

Python Coding Rules

Python basics

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Table of contents

General	2
Prefer Unpacking Over Indexing	3
Prefer enumerate Over range	3
Use zip to process Iterators in parallel	3
Avoid 'else' Blocks After 'for' and 'while' Loops	5
Prevent repetition with assignment Expressions such as 'walrus operator'	7
Lists and dictionaries	8
Know how to slice sequences	8
Avoid striding and slicing in a single expression	8
Perfect Catch-'All Unpacking Over Slicing'	9
Sort by Complex Criteria using the 'key' parameter	9
Dictionaries : insertion ordering, dict types, dict values	11
Prefer 'get' Over 'in' and 'KeyError' to handle missing dictionary keys	11
Prefer 'defaultdict' Over 'Setdefault' to handle missing items	14
Functions	15
Never Unpack more than 3 variables when functions return multiple values	15
Prefer raising exceptions to returning None	16
Know how Closures Interact with Variable Scope	17
Reduce Visual Noise with Variable Positional Arguments	18
Provide Optional Behavior with Keyword Arguments	19
Use None and Docstrings to Specify Dynamic Default Arguments	19
Define Function Decorators with functools.wraps	20

General

C-style formatting strings in Python (4 errors)

- reversing order gives traceback
- difficult to read the code
- using same value multiple times in tuple (repeat it in the right side)
- dictionary formats

Write helper functions instead of complex expressions

- Use if/else conditional to reduce visual noise
- Moreover, if/else expression provides a more readable alternative over the boolean or/and in expressions.

Prefer Unpacking Over Indexing

- use special syntax to unpack multiple values and keys in a single statement.

Prefer enumerate Over range

- range (built-in function) is useful for loops
- prefer enumerate instead of looping over a range

```
# example of enumeration with list-  
flavor_list = ['vanilla', 'chocolate', 'pecan', 'strawberry']  
for flavor in flavor_list:  
    print(f'{flavor} is delicious')
```

```
vanilla is delicious  
chocolate is delicious  
pecan is delicious  
strawberry is delicious
```

Use zip to process Iterators in parallel

```
names = ['Kunal', 'Xives', 'pricila']  
counts = [len(n) for n in names]  
print(counts)
```

```
[5, 5, 7]
```

```
# iterating over length of lists  
longest_name = None  
max_count = 0  
  
for i in range(len(names)):
```

```

        count = counts[i]
        if count > max_count:
            longest_name = names[i]
            max_count = count

print(longest_name)

```

pricila

```

# we see that the above code is a bit noisy.
# to improve it, we'll use the enumerate method

for i, name in enumerate(names):
    count = counts[i]
    if count > max_count:
        longest_name = name
        max_count = count
print(longest_name)

```

pricila

```

# to improve it further, we'll use the inbuilt zip function

for name, count in zip(names, counts):
    if count > max_count:
        longest_name = name
        max_count = count

print(longest_name)

```

pricila

```

# zip's behavior is different if counts are not updated

names.append('Rosy')
for name, count in zip(names, counts):
    print(name)

```

Kunal
Xives
pricila

```
# so, be careful when using iterators of different lenght.  
  
# consider using zip_longest function from itertools instead  
  
import itertools  
for name, count in itertools.zip_longest (names, counts):  
    print (f'{name}: {count}')
```

Kunal: 5
Xives: 5
pricila: 7
Rosy: None

Avoid 'else' Blocks After 'for' and 'while' Loops

```
# for loops first  
  
for i in range(3):  
    print('Loop', i)  
else:  
    print('Else block!')
```

Loop 0
Loop 1
Loop 2
Else block!

```
# using break in the code  
  
for i in range(3):  
    print('Loop', i)  
    if i == 1:  
        break  
  
else:
```

```
print('Else block!')
```

Loop 0

Loop 1

```
# else runs immediately if looped over an empty sequence

for x in []:
    print('Never runs')
else:
    print('For else block!')
```

For else block!

```
# else also runs when while loops are initially false
while False:
    print('Never runs')
else:
    print('While else block!')
```

While else block!

```
## finding coprimes (having common divisor i.e. 1)

a = 11
b = 9

for i in range(2, min(a, b) + 1):
    print('Testing', i)
    if a%i == 0 and b%i == 0:
        print('Not coprime')
        break
else:
    print('coprime')
```

Testing 2

Testing 3

Testing 4
Testing 5
Testing 6
Testing 7
Testing 8
Testing 9
coprime

Prevent repetition with assignment Expressions such as 'walrus operator'

```
# Without the walrus operator
even_numbers_without_walrus = []
count = 0
while count < 5:
    number = count * 2
    if number % 2 == 0:
        even_numbers_without_walrus.append(number)
    count += 1

print(even_numbers_without_walrus)
```

[0, 2, 4, 6, 8]

```
# With the walrus operator
even_numbers_with_walrus = []
count = 0
while count < 5:
    if (number := count * 2) % 2 == 0:
        even_numbers_with_walrus.append(number)
    count += 1

print(even_numbers_with_walrus)
```

[0, 2, 4, 6, 8]

Lists and dictionaries

Know how to slice sequences

```
#somelist [start:end]
a = ['a', 'b', 'c', 'd', 'e', 'f']
print ('Middle two: ', a[2:4])
```

Middle two: ['c', 'd']

Avoid striding and slicing in a single expression

```
b = [1, 2, 3, 4, 5, 6]
odds = b[::2]
evens = b[1::2]
print(odds)
print(evens)
```

[1, 3, 5]

[2, 4, 6]

```
# stride syntax that can introduce bugs ; Avoid
c = b'rouge'
d = c[::-1]

print(d)
```

b'eguor'

```
x = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h']
print(x[2::2])      # ['c', 'e', 'g']
print(x[-2::-2])    # ['g', 'e', 'c', 'a']
print(x[-2:2:-2])   # ['g', 'e']   #[start: stop : step]
print(x[2:2:-2])    # []
```



```
['c', 'e', 'g']
['g', 'e', 'c', 'a']
['g', 'e']
[]
```

Perfect Catch-‘All Unpacking Over Slicing’

- Unpacking - extracting individual elements from a sequence (like a list or tuple) and assigning them to variables.
- Slicing - selecting a subset of elements from a sequence.

```
# Example sequence
numbers = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

# Using slicing to get a portion of the sequence
subset = numbers[2:8]

# Using unpacking to assign values to variables
first, *middle, last = subset    # *used for extended unpacking

# Print the results
print("Subset:", subset)
print("First element:", first)
print("Middle elements:", middle)
print("Last element:", last)
```

```
Subset: [3, 4, 5, 6, 7, 8]
First element: 3
Middle elements: [4, 5, 6, 7]
Last element: 8
```

Sort by Complex Criteria using the ‘key’ parameter

- sort method works for all built-in types (strings, floats, etc.), but it doesn’t work for the classes, including a **repr** method for instance.

```
class Tool:
    def __init__(self, name, weight):
        self.name = name
        self.weight = weight
```

```

    def __repr__(self):
        return f'Tool({self.name}, {self.weight})'

# Example usage of the Tool class
tools = [
    Tool('level', 3.5),
    Tool('hammer', 1.25),
    Tool('screwdriver', 0.5),
    Tool('chisel', 0.25),
]

# tools.sort()    #this will give us a traceback

# Display the unsorted list of tools
print('Unsorted:')
for tool in tools:
    print(repr(tool))

# Sort the tools based on their names
tools.sort(key=lambda x: x.name)

# Display the sorted list of tools
print('\nSorted:')
for tool in tools:
    print(tool)

```

Unsorted:

```

Tool(level, 3.5)
Tool(hammer, 1.25)
Tool(screwdriver, 0.5)
Tool(chisel, 0.25)

```

Sorted:

```

Tool(chisel, 0.25)
Tool(hammer, 1.25)
Tool(level, 3.5)
Tool(screwdriver, 0.5)

```

Dictionaries : insertion ordering, dict types, dict values

```
# cutest baby animal

votes = {
    'otter': 1281,
    'polar bear': 587,
    'fox': 863,
}

# save the rank to an empty dictionary
def populate_ranks(votes, ranks): #takes votes and ranks dictionary
    names = list(votes.keys())
    names.sort(key=votes.get, reverse=True)
    for i, name in enumerate(names, 1):
        ranks[name] = i

# function that returns the animal with highest rank
def get_winner(ranks):
    return next(iter(ranks))

# results
ranks = {}
populate_ranks(votes, ranks)
print(ranks)
winner = get_winner(ranks)
print(winner)
```

```
{'otter': 1, 'fox': 2, 'polar bear': 3}
otter
```

Prefer 'get' Over 'in' and 'KeyError' to handle missing dictionary keys

- accessing and assigning
- for maintaining dictionaries, consider Counter class from the collections built-in module
- setdefault is another shortened method other than get method, but readability is not clear. so, avoid it

example 1

```
bread = {
    '14grain': 4,
    'multigrain' : 2
}

#1) 'in' method
key = 'wheat'

if key in bread:
    count = bread[key]
else:
    count = 0

bread[key] = count + 1 #incrementing the count by 1 for 'wheat' key
```

#2) 'KeyError' method key = 'wheat'

try: count = bread[key] except KeyError: count = 0

bread[key] = count + 1

#3) 'get' method - best one (shortest and clearest)

```
key = 'oats'

count = bread.get(key,0)
bread[key] = count + 1
```

bread

{'14grain': 4, 'multigrain': 2, 'wheat': 2, 'oats': 1}

example 2

more complex dictionary, to know who voted for which type of bread

```
votes = {
    '14grain' : ['Bob', 'Ashley', 'Suzan', 'Susan'],
    'multigrain' : ['Dikshita', 'Kavya'],
```



```
# prevent repetition
if (names := votes.get(key)) is None:
    votes[key] = names = []
names.append(who)

print(votes)
```

```
{'14grain': ['Bob', 'Ashley', 'Suzan', 'Susan'], 'multigrain': ['Dikshita', 'Kavya'], 'wheat': ['Dikshita', 'Kavya']}
```

Prefer 'defaultdict' Over 'Setdefault' to handle missing items

```
# list of countires and cities visited
visits = {
    'India' : {'Punjab', 'Rajasthan', 'Goa', 'Himachal Pardesh', 'Haryana'},
    'UAE' : {'Dubai'},
    'Nepal' : {'Kathmandu'},
    'Canada' : {'Québec', 'Ontario'},
}
```

```
# using setdefault method to add to the list (method 1)

visits.setdefault('France', set()).add('Remi') #short

if (japan := visits.get('Japan')) is None:      #long
    visits['Japan'] = japan = set()
japan.add('Kyoto')

print(visits)
```

```
{'India': {'Rajasthan', 'Haryana', 'Punjab', 'Himachal Pardesh', 'Goa'}, 'UAE': {'Dubai'}, 'Nepal': {'Kathmandu'}, 'Canada': {'Québec', 'Ontario'}}
```

```
# how about i create a class then add places

from collections import defaultdict

class Visits:
    def __init__(self):
        self.data = defaultdict(set)
```

```

    def add(self, country, city):
        self.data[country].add(city)

visits = Visits()
visits.add('England', 'Bath')
visits.add('England', 'London')
print(visits.data)

```

```
defaultdict(<class 'set'>, {'England': {'Bath', 'London'}})
```

Functions

Never Unpack more than 3 variables when functions return multiple values

```

# Function returning multiple values
def get_person_details():
    name = "John"
    age = 30
    city = "Montréal"
    gender = "Male"
    return name, age, city, gender

# Unpacking with three variables
name, age, city = get_person_details() #return 3
variables

# Displaying the results
print("Name:", name)
print("Age:", age)
print("City:", city)

```

ValueError: too many values to unpack (expected 3)

```

# Function returning multiple values
def get_person_details():
    name = "John"
    age = 30
    city = "Montréal"

```

```

    #gender = "Male"
    return name, age, city

# Unpacking with three variables
name, age, city = get_person_details() #3 return variables

# Displaying the results
print("Name:", name)
print("Age:", age)
print("City:", city)

```

Name: John
 Age: 30
 City: Montréal

Prefer raising exceptions to returning None

```

# Function that returns None on failure
def divide_numbers(a, b):
    if b == 0:
        return None # Indicating failure by returning None
    else:
        return a / b

# Using the function and checking for failure with None
result = divide_numbers(10, 2)

if result is not None:
    print("Result:", result)
else:
    print("Error: Cannot divide by zero.")

# Using the function and checking for failure with None
result = divide_numbers(10, 0)

if result is not None:
    print("Result:", result)
else:
    print("Error: Cannot divide by zero.")

```


Result: 5.0

Error: Cannot divide by zero.

```
# Function that raises an exception on failure
def divide_numbers(a, b):
    if b == 0:
        raise ValueError("Cannot divide by zero")
    else:
        return a / b

# Using the function and handling the exception
try:
    result = divide_numbers(10, 2)
    print("Result:", result)
except ValueError as e:
    print("Error:", e)

# Using the function and handling the exception
try:
    result = divide_numbers(10, 0)
    print("Result:", result)
except ValueError as e:
    print("Error:", e)
```

Result: 5.0

Error: Cannot divide by zero

Know how Closures Interact with Variable Scope

- It is better to write a helper class compared to non-local or helper function.
- used specifically when we want to prioritise certain groups in a function.

```
class Sorter:
    def __init__(self, group):
        self.group = group
        self.found = False

    def __call__(self, x):
        if x in self.group:
            self.found = True
```

```

        return (0, x)
    else:
        return (1, x)

# Example usage
group = {2, 4, 6}
numbers = [5, 3, 2, 1, 4]

sorter = Sorter(group)
numbers.sort(key=sorter)

# Display the sorted list
print("Sorted List:", numbers)

# Check if any item from the group is found during sorting
assert sorter.found is True

```

Sorted List: [2, 4, 1, 3, 5]

Reduce Visual Noise with Variable Positional Arguments

*args is not suggested for two reasons-

- 1) Optional positional arguments are always turned into a tuple before they are passed to a function.
- 2) Doesn't provide value inclusive of the new argument. Hence, no use of adding an additional argument.

```

# Original function with *args
def example_function(*args):
    # Existing functionality using args
    total = sum(args)
    return total

# Example usage
result = example_function(1, 2, 3)
print("Result:", result)

# Attempt to add a new positional argument
# This would break existing callers
def updated_function(new_arg, *args):

```

```

        total = sum(args) + new_arg
    return total

result2 = updated_function(4,5)
print('Result2:', result2)

```

Result: 6
Result2: 9

Provide Optional Behavior with Keyword Arguments

```

def calculate_rectangle_area(length, width):
    return length * width

def calculate_rectangle_area(length, width=None):
    if width is not None:
        return length * width
    else:
        # If width is not provided, assume it's a square (width = length)
        return length * length

area1 = calculate_rectangle_area(5, 3) # Calculates area of a rectangle
area2 = calculate_rectangle_area(4)    # Assumes it's a square with side length 4

print(area1)
print(area2)

```

15
16

Use None and Docstrings to Specify Dynamic Default Arguments

```

from datetime import datetime

def log_message(message, timestamp=None):
    """
    Log a message with an optional timestamp.
    """

```

```

Parameters:
- message (str): The message to be logged.
- timestamp (datetime, optional): The timestamp for the log message.
  Defaults to the current time if not provided.
"""
if timestamp is None:
    timestamp = datetime.now()

print(f"{timestamp}: {message}")

# Example usage
log_message("Error occurred") # Logs the message with the current timestamp
log_message("Warning", timestamp=datetime(2023, 1, 1)) # Logs the message with a specific

```

```

2023-12-05 18:49:25.657917: Error occurred
2023-01-01 00:00:00: Warning

```

Define Function Decorators with functools.wraps

- Decorator in Python is a function that takes another function as input and extends or modifies the behavior of the latter function.
- In this case, the trace decorator is designed to print information about the function calls.

```

def trace(func):
    def wrapper(*args, **kwargs):
        result = func(*args, **kwargs)
        print(f'{func.__name__}({args!r}, {kwargs!r}) '
              f'-> {result!r}')
        return result
    return wrapper

@trace
def example_function(x, y):
    return x * y

result = example_function(3, 4)

```

```

example_function((3, 4), {}) -> 12

```

```
help(example_function)
```

Help on function wrapper in module __main__:

```
wrapper(*args, **kwargs)
```