors

Signaling an error:
`raise` *ExcClass(…)*

Errors processing:
`try:`
→ *normal processing block*
`except` *Exception* `as e:`
→ *error processing block*



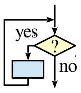
☝ `finally` *block for final processing in all cases.*

Conditional Loop Statement

☝ beware of infinite loops!

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

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*)

☝ *read empty string if end of file* **reading**

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*])**

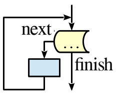
Very common: opening with a guarded block (automatic closing) and reading loop on lines of a text file:

```
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*

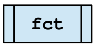
☝ *range provides an immutable sequence of int constructed as needed*

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

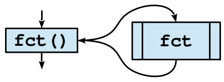
```
r = fct(3,i+2,2*i)
```

storage/use of returned value

one argument per parameter

☝ this is the use of function name *with parenthesis* 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)

Data Science Cheat Sheet

Python - Intermediate

KEY BASICS, PRINTING AND GETTING HELP

This cheat sheet assumes you are familiar with the content of our Python Basics Cheat Sheet

`s` - A Python string variable
`i` - A Python integer variable
`f` - A Python float variable
`l` - A Python list variable
`d` - A Python dictionary variable

LISTS

`l.pop(3)` - Returns the fourth item from **l** and deletes it from the list

`l.remove(x)` - Removes the first item in **l** that is equal to **x**

`l.reverse()` - Reverses the order of the items in **l**

`l[1::2]` - Returns every second item from **l**, commencing from the **1**st item

`l[-5:]` - Returns the last 5 items from **l** specific axis

STRINGS

`s.lower()` - Returns a lowercase version of **s**

`s.title()` - Returns **s** with the first letter of every word capitalized

`"23".zfill(4)` - Returns **"0023"** by left-filling the string with **0**'s to make it's length **4**.

`s.splitlines()` - Returns a list by splitting the string on any newline characters.

Python strings share some common methods with lists

`s[:5]` - Returns the first **5** characters of **s**

`"fri" + "end"` - Returns **"friend"**

`"end" in s` - Returns **True** if the substring **"end"** is found in **s**

RANGE

Range objects are useful for creating sequences of integers for looping.

`range(5)` - Returns a sequence from **0** to **4**

`range(2000,2018)` - Returns a sequence from **2000** to **2017**

`range(0,11,2)` - Returns a sequence from **0** to **10**, with each item incrementing by **2**

`range(0,-10,-1)` - Returns a sequence from **0** to **-9**

`list(range(5))` - Returns a list from **0** to **4**

DICTIONARIES

`max(d, key=d.get)` - Return the key that corresponds to the largest value in **d**

`min(d, key=d.get)` - Return the key that corresponds to the smallest value in **d**

SETS

`my_set = set(l)` - Return a **set** object containing the unique values from **l**

`len(my_set)` - Returns the number of objects in **my_set** (or, the number of unique values from **l**)

`a in my_set` - Returns **True** if the value **a** exists in **my_set**

REGULAR EXPRESSIONS

`import re` - Import the Regular Expressions module

`re.search("abc",s)` - Returns a **match** object if the regex **"abc"** is found in **s**, otherwise **None**

`re.sub("abc","xyz",s)` - Returns a string where all instances matching regex **"abc"** are replaced by **"xyz"**

LIST COMPREHENSION

A one-line expression of a for loop

`[i ** 2 for i in range(10)]` - Returns a list of the squares of values from **0** to **9**

`[s.lower() for s in l_strings]` - Returns the list **l_strings**, with each item having had the **.lower()** method applied

`[i for i in l_floats if i < 0.5]` - Returns the items from **l_floats** that are less than **0.5**

FUNCTIONS FOR LOOPING

```
for i, value in enumerate(l):
    print("The value of item {} is {}".
    format(i,value))
```

- Iterate over the list **l**, printing the index location of each item and its value

```
for one, two in zip(l_one,l_two):
    print("one: {}, two: {}".format(one,two))
```

- Iterate over two lists, **l_one** and **l_two** and print each value

```
while x < 10:
    x += 1
```

- Run the code in the body of the loop until the value of **x** is no longer less than **10**

DATETIME

`import datetime as dt` - Import the **datetime** module

`now = dt.datetime.now()` - Assign **datetime** object representing the current time to **now**

`wks4 = dt.datetime.timedelta(weeks=4)` - Assign a **timedelta** object representing a timespan of 4 weeks to **wks4**

`now - wks4` - Return a **datetime** object representing the time 4 weeks prior to **now**

`newyear_2020 = dt.datetime(year=2020, month=12, day=31)` - Assign a **datetime** object representing December 25, 2020 to **newyear_2020**

`newyear_2020.strftime("%A, %b %d, %Y")` - Returns **"Thursday, Dec 31, 2020"**

`dt.datetime.strptime('Dec 31, 2020',"%b %d, %Y")` - Return a **datetime** object representing December 31, 2020

RANDOM

`import random` - Import the **random** module

`random.random()` - Returns a random float between **0.0** and **1.0**

`random.randint(0,10)` - Returns a random integer between **0** and **10**

`random.choice(l)` - Returns a random item from the list **l**

COUNTER

`from collections import Counter` - Import the **Counter** class

`c = Counter(l)` - Assign a **Counter** (dict-like) object with the counts of each unique item from **l**, to **c**

`c.most_common(3)` - Return the 3 most common items from **l**

TRY/EXCEPT

Catch and deal with Errors

`l_ints = [1, 2, 3, "", 5]` - Assign a list of integers with one missing value to **l_ints**

```
l_floats = []
for i in l_ints:
    try:
        l_floats.append(float(i))
    except:
        l_floats.append(i)
```

- Convert each value of **l_ints** to a float, catching and handling **ValueError: could not convert string to float:** where values are missing.