Python Built-in Objects

Goal: use Python built-in objects to manipulate data better than a spreadsheet and frame like a hammer.

- Why? Spreadsheets are second tier tools vs. data objects providing long-term flexibility and sustainability.
  - Object data manipulating skills makes you more agile and confident with data in any form from anywhere.
  - Data transformer skills with lists, tuple, string, etc improves agility skills to combine, sort, and do work now.
  - These concepts help perform system design and analysis, expedite project planning, data uploading, and finding missing info.

Mechanics

```
1. mylist,mytuple  = [    'a',   'b',   'c',  10,     20,    ]
a. iterator/index [i]      0     1     2     3       4
b.          len(mylist)       |->                        <-| n=5
c. print( mylist[i])    'a'        'b'    'c'    10      20
```

Description

- create the data for list, tuple, etc

1. iteration or count;
2. len() inherits total items from an object
3. iterator <for i in mylist>

Lists = []

- organize similar\dissimilar information
- mutable! (.append() ~.remove() ~.pop()
- sequential with an ID# per position
- contain string, list, dict., etc

```
mylist = ['bambam', "a+b=c", 2_0j, [1,2,3]]
for i in mylist: print(i)
bambam,  a+b=c,  20j,  [1, 2, 3]
```

comprehension places formula before iterator to generate data

```
mylist =[i*2 for i in range(0,4) ]; mylist
[0, 2, 4, 6]

mytuple = (0,1,3,4)
mylist = [i*3 for i in mytuple]; mylist
[0, 3, 9, 12]
me1 = ['adam','carly','jackson','danny']
dict(enumerate(me1,start=100))
100:'adam',101:'carly',102:'jackson',103: 'danny'}
mylist_values[0] => object slicing
mylist_values[1] => grab data position 1
data pack / unpack
for i mylist[1]: newlist.append[i]
```

Functions

```
.append()
.pop()
.remove()
```

Tuples = (a,b,)

- immutable w sequential ID[x] per position
- immutable! can't add/substract data
- practical reference table to other data
- need a trailing comma!=>(1,2,)
- use type(object) to know what it is

```
mytuple = ('snhu', 2+0j, [1,2,3],)
type(mytuple)
('snhu',(2+0j),[1,2,3])    #note diff.data types!
tuple

mytuple = (1,2,3,)
mytuple + mytuple   #note d
(1, 2, 3, 1, 2, 3)
```

Object Operations

Operation	Result
`x in s`	`True` if an item of *s* is equal to *x*, else `False`
`x not in s`	`False` if an item of *s* is equal to *x*, else `True`
`s + t`	the concatenation of *s* and *t*
`s * n` or `n * s`	equivalent to adding *s* to itself *n* times
`s[i]`	*i*th 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)`	total number of occurrences of *x* in *s*

Dictionary = { key:value }

- essential for pairing related data
- go-to-tool for real-world modeling
- keys immutable, values=mutable
- dict would reference your unique ID and an associated list would have the characteristic data in
- returns data unordered & random

```
mydict= {'key_1':['value_1'],'key1':(1,2,3,)}
{ 'key_1':['value_1'], 'key1':(1, 2, 3) }
if
mydict = dict(key_1= [1,2,'z'])
mydict
{'key_1': [1, 2, 'z']}

keytuple = ('customer_name','age')
valuelist = [['john','doe'],[35,76]]
dict(zip(keytuple,valuelist))
{'customer_name':['john','doe'],'age':[35, 76]}
```

Functions

```
.keys(), .values(), .items()=>
mydict={'key_1':['value_1'],'key2':(1,2,)}
for k,v in mydict.items():
print(mydict.keys(), mydict.values())
dict_keys(['key_1', 'key1']) dict_values([['value_1'], (1, 2)])  #top keys,bottom value
dict_keys(['key_1', 'key1']) dict_values([['value_1'], (1,
```

b.h.

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Mechanics

```
1.      mystring   = 'python training is fun '
2.    index [i]       012345.........................23
3.   len(mylist)      |->                       <-|   n=23
```

- slicing `mystring[10:] >>> 'ining is fun '`

Description

- <pending>

Strings = 'abc '

w	e	i	r	d
[0]	[1]	[2]	[3]	[4]

- text processors quotes =! python quotes
- strings factilate text and natural language processing.
- a whole book may be in a single string

```
fruit = 'apple'
i = 0
myL = []
while i < len(fruit):
    letter = fruit[i]
    myL.append(letter)
    i = i + 1
myL
['a', 'p', 'p', 'l', 'e']
```

set(), frozenset()

- A set object is an unordered collection of distinct hashable objects.
- Use removing duplicates\test if have ID
- Compute difference in 2 data sets: union intersection, difference, symmetric diff
- Hashability makes an object usable as a dictionary key and a set member/

```
mylist = ['a', 'p', 'p', 'l', 'e']
myset = set(mylist); myset
{'a', 'e', 'l', 'p'}

'a' in myset     | 'a' not in myset
True                False
{c for c in 'abracadabra' if c not in 'abc'}
{'d', 'r'}
```

pandas series and dataframe

```
import pandas as pd
import pandas as pd          #dataframe library
#df = pd.read_excel("."),
df.to_dict()
pd.DataFrame.from_dict(mydict)
import numpy as np            #num library

                              #vis library
import matplotlib.pyplot as plt
#import os                    #op system
#help(os.listdir)             #see all methods
import sys
#sys.exit()

# inform operating system directory
os.chdir('C:\\Users\\17574\\Desktop\\data\\')

# inform operation system file name
path ='C:\\Users\\17574\\Desktop\\data\\<file>'
mylist_filenames = os.listdir(path)
```

Data structure summary: <per the following table>, the ability to readily recall every object.name, character code, and constructor function will propel your ability to quickly perform data transformation.

object.name	character code	constructor function	example object.name
mytuple =	(,)	=> mytuple = tuple(myobject)	=> ('string',(2+0j),[1,2,3])
mylist =	[ ]	=> mylist = list(myobject)	=> ['bambam', "a+b=c", [1,2,3]]
mydict =	{ key:value}	=> mydict = dict(myobject)	=> {'customer':['john','doe'] }
myset =	set(myobject)	=> myset = set(myobject)	=> ['b', 'o', 'o'] => {'b', 'o',}
mydataframe=	pd.DataFrame()	=> df=pd.DataFrame(myobject)	=> df=pd.read_csv("data.csv")
mystring =	" "	=> mystring= str(myobject)	=> str(myset <or mylist, etc>)
mybool =	True or False	=> mybool = True/False	=> b1=True;b2=False; b1==b2. False
myrange =	(min,max,step)	=> myrange = range(0,4)	=> for i in myrange: print(i). 0,1,2,3
mybyte =	b'=backslash \\	=> mybyte = b'\x41'	=> print(mybyte). b'A'

Built-in Types
Conditional Statements

Built-in types are truth testing logic using boolean, comparisons, (+,-,/,//,%)
Conditionals are the testing logic to evaluate whether sometime is True or False

Boolean – and, or, not

These are the Boolean operations, ordered by ascending priority:

Operation	Result	Notes
`x or y`	if *x* is false, then *y*, else *x*	(1)
`x and y`	if *x* is false, then *x*, else *y*	(2)
`not x`	if *x* is false, then `True`, else `False`	(3)

Notes:

1. This is a short-circuit operator, so it only evaluates the second argument if the first one is false.
2. This is a short-circuit operator, so it only evaluates the second argument if the first one is true.
3. not has a lower priority than non-Boolean operators, so not a == b is interpreted as not (a == b), and a == not b is a syntax error.

Comparisons

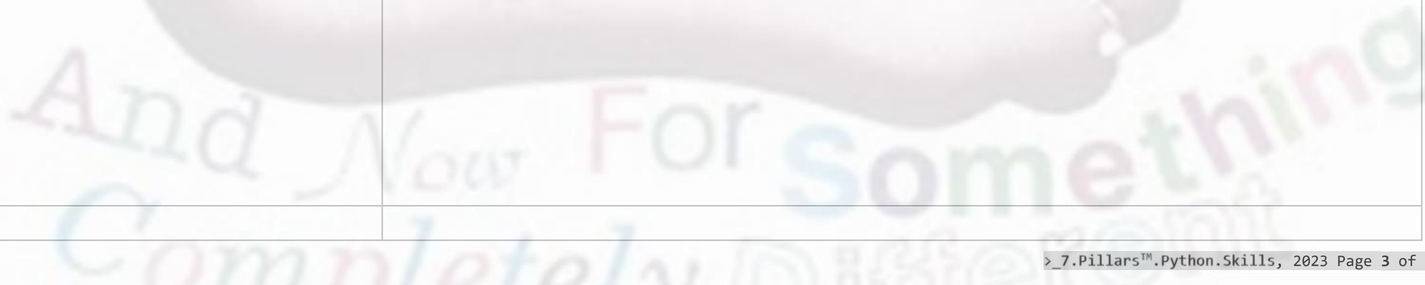
There are eight comparison operations in Python. They all have the same priority (which is higher than that of the Boolean operations). Comparisons can be chained arbitrarily; for example, x < y <= z is equivalent to x < y and y <= z, except that *y* is evaluated only once (but in both cases *z* is not evaluated at all when x < y is found to be false).

Operation	Meaning
`<`	strictly less than
`<=`	less than or equal
`>`	strictly greater than
`>=`	greater than or equal
`==`	equal
`!=`	not equal
`is`	object identity
`is not`	negated object identity

Numeric Type operations

Use constructors `int()`, `float()`, and `complex()` to product specific #s

Operation	Result	Notes
`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*	(1)
`x % y`	remainder of `x / y`	(2)
`-x`	*x* negated	
`+x`	*x* unchanged	
`abs(x)`	absolute value or magnitude of *x*	
`int(x)`	*x* converted to integer	(3)(6)
`float(x)`	*x* converted to floating point	(4)(6)
`complex(re, im)`	a complex number with real part *re*, imaginary part *im*. *im* defaults to zero.	(6)
`c.conjugate()`	conjugate of the complex number *c*	
`divmod(x, y)`	the pair `(x // y, x % y)`	(2)
`pow(x, y)`	*x* to the power *y*	(5)
`x ** y`	*x* to the power *y*	(5)



Iterators	
• for • range • while	• Iteration is the act of looping instructions repeatably • instructions continuously execute until False or termination • such as an end of range, conditional is != • most efficient means to cycle data in lists,tuples,ranges,etc • Iterators are sequential like 0->1->2->3, and may step >1

Mechanics

1. mylist	= ['a',	'b',	'c',	10,	]
1. iterator/index [i]	0	1	2	3	
2. len(mylist)	|->			<-|	n=4
3. print(mylist[i]*3)	aaa	bbb	ccc	30	
4. negative index [i]	-4	-3	-2	-1	

```
for i in mylist: print(mylist[i]*3)
```

Mechanics Description

- create the data for list, tuple, etc
  1. iteration is the count; index is the position
  2. len() inherits count of total items from mylist
  3. for i in mylist:
     print(mylist[i]*3) #multiply each list iterate *3
  4. negative index is neg. number values for an sequence position

for i in <object>:

- starts from 0 for all items in the object
- inherits length from object
- i shorthand for iterator
- regularly combined with conditional statements to make decisions if-elif-else
-

```
mylist = [1,4]
for i in mylist:
    print(i*3)
3, 12

from math import log10
def myfunction(x):
    return log10(x)
for i in range (2,4,1):
    print("loop#{a}, value={b}".
format(a=i,b=(round(myfunction(i),2))))
loop#2, value=0.3
loop#3, value=0.48

myL = [1,2,3]
data = (round(myfunction(i),3) for i in
myL)
print(list(data))
```

- [0.0, 0.301, 0.477]

while i <= <value/object>:

- use to iterate in a forward or reverse direction
- slash breaks code to next line

```
i = 0
mylist = [] #add result to list
while i <=1:
  mylist.append(i); i +=1
mylist
[0, 1]

i=1  #loop+print custom results
while i < 2:
   print("loop# i={}".format\
(str(i)))
   i +=1
print("final loop i is
="+str(i))
loop# i=1
final loop i is =2
```

range(start,stop,step)

- use set a numeric range to iterator or calculate with
- default start is zero and default setp is one
- may inherit values form use objects, attributes

```
for i in range(0,2): print(i)
0 ,1

me1=('adam','carly','jackson','danny')
for i in range(len(me1)): print(i)
0, 1,2 ,3

#see data transposition slide
me1 = ['w','e','i','r','d']
me2 = []              # (+) indexing
for i in range(0,5):
    me2.append(me1[i])
['w', 'e', 'i', 'r', 'd']
me1 = ['d','r','i','e','w']
me2 = []              # (-) indexing
for i in range(1,6):
    me2.append(me1[-i])
['w', 'e', 'i', 'r', 'd']
```

Misc

- row for row in open ('filepath.txt')
- generator <fix this>

```
sum((i*3 for i in range(2))

with open ('path of file.txt',
'r') as data_file:
  for line in data_file:
     print(line)
```

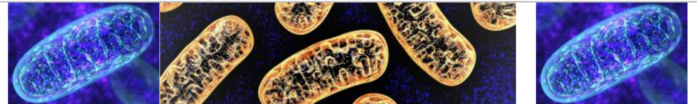
-Quickly create lists or dict with-

enumerate() adds list index #

```
me1 =
['adam','carly','jackson','danny']
me2 = list(enumerate(me1)); me2
[(0, 'adam'), (1, 'carly'), (2, 'jackson'), (3,
'danny')]
```

Essetial Functions

Functions are the workhorses helping transform, transpose, combine and just about anything else you can think of



- each function has unique parameters (values it accepts) and means of operating. To figure out read the docs and when necessary look for examples on stackoverflow, jupyterform, and google but try to be selective so your time is not wasted

dir() shows an object's director with all constructors and methods. Use it often to learn.
dir(mylist)=

Built-in Functions

A
abs()
aiter()
all()
any()
anext()
ascii()

B
bin()
bool()
breakpoint()
bytearray()
bytes()

C
callable()
chr()
classmethod()
compile()
complex()

D
delatr()
dict()
dir()
divmod()

E
enumerate()
eval()
exec()

F
filter()
float()
format()
frozenset()

G
getattr()
globals()

H
hasattr()
hash()
help()
hex()

I
id()
input()
int()
isinstance()
issubclass()
iter()

L
len()
list()
locals()

M
map()
max()
memoryview()
min()

N
next()

O
object()
oct()
open()
ord()

P
pow()
print()
property()

R
range()
repr()
reversed()
round()

S
set()
setattr()
slice()
sorted()
staticmethod()
str()
sum()
super()

T
tuple()
type()

V
vars()

Z
zip()

_
__import__()

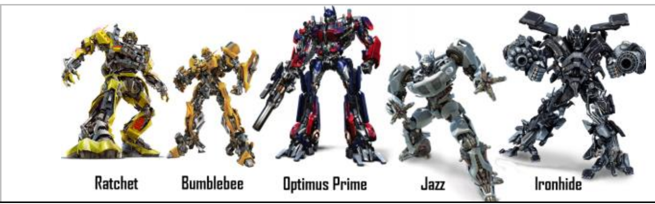
..

-
- abs(-1) = 1
- bool() -> always True, unless object is empty, like [], (), {},False, 0, None
- chr(97)->a. returns string unicode character, chr(100)->d
- dict()-> create a dict from object, mydict(mylist)
- dir() if object has __dir__ returns list of attributes
- divmod(numerator,denominator), result=(quotient,remainder)
- x=['a','b']->list(enumerate([x])) -> [(0, 'a'), (1, 'b')]
  returns an iterable tuple object
- float(1) -> 1.0
- .format customize output, print("{a}".format(a=1.01))-> 1.01
- frozenset() -> immutable set
- help() details on any function or object, help(set())
- int() -> cast to integer; x = "1", chr(x) = 1
- isinstance()->tests if in a class
- len() essential function! # items inside or across object
- list()->constructor-> mytuple=1,2,;mylist(mytuple)->[1,2]
- isinstance() -> x ="me", isinstance(me,str) -> True
- min(0,3,4) -> 0; max(0,3) -> 3
- range(start,stop,start)->for i in range(0,10,2):print(i)-> 0,2,4,6,8
- round(1.5) -> 2
- set()->constructor->only unique values;mutable|x=1,1,1;set(x)->{1}
- slice(start,end,step)-> a=('a','b',11); x=slice(1,3); print(a[x])->('b',11)
- sorted()->
- sum()-> a=100,1; sum(a)->101
- tuple()->constructor-> mylist=['a',1];tuple(mylist)->('a',1)
- type() -> what object is it? type(tuple())-> tuple
- zip()->for item in zip([1, 2],['a','b']):print(item)->(1,'a')(2,'b')

..

Data Transform pos/neg indexing

- Moving data around is art and may require wizardry.
- For starters master 2 dimensions <x and y>, ie rows and columns
- Data moves =>left to right, right to left, top to bottom, bottom top
- <like cartesian coordinates
- up\down, left\right, down\up, right\left



Python indexing, Pandas axis, and pd.read_xlsx to a python dictionary object

Python iterable objects, list, tuples, ranges have sequential index position values

When importing ensure to inspect values start on the index you want them to.

import pandas as pd; pd.read_xlsx('flie_path')

r1c1 Excel setting -> file \ options \ formulas \ turn on R1C1

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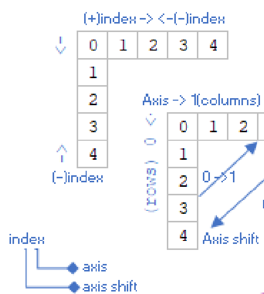
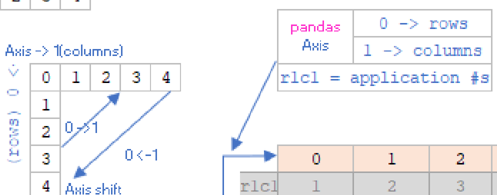




pandas Axis	
	0 -> rows
	1 -> columns
r1c1 = application #s	

	0	1	2	3	4	
r1c1	1	2	3	4	5	
	1	title	script	type	id
0	2	Alls Well Th	in delivering	Comedy	0
1	3	As You Like	as i rememb	Comedy	1
2	4	The Comed	proceed sol	Comedy	2
3	5	Cymbeline	you do not r	Comedy	3
4	6	Loves Labo	let fame tha	Comedy	4
5	7				

Python positional index

r1c1 = application index

A

row x column

title	script	type	ID
r1c1	r1c2	r1c3	r1c4
r2c1			
	r3c2		
		r4c3	
			r4c4

```
df0 = pd.read_excel("data_shakes_corpus_v1.xlsx") #ETL method 2
df0.info()
mydict = df0.to_dict()  #dataframe to python dictionary !
''''mydict = megadict = {'title':{},'script':{},'type':{},'ID:{} }'''
mydict
#37 rows x 4 xcolumns

        col-0   |  col-1  | col-2  | col-3
header  title   |  script | type   | id
row-0 = 1st line; total = 37 rows or 37x4 (R x C)'''
```

a) df.to_dict()
b) df.to_frame()

B

df0 - DataFrame

Index	title	script	type	ID
0	Alls Well That Ends Well	in delivering my son from me i bury a second h…	Comedy	0
1	As You Like It	as i remember adam it was upon this fashion be…	Comedy	1
2	The Comedy of Errors	proceed solinus to procure my fall and by the …	Comedy	2

C

mydict - Dictionary (4 elements)

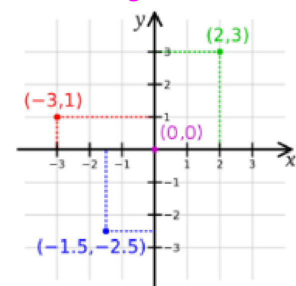
Key	Type	Size	Value
ID	dict	37	{0:0, 1:1, 2:2, 3:3, 4:4, 5:5, 6:6, 7:7, 8:8, 9:9, ...}
script	dict	37	{0:'in delivering my son from me i bury a second husband what hope is …
title	dict	37	{0:'Alls Well That Ends Well', 1:'As You Like It', 2:'The Comedy of Er …
type	dict	37	{0:'Comedy', 1:'Comedy', 2:'Comedy', 3:'Comedy', 4:'Comedy', 5:'Comedy …

megasaurus pack and unpack => [({...})] => list, tuple, dict

Illustrates postive and negative sequential data indexing

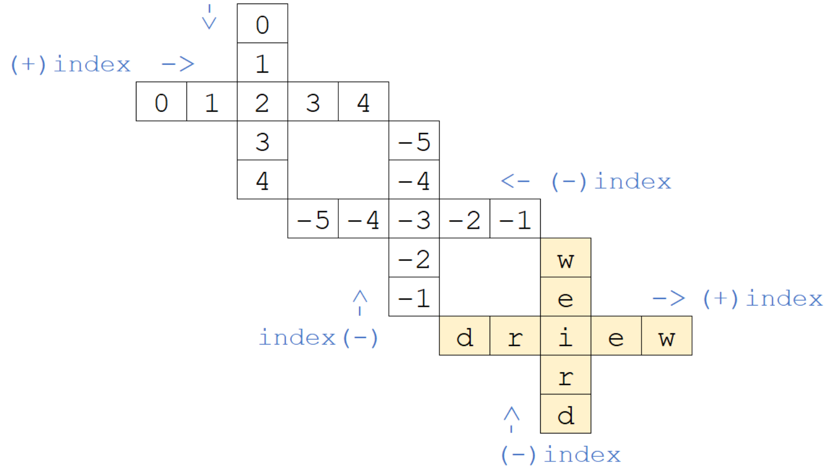
#(+)index

```
me1 = ['w','e','i','r','d']
me2 = []
for i in range(0,5):
    me2.append(me1[i])
me2
#['w', 'e', 'i', 'r', 'd']
```



#(-)index

```
me1 = ['d','r','i','e','w']
me2 = []
for i in range(1,6):
    me2.append(me1[-i])
me2
#['w', 'e', 'i', 'r', 'd']
```



Build Object 'class'

a. **Classes** are a framework for creating objects, functions specific to an object family, attributes, and child class via inheritance
b. **Objects** are entities that perform work. Child objects are instantiated from parents
c. **Methods** are instructions detailing "how" to perform work. Built parent or child level.
d. **Attributes** are alpha\numeric values associated with an object or class. Methods can use this values to perform work and make decisions
e. **self** <self.attribute> is the first argument in a class function self-identifying itself while processing instructions
f. **Function** – set of instructions to perform a task independent of any object. Methods are functions but associated with an object.

```
mydict = {"training done":[], "total animals":0}
class myFarm:    #create parent class object
    pass
    name = ""
    species = ""
    train = ""
 def add_train(traintype):#create a user function to count, sort
    mydict["training done"].append(traintype)
    mydict["total animals"] =+1

#------------->   #children instantiate from parents
a1 = myFarm()     # instantiate children objects, a for animal
a2 = myFarm()     # all object names are user defined
```

#update attributes	<only here bc space>
a1.name = "mackenzie"	a2.name = "vinny"
a1.species = "dog"	a2.species = "horse"
a1.train = "speak"	a2.train = "jumping"
add_train(a1.train) #cheCK-OUT!	add_train(a2.train)
function accepts attribute to update dictionary objec	

```
#write a simple report using a dictionary data object format
mydict_rpt = {a1.name:a1.species,
a2.name:a2.species,"metrics=>":mydict}
   mydict_rpt
{'arnold': 'dog','vinny': 'horse','metrics=>': {'training done':
['catch', 'jumping'], 'total animals': 1}}

#use object's constructors to view its contents
print(a1.__dict__,a2.__dict__)
{'name': 'arnold', 'species': 'dog', 'train': 'catch'} {'name':
'vinny', 'species': 'horse', 'train': 'jumping'}
```

```
#user functions built in or out of objects
def sum(a, b):
    return (a + b)
a = int(input('Enter 1st number: '))
b = int(input('Enter 2nd number: '))

print(f'Sum of {a} and {b} is {sum(a, b)}'
Enter 1st number :              1
Enter 2nd number:               2
Sum of 1 and 2 is               3
------------------------------------------
```

Class constructors: A constructor is a special class method automatically invoked when an object of the class is created. Constructors initialize an object's attributes and perform any setup required for an object to function correctly. The Python constructor method is " __init__," which accepts parameters for setting initial value attributes.

```
class Person:
    def __init__(self, name, age):
        self.name = name
        self.age = age
    def introduce(self):
        print(f"My name is {self.name} and I am {self.age} years old.")
# Example usage
person1 = Person("Alice", 25)
person1.introduce()  # Output: My name is Alice and I am 25 years old.
```

Common Python dunder(__) constructors:
->__init__: The initializer or constructor method.
-> __new__: Creates a new class instance before initialized.
-> __del__: Cleans up an instance when destroyed.
->__repr__: Returns a string representation of the instance.
-> __str__: Returns a user-friendly string of the instance.