

Datatypes

Text	<code>str</code>
Numeric	<code>int</code> , <code>float</code>
Sequence	<code>list</code> , <code>tuple</code> , <code>range</code>
Mapping	<code>dict</code>
Set	<code>set</code>
Other	<code>bool</code> , <code>NoneType</code> , <code>bytes</code>

Casting

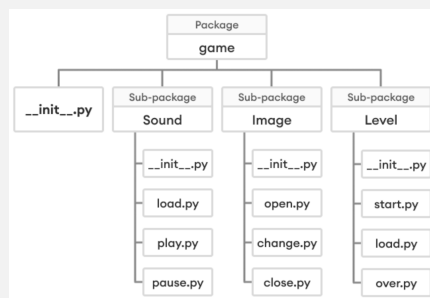
<code>int()</code>	converts into an integer	<code>int(2.8) = 2</code> <code>int("3") = 3</code>
<code>float()</code>	converts into float	<code>float(1) = 1.0</code> <code>float("3") = 3.0</code>
<code>str()</code>	converts into string	<code>str(3) = "3"</code> <code>str(1.0) = "1.0"</code>

Casting is converting a datatype to another

Input & Output (I/O)

Output	we use the <code>print()</code> function	it has 3 main arguments which the string, the separator and the end statement	<code>print("Are you okay", end=" ?")</code> <code>print("Hi", "How are you", "I missed you", sep="! !")</code>
Input	we use the <code>input()</code> function	the input function is used to take input from user and takes a text that is optional as argument	<code>num = input('Enter your age: ')</code>

Packages



A directory must contain a file named `__init__.py` in order for Python to consider it as a package. This file can be left empty but we generally place the initialisation code for that package in this file.

Operators

Logical (<code>and</code> , <code>or</code> , <code>not</code>)	used to check whether an expression is <i>True</i> or <i>False</i>	<pre> a = 5 b = 6 print((a > 2) and (b >= 6)) > True </pre>
---	--	--



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Operators (cont)

Identity (<code>is</code> , <code>is not</code>)	used to check if two values are located on the same part of the memory	<pre>x1 = 5 y1 = 5 print(x1 is not y1) > False</pre>
Membership (<code>in</code> , <code>not in</code>)	used to test whether a value or variable is found in a sequence (string, list, tuple, set, dictionary)	<pre>x = 'Hello world' print('hello' not in x) > True</pre>

for membership operators, in dictionaries it only checks the keys and not values

Module

- **Module** is a file that contains code to perform a specific task.
- A **module** may contain variables, functions, classes ...
- A collection of **modules**, can make what we call a **package**

As our program grows bigger, it may contain many lines of code. Instead of putting everything in a single file, we can use modules to separate codes in separate files as per their functionality. This makes our code organised and easier to maintain.

```
----- example.py -----
def add(a, b):
    result = a + b
    return result
----- main.py -----
import example
addition.add(4,5) # returns 9
```

List's Basic Operations

Accessing Lists	<code>list[index]</code>	<pre>languages = ["Python", "Swift"] # access item at index 0 print(languages[0])</pre>
Slicing Lists	<code>list[from:to]</code>	<pre># List slicing in Python my_list = ['p', 'r', 'o', 'g', 'r'] # items from index 2 to index 4 print(my_list[2:5])</pre>
Adding one item at the end of list	<code>list.append(item)</code>	<pre>numbers = [21, 34, 54, 12] numbers.append(32)</pre>
Adding All items of an iterable	<code>list1.extend(list2)</code>	<pre>numbers = [1, 3, 5] even_numbers = [4, 6, 8] numbers.extend(even_numbers)</pre>



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List's Basic Operations (cont)

Adding one item at specific index	<code>list.insert(index, item)</code>	<code>numbers = [10, 30, 40]</code> <code>numbers.insert(1, 20)</code>
Changing item values	<code>list[item_index] = new_value</code>	<code>languages = ['Python', 'Swift', 'C++']</code> # changing the third item to 'C' <code>languages[2] = 'C'</code>
Removing one item of a list	<code>list.remove(item)</code>	<code>languages = ['Python', 'Swift']</code> # remove 'Python' from the list <code>languages.remove('Python')</code>
Removing one or more items of a list	<code>del list[from:to]</code>	<code>del languages[1]</code> <code>del languages[0:2]</code>
Check if an item exists in a list	<code>item in list</code>	<code>languages = ['Python', 'Swift', 'C++']</code> <code>print('C' in languages)</code> > False

A list is a data structure that holds :

- 1) multiple data at once
- 2) of different data types (str,int,float)
- 3) can store duplicates

> we can create lists using brackets `[]` or the `list()` constructor

Other Lists Methods

Remove all items from a list	<code>list.clear()</code>	<code>languages.clear()</code>
Return index of item	<code>list.index(item)</code>	<code>animals = ['cat', 'dog', 'rabbit', 'horse']</code> # get the index of 'dog' <code>index = animals.index('dog')</code>
Return length of a list	<code>len(list)</code>	<code>length (languages)</code> > 3
Return count of a specific item in a list	<code>list.count(item)</code>	<code>numbers = [2, 3, 5, 2, 11, 2, 7]</code> # check the count of 2 <code>count = numbers.count(2)</code>
Sort a list (by default ascending)	<code>list.sort(reverse=False)</code>	<code>vowels = ['e', 'a', 'u', 'o', 'i']</code> <code>vowels.sort(reverse=True)</code> > ['u', 'o', 'i', 'e', 'a']



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Other Lists Methods (cont)

Reverse items of list	<code>list.reverse()</code>	<pre>prime_numbers = [2, 3, 5, 7] # reverse the order of list elements prime_numbers.reverse()</pre>
Copy a list	<code>list.copy()</code>	<pre>prime_numbers = [2, 3, 5] # copying a list numbers = prime_numbers.copy()</pre>

List Comprehensions

Like there is a short way to write functions, there is a short one to also write lists and it's called **list comprehension**

Syntax: `[expression for item in list]`

List comprehension is generally more compact and faster than normal functions and loops for creating list

Examples :

```
h_letters = [ letter for letter in 'human' ]
print(h_letters)
> ['h', 'u', 'm', 'a', 'n']
```

- We can add conditional to list comprehensions :

----- example 01 -----

```
number_list = [ x for x in range(20) if x % 2 == 0 ]
print(number_list)
> [0, 2, 4, 6, 8, 10, 12, 14, 16, 18]
```

----- example 02 -----

```
num_list = [y for y in range(100) if y % 2 == 0 if y % 5 == 0]
print(num_list)
> [0, 10, 20, 30, 40, 50, 60, 70, 80, 90]
```

Python Tuples

Accessing tuples	<code>tuple[index]</code>	<pre>letters = 'a','b','c' letters[0]</pre>
Slicing tuples	<code>tuple[from :to]</code>	<pre>letters = ('a','b','c','d','e') letters[1:3]</pre>
Return index of item	<code>tuple.index(item)</code>	<pre>letters = ('a','b','c','d','e') letters.index('a')</pre>
Return count of a specific item	<code>tuple.count(item)</code>	<pre>letters = ('a','b','a','d','e') letters.count('a')</pre>
Iterating over a tuple	<code>for item in tuple :</code>	<pre>languages = ('Python', 'Swift', 'C++') # iterating through the tuple for language in languages: print(language)</pre>



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Python Tuples (cont)

Check if a tuple element exists

item in tuple

'C' in languages

A **tuple** is a data structure that :

- holds multiple data at once
- of different types (str,int,float)
- can store duplicates
- is **immutable** so we cannot modify its items (this makes it faster to iterate over compared to lists) , meaning no delete or assignement operations

we can create lists using brackets () or just comma seperated value (meaning the () are optional) like follows :

```
first_tuple = (1,2,3)
second_tuple = 1,2,3
```

Dictionaries

Accessing Items

```
dictionary[key]
dictionary.get(key)

country_capitals = {
    "United States": "Washington D.C.",
    "Italy": "Rome",
    "England": "London"
}
print(country_capitals["United States"])
> Washington D.C
```

Removing Items

```
del dictionary[key]
dictionary.pop(key)

sales = { 'apple': 2, 'orange': 3, 'grapes': 4 }
popped_element = sales.pop('apple')
```

Membership Test (keys only)

```
key in dictionary

my_list = {1: "Hello", "Hi": 25, "Howdy": 100}
print(1 in my_list) -> True
print("Howdy" not in my_list) -> False
print("Hello" in my_list) -> False
```



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Dictionaries (cont)

```
Iterating Items    for key,value in dictio nar y.i tem s()
                    my_dict = {'apple': 1, 'banana': 2, 'orange': 3, 'grape': 4}
                    for key, value in my_dic t.i tems():
                    print(f"Key: {key}, Value: {value }")
```

A **dictionary** is a data structure and a collection that :

- allows us to store data in key-value pairs.
- **dictionary** keys must be immutable, such as tuples, strings, integers, etc meaning we cannot use mutable (changeable) objects such as lists as keys.
- **dictionary** values must be mutable of course

We create dictionaries by placing **key:value** pairs inside curly brackets {}, separated by commas

Other Dictionary Methods

Update Items	dictio nar y.u pda te({key : new_va lue}) dictio nar y.u pda te({ne w_key : new_va lue})	d = {1: " one ", 2: " thr ee"} d1 = {2: " two "} # updates the value of key 2 d.update(d1)
Remove All Items	dictio nar y.c lear()	d.clear()
Return All Keys	dictio nar y.k eys()	numbers = {1: 'one', 2: 'two', 3: 'three'} # extracts the keys of the dictionary dictionaryKeys = number s.k eys()
Return All Values	dictio nar y.v alues()	marks = {'Phys ics ':67, 'Maths ':87} print(marks.values())
Return Items	dictio nar y.i tems()	marks = {'Phys ics ':67, 'Maths ':87} print(marks.items()) > dict_i tem s([('P hys ics', 67), ('Maths', 87)])



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Other Dictionary Methods (cont)

Copy Dictionary	<code>dictionary.copy()</code>	<code>original_marks = {'Physics':67, 'Maths':87}</code> <code>copied_marks = original_marks.copy()</code>
Create Dictionary From Keys & Values	<code>dict.fromkeys(keys, value)</code>	<code>keys = {'a', 'e', 'i', 'o', 'u'}</code> <code>value = [1]</code> <code>vowels = dict.fromkeys(keys, value)</code>

Sets

Adding Items	<code>set.add(item)</code>	<code>numbers = {21, 34, 54, 12}</code> <code>numbers.add(32)</code>
Update Items	<code>set.update(iterable)</code>	<code>companies = {'Lacoste', 'Ralph Lauren'}</code> <code>tech_companies = ['apple', 'google', 'apple']</code> <code>companies.update(tech_companies)</code> <code>print(companies)</code> <code>> {'google', 'apple', 'Lacoste', 'Ralph Lauren'}</code>
Remove Items	<code>set.discard(item)</code>	<code>remove_dValue = languages.discard('Java')</code>
Checking if All Set Items Are True (or empty)	<code>all(set)</code> (stands for U or *)	<code>L = [1, 3, 4, 5]</code> <code>print(all(L))</code> <code>> True</code>
Checking if Any Set Items Are True	<code>any(set)</code> (stands for n or +)	<code>L = [1, 3, 4, 0]</code> <code>print(any(L))</code> <code>> True</code>



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Sets (cont)

Returning Enumerate Object	<code>enumur ate (it erable)</code>	<pre>grocery = ['bread', 'milk', 'butter'] for count, item in enumer ate (gr ocery): print(count, item) > 0 bread 1 milk 2 butter</pre>
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Returning Length Of Set	<code>len(set)</code>	<code>len(gr ocery)</code>
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Largest & Smallest item	<pre>max(set) min(set)</pre>	<pre>numbers = [9, 34, 11, -4, 27] # find the maximum number max_number = max(nu mbers)</pre>
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Sorting Set	<code>sorted (set)</code>	<pre>py_set = {'e', 'a', 'u', 'o', 'i'} print(sorted(py_set)) > ['a', 'e', 'i', 'o', 'u']</pre>
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Summing Set Items	<code>sum(set)</code>	<pre>marks = {65, 71, 68, 74, 61} # find sum of all marks total_marks = sum(marks) > 339</pre>
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Iterate Over Set	<code>for item in set :</code>	<pre>fruits = {"Ap ple ", " Pea ch", " Man go"} # loop to access each fruits for fruit in fruits: print(fruit)</pre>
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A **Set** is data structure that :

- Stores different data types
- Cannot have duplicates
- has **immutable** elements unlike lists and dictionaries

In Python, we create sets by placing all the elements inside curly braces `{}` , separated by comma or using the **set()** constructor.

```
student_id = {112, 114, 116, 118, 115}
```

Set Operations

Union	<pre>set1.u nio n(set2) set1 set2</pre>	<pre>A = {1, 3, 5} B = {0, 2, 4} print(A B) > {0, 1, 2, 3, 4, 5}</pre>
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Set Operations (cont)

Intersection	<pre>set1.intersection(set2) set1 & set2</pre>	<pre>A = {1, 3, 5} B = {1, 2, 3} print(A & B) > {1, 3}</pre>
Difference	<pre>set1.difference(set2) set1 - set2</pre>	<pre>A = {2, 3, 5} B = {1, 2, 6} print(A - B) > {3, 5}</pre>
Symmetric Difference	<pre>set1.symmetric_difference(set2) set1 ^ set2</pre>	<pre>A = {2, 3, 5} B = {1, 2, 6} print(A ^ B) > {1, 3, 5, 6}</pre>

Python Strings

Accessing Strings	<pre>string[index]</pre>	<pre>greet = 'hello' print(greet[1])</pre>
Slicing Strings	<pre>string[from:to]</pre>	<pre>greet = 'hello' print(greet[0:2])</pre>
Comparing Two Strings	<pre>string1 == string2</pre>	<pre>str1 = "Hello, world! " str2 = "I love Python." print(str1 == str2)</pre>
Joining Strings	<pre>string1 + string2</pre>	<pre>str1 = "Hello, world! " str2 = "I love Python." print(str1 + str2)</pre>
String Length	<pre>len(string)</pre>	<pre>greet = 'hello' print(len(greet))</pre>
Formatting Strings (f-strings)	<pre>f'{string} "</pre>	<pre>print(f'{name} is from {country}')</pre>
Uppercase & Lowercase Strings	<pre>string.upper() string.lower()</pre>	<pre>message = 'python is fun' print(message.upper())</pre>



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Python Strings (cont)

Partitioning String Into Three Part Tuples	<code>string.partition(separator)</code>	<pre>string = " Python is fun, isn't it!" print(string.partition('is')) >('Python ', 'is', " fun, isn't it!")</pre>
Replacing Sub-String	<code>string.replace(old_substring, new_substring, occurrences^{optional})</code>	<pre>song = 'Let it be, let it be, let it be' # replacing only two occurrences print(song.replace('let', " don't"))</pre>
Return Index of Substring	<code>string.find(substring)</code>	<pre>quote = 'Let it be, let it be, let it be' # first occurrence of 'let it'(case sensitive) result = quote.find('let it')</pre>
Remove Trailing Characters (By default removes whitespaces)	<code>string.rstrip(substring^{optional})</code>	<pre>website = 'www.programiz.com/' print(website.rstrip('m/.'))</pre>
Splitting Strings	<code>string.split(separator, maxsplit)</code>	<pre>grocery = " Milk, Chicken, Bread, Butter" print(grocery.split(', ', 1)) >["Milk", "Chicken, Bread, Butter"]</pre>
Checking String Start	<code>string.startswith(substring)</code>	<pre>text = " Python is easy to learn." result = text.startswith('is easy') > False</pre>



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Python Strings (cont)

Advanced String Indexing	<code>`string.index(substring , from, to <sup>optional</sup>)`</code>	<pre> sentence = 'Python programming is fun.' # Substring is searched in 'gramming is ' print(sentence.index('g is', 10, -4)) </pre>
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Python strings are immutable meaning we cannot change them , but we can assign its variable to another string which can do the job :

```
message = 'Hola Amigos'
message = 'Hello Friends'
```

Python Files

A **file** is a container in computer storage devices used for storing data.

When we want to read from or write to a file, we need to :

- 1- Open the file
- 2- Read or write in the file
- 3- Close the file

File Operations

Opening Files For Reading	<code>open(s our ce, 'r')</code>	<code>file1= open("t est.tx t", 'r')</code>
Reading Files	<code>file.r ead()</code>	<code>read_c ontent = file1.r ead()</code> <code>print(read_content)</code>
Closing Files	<code>file.c lose()</code>	<code>file1.c lose()</code>
Opening Files For Writing	<code>open(s our ce, 'w')</code>	<code>file2 = open("t est.tx t", 'w')</code>
Writing in Files	<code>file.w rit e(text)</code>	<code>file2.w ri te('Pr ogr amming is Fun.')</code>
Automatically Closing Files	<code>with open(s our ce, mode) as filename :</code> <code>#instructions</code>	<code>with open("t est.tx t", " r") as file1:</code> <code>read_content = file1.read()</code> <code>print(read_content)</code>

Directory Management

Get Current Working Directory	<pre>os.get_cwd() import os print(os.getcwd()) > /Users /ta yss irb ouk rou ba/Data Science Cheat Sheet</pre>
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Directory Management (cont)

Changing Directory	<code>os.chdir(new_directory)</code>	<code>import os</code> <code>os.chdir('/Users/tayssirboukrouba/')</code> <code>print(os.getcwd())</code>
List Directories	<code>os.listdir()</code>	<code>import os</code> <code>os.chdir('/Users/tayssirboukrouba/')</code> <code>os.listdir()</code>
Making New Directory	<code>os.mkdir('directory_name')</code>	<code>os.mkdir('test')</code> <code>os.listdir()</code>
Renaming Directory or File	<code>os.rename('old_dir', 'new_dir')</code>	<code>import os</code> <code>os.listdir()</code> <code>os.rename('test', 'new_one')</code> <code>os.listdir()</code>
Removing Directories	<code>os.remove('directory')</code>	<code>import os</code> <code># delete "test.txt" file</code> <code>os.remove("test.txt")</code>

A **Directory** is a collection of files and subdirectories.

A directory inside a directory is known as a **sub-directory**.

Python has the `os` module that provides us with many useful methods to work with directories (and files as well).

Conditionals

if	used to execute an instruction if a condition was true	<code>number = 0</code> <code>if number > 0:</code> <code>print("Positive number "</code> <code>)</code>
elif	used to execute an instruction if the previous condition was not true and stands for <i>else if</i>	<code>elif number == 0:</code> <code>print('Zero')</code>
else	used to execute an instruction if all conditions were not true	<code>else print("not positive")</code>

Loops

for	used mostly to loop through a sequence	<code>languages = ['Swift', 'Python', 'Go', 'JavaScript']</code> <code>for language in languages:</code> <code>print(language)</code>
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Loops (cont)

while	used to loop through a statement while the condition is not met	<pre> counter = 0 while counter < 3: print('Inside loop') counter = counter + 1 else print('Inside else') </pre>
break	used to terminate the loop immediately when it is encountered	<pre> for i in range(5): if i == 3: break print(i) </pre>
continue	used to skip the current iteration of the loop and the control flow of the program goes to the next iteration	<pre> for i in range(5): if i == 3: continue print(i) </pre>
pass	null statement which can be used as a placeholder for future code	<pre> n = 10 if n > 10: pass print('Hello') </pre>

Functions & Arguments

Syntax	<pre> def function_name(arguments): # function body return </pre>
Arguments with default values	<pre> def add_numbers(a = 7, b = 8): </pre>
Arguments with keywords	<pre> def display_info (first_name, last_name): print('First Name:', first_name) print('Last Name:', last_name) display_info(last_name = 'Cartman', first_name = 'Eric') </pre>



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Functions & Arguments (cont)

Arbitrary Arguments

```
def my_function(*kids):
    print("The youngest child is " + kids[2])

my_function("Emil", "Tobias", "Linus")
```

If you do not know how many arguments that will be passed into your function, add a `*` before the parameter name in the function definition which will make the param an *arbitrary argument*

Variables Scopes

Local variable a variables that is declared inside a function (cannot be accessed outside it)

```
def greet():
    # local variable
    message = 'Hello'
    print('Local', message)
greet()
```

Global variable a variables that is declared outside a function (can be accessed outside or inside it)

```
# declare global variable
message = 'Hello'

def greet():
    # declare local variable
    print('Local', message)
greet()

print('Global', message)
```

we can use the `global` keyword when we are inside a function , and we want to read and write a global variable inside a function.

Lambda Functions

Syntax `lambda arguments : expression`

Example

```
greet_user = lambda name : print('Hey,', name)

greet_user('Delilah')

> Hey, Delilah
```

Lambda functions are also called anonymous functions because they have no name

Python OOP

Object it's a collection of **data** (variables) and **methods** (functions).

```
class Bike:
    #Attributes with default values :
    name = ""
    gear = 0
```



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Python OOP (cont)

Class	it is a blueprint or an example (sample) of that object	<code>bike1 = Bike()</code>
Accessing Class Attributes Using Objects	We use the "." notation to access the attributes of a class	<pre># modify the name attribute bike1.name = "Mountain Bike" # access the gear attribute bike1.gear</pre>
Class Methods	A Python Function defined inside a class is called a method .	<pre>class Room: length = 0.0 breadth = 0.0 # method to calculate area def calculate_area(self): print("Area of Room =", self.length * self.breadth)</pre>
Constructors	We can initialise class using <code>__init__()</code> function	<pre>class Bike: # constructor function def __init__(self, name = ""): self.name = name bike1 = Bike() bike1 = Bike("Mountain Bike")</pre>

Exception Handling

try-except Statement

```
try:
    numerator = 10
    denominator = 0
    result = numerator/denominator
    print(result)
except:
    print("Error: Denominator cannot be 0.")
# Output: Error: Denominator cannot be 0.
```



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Exception Handling (cont)

Catching Specific Exceptions

```
try:
    even_numbers = [2,4,6,8]
    print(even_numbers[5])
except ZeroDivisionError:
    print( " Denomi nator cannot be 0.")
except IndexError:
    print( " Index Out of Bound.")
# Output: Index Out of Bound
```

try-else Statement

```
# program to print the reciprocal of even numbers
try:
    num = int(input ("Enter a number: "))
    assert num % 2 == 0
except:
    print( "Not an even number!")
else:
    reciprocal = 1/num
    print( rec ipr ocal)
```

try-fi nally Statement

```
try:
    numerator = 10
    denomi nator = 0
    result = numerator/denominator
    print( result)
except:
    print( " Error: Denomi nator cannot be 0.")
finally:
    print( "This is finally block." )
```

Exceptions can terminate the program's execution , that's why it is important to handle them

*when an exception occurs, the rest of the code inside the **try** block is skipped. If none of the statements in the **try** block generates an exception, the **except** block is skipped.*

In Python, the **finally** block is always executed no matter whether there is an exception or not.

Python Exceptions

Syntax Error Raised when there is a syntax error in the code, such as incorrect indentation, invalid syntax, or mismatched parentheses.

r



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Python Exceptions (cont)

<code>IndentationError</code>	A specific type of <code>SyntaxError</code> that occurs when there are problems with the indentation of the code.
<code>NameError</code>	Raised when a variable or name is used before it is defined.
<code>TypeError</code>	Occurs when an operation or function is applied to an object of an inappropriate type.
<code>ValueError</code>	Raised when a function receives an argument of the correct data type but an inappropriate value
<code>ZeroDivisionError</code>	Occurs when attempting to divide by zero
<code>IndexError</code>	Raised when trying to access an index that is out of range for a list, tuple, or string.
<code>KeyError</code>	Raised when trying to access a non-existent key in a dictionary.
<code>AttributeError</code>	Raised when an attribute or method is not found for an object.
<code>ImportError</code>	Occurs when a module cannot be imported.
<code>AssertionError</code>	Raised when an assert statement fails.
<code>OverflowError</code>	Raised when the result of an arithmetic operation is too large to be represented.
<code>MemoryError</code>	Occurs when the Python interpreter cannot allocate enough memory for an object.
<code>RuntimeError</code>	A generic error that is raised when no specific exception applies.

An **exception** is an unexpected event (error) that occurs during program execution , for example :

```
divide_by_zero = 7 / 0
```

The above code causes an exception as it is not possible to divide a number by 0.



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