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Introduction to Python Programming

UNIT 4

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Go, Change the World

Outline

→Functions

- Creating Functions
- Using Parameters and Return Values
- Using Keyword Arguments and Default Parameters Values
- Using Global Variables and Constants

→ Files and Exceptions

- Reading from Text Files
- Writing to Text Files
- Handling Exceptions

Functions

- **Functions**
  - A function in Python is **a block of code which only runs when it is called**.
  - You can pass data, known as parameters, into a function.
  - A function can return data as a result.
- **Need of functions**
  - Once your programs reach a certain size or level of complexity, it becomes hard to work with them this way.
  - Fortunately, there are ways to break up big programs into smaller, manageable chunks of code.
  - These manageable chunks are called as functions.

Functions (contd.)

Defining & Calling a Function

To call a function, use the function name followed by parenthesis:

```
def my_function(): # function defination
  print("Hello from a function")

my_function() # Function calling
```

Functions (contd.)

- **Defining Functions / Function creation**

- Function blocks begin with the keyword **def** followed by the **function-name** and **parentheses** (( )).
- Any input **parameters or arguments** should be placed within these parentheses. You can also define parameters inside these parentheses.
- The first statement of a function can be an optional statement - the documentation string of the function or docstring.
- The code block within every function starts with a **colon (:)** and is **indented**.
- The statement **return [expression]** exits a function, **optionally passing back** an expression to the caller. A return statement with no arguments is the same as return None.

Syntax

```
def functionname( parameters ):
       "function_docstring"
       function_suite / Body of function
       return [expression]
```

This line tells the computer that the block of code that follows is to be used together as the function instructions(). I'm basically naming this block of statements. This means that whenever I call the function instructions() in this program, the block of code runs.

Functions (contd.)

- **Example**
- The following function takes a string as input parameter and prints it on standard screen.

```
def display( str ):
       "This prints a passed string into this function"
       print str
       return
```

This line tells the computer that the block of code that follows is to be used together as the function display(). This means that whenever I call the function display() in program, the block of code runs.

Function Parameters/ Arguments

Arguments /Parameters to function

- Information can be passed into functions as arguments.
- Arguments are specified after the function name, inside the parentheses. You can add as many arguments as you want, just separate them with a comma.

The following example has a function with one argument (fname). When the function is called, we pass along a first name, which is used inside the function to print the full name:

Example

```
def my_function(fname):
       print(fname + " Refsnes")

my_function(“Helo World!")
```

From a function's perspective:

A parameter is the variable listed inside the parentheses in the function definition.

An argument is the value that is sent to the function when it is called.

Function Parameters/ Arguments

Number of Arguments

- By default, a function must be called with the correct number of arguments. Meaning that if your function expects 2 arguments, you have to call the function with 2 arguments, not more, and not less.

```
def my_function(fname, lname):
      print(fname + " " + lname)
```

Arbitrary Arguments, *args

- 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.
- This way the function will receive a tuple of arguments, and can access the items accordingly:

```
def my_function(*cities):
      print("The last city is " + cities[2])

my_function(“Mysore", “Tumkur", “Bangalore")
```

Function Return Values

Return Values

- **A return statement** is used to end the execution of the function call and “returns” the result (value of the expression following the return keyword) to the caller.
- The statements after the return statements are not executed.
- To let a function return a value, use the return statement:

```
def fun():
      statements . .

      return [expression]
```

Function Parameters/ Arguments

Arbitrary Keyword Arguments, **kwargs

- If you do not know how many keyword arguments that will be passed into your function, add two asterisk: ** before the parameter name in the function definition.
- This way the function will receive a *dictionary* of arguments, and can access the items accordingly:

```
def my_function(**kid):
  print("His last name is " + kid["lname"])

my_function(fname = "Tobias", lname= "Refsnes")
```

Function Parameters/ Arguments

Default Values

- Default values indicate that the function argument will take that value if no argument value is passed during the function call.
- The default value is assigned by using the assignment(=) operator of the form *keywordname*=value.

```
def my_function(country = "India"):
        print("I am from " + country)

my_function("Sweden")
my_function("Norway")
my_function()
my_function("Brazil")
```

Function Parameters/ Arguments

Global Variables

- Variables that are created outside of a function (as in all of the examples above) are known as global variables.
- Global variables can be used by everyone, both inside of functions and outside.

Example 1

```
x = "awesome"

def myfunc():
  print("Python is " + x)

myfunc()
```

Example 2

```
x = "awesome"

def myfunc():
  x = "fantastic"
  print("Python is " + x)

myfunc()

print("Python is " + x)
```

Function Parameters/ Arguments

Python Constants

- A constant is a special type of variable whose value cannot be changed.
- In Python, constants are usually declared and assigned in a module (a new file containing variables, functions, etc which is imported to the main file).
- Let's see how we declare constants in separate file and use it in the main file,

File name : constant.py

```
# declare constants
PI = 3.14
GRAVITY = 9.8
```

File name main.py

```
# import constant file we created above
import constant
print(constant.PI) # prints 3.14
print(constant.GRAVITY) # prints 9.8
```

Files and Exceptions

Python too supports file handling and allows users to handle files i.e., to read and write files, along with many other file handling options, to operate on files.

File Handling

The key function for working with files in Python is the `open()` function.
The `open()` function takes two parameters; *filename*, and *mode*.
There are four different methods (modes) for opening a file:

Before performing any operation on the file like reading or writing, first, we have to open that file. For this, we should use Python's inbuilt function open() but at the time of opening, we have to specify the mode, which represents the purpose of the opening file.

```
f = open(filename, mode)
```

Files and Exceptions

Mode is supported:

1. r: open an existing file for a read operation.

2. w: open an existing file for a write operation. If the file already contains some data then it will be overridden but if the file is not present then it creates the file as well.

3. a: open an existing file for append operation. It won't override existing data.

4. r+: To read and write data into the file. The previous data in the file will be overridden.

5. w+: To write and read data. It will override existing data.

6. a+: To append and read data from the file. It won't override existing data.

Files and Exceptions

```
# a file named “mytext", will be opened with the reading mode.
file = open(‘myfile.txt', 'r')
# This will print every line one by one in the file
for each in file:
        print (each)
```

There is more than one way to read a file in Python. If you need to extract a string that contains all characters in the file then we can use **file.read()**. The full code would work like this:

```
# Python code to illustrate read() mode
file = open("file.txt", "r")
print (file.read())
```

Files and Exceptions

Another way to read a file is to call a certain number of characters like in the following code the interpreter will read the first five characters of stored data and return it as a string:

```
# Python code to illustrate read() mode character wise
file = open("file.txt", "r")
print (file.read(5))
```

Files and Exceptions

Creating a file using write() mode

Let’s see how to create a file and how to write mode works, so in order to manipulate the file, write the following in your Python environment:

```
# Python code to create a file
file = open(‘myfile.txt','w')
file.write("This is the write command")
file.write("It allows us to write in a particular file")
file.close()
```

Files and Exceptions

Creating a file using append() mode

It is same as write mode but the previous content remains as it is and the new content appended at the end of the file

```
# Python code to illustrate append() mode
file = open('geek.txt', 'a')
file.write("This will add this line")
file.close()
```

Files and Exceptions

There are also various other commands in file handling that is used to handle various tasks like:

rstrip(): This function strips each line of a file off spaces from the right-hand side.

lstrip(): This function strips each line of a file off spaces from the left-hand side.

Files and Exceptions

Using write along with the with() function

We can also use the write function along with the with() function:

```
# Python code to illustrate with() alongwith write()
with open("file.txt", "w") as f:
            f.write("Hello World!!!")
```

split() using file handling

We can also split lines using file handling in Python. This splits the variable when space is encountered. You can also split using any characters as we wish. Here is the code:

```
# Python code to illustrate split() function
with open("file.text", "r") as file:
            data = file.readlines()
            for line in data:
                        word = line.split()
                        print (word)
```

Exceptions

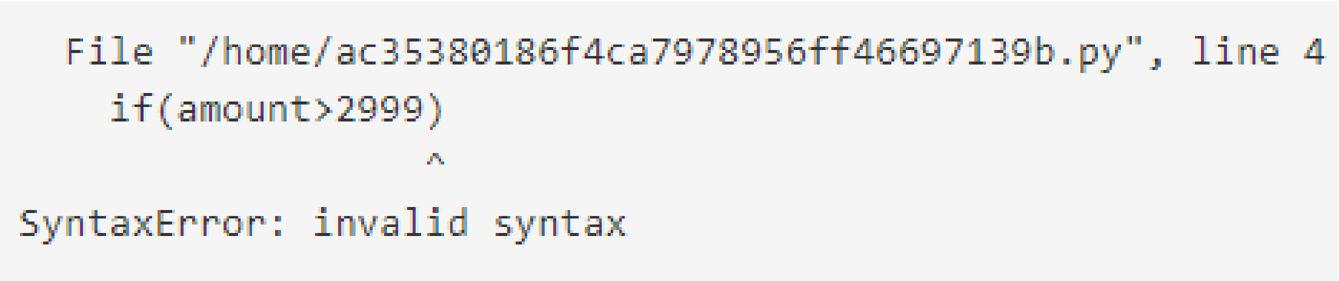
Error in Python can be of two types i.e. Syntax errors and Exceptions. Errors are the problems in a program due to which the program will stop the execution. On the other hand, exceptions are raised when some internal events occur which changes the normal flow of the program.

Difference between Syntax Error and Exceptions

Syntax Error: As the name suggests this error is caused by the wrong syntax in the code. It leads to the termination of the program.

```
# initialize the amount variable
amount = 10000

# check that You are eligible to
# purchase Dsa Self Paced or not
if(amount > 2999)
print("You are eligible to purchase Dsa Self Paced")
```



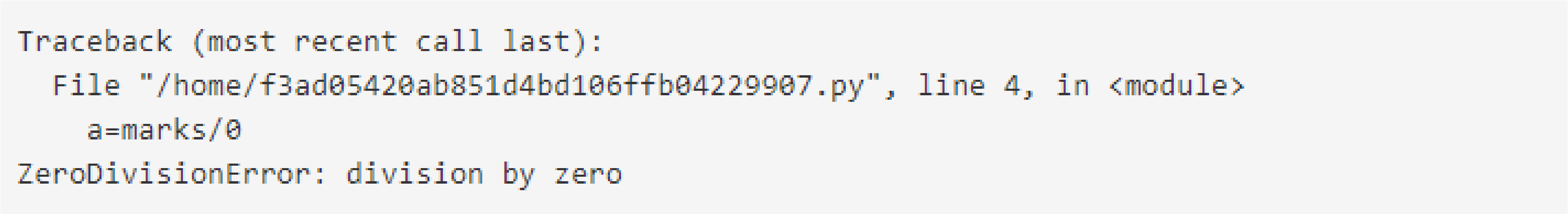
```
  File "/home/ac35380186f4ca7978956ff46697139b.py", line 4
    if(amount>2999)
                  ^
SyntaxError: invalid syntax
```

Exceptions

Exceptions: Exceptions are raised when the program is syntactically correct, but the code resulted in an error. This error does not stop the execution of the program, however, it changes the normal flow of the program.

```
# initialize the amount variable
marks = 10000

# perform division with 0
a = marks / 0
print(a)
```



```
Traceback (most recent call last):
  File "/home/f3ad05420ab851d4bd106ffb04229907.py", line 4, in <module>
    a=marks/0
ZeroDivisionError: division by zero
```

Exceptions

Try and Except Statement – Catching Exceptions

Try and except statements are used to catch and handle exceptions in Python. Statements that can raise exceptions are kept inside the try clause and the statements that handle the exception are written inside except clause.

```
# Python program to handle simple runtime error
#Python 3

a = [1, 2, 3]
try:
        print ("Second element = %d" %(a[1]))

        # Throws error since there are only 3 elements in array
        print ("Fourth element = %d" %(a[3]))

except:
        print ("An error occurred")
```

Output

```
Second element = 2
An error occurred
```

Exceptions

Catching specific exception in Python

```
# Program to handle multiple errors with one
# except statement
# Python 3

def fun(a):
    if a < 4:

        # throws ZeroDivisionError for a = 3
        b = a/(a-3)

    # throws NameError if a >= 4
    print("Value of b = ", b)
```

```
try:
    fun(3)
    fun(5)

# note that braces () are necessary here for
# multiple exceptions
except ZeroDivisionError:
    print("ZeroDivisionError Occurred and Handled")
except NameError:
    print("NameError Occurred and Handled")
```

The output above is so because as soon as python tries to access the value of b, NameError occurs.

Exceptions

Try with Else Clause

In python, you can also use the else clause on the try-except block which must be present after all the except clauses. The code enters the else block only if the try clause does not raise an exception.

```
# Program to depict else clause with try-except
# Python 3
# Function which returns a/b
def AbyB(a , b):
        try:
                c = ((a+b) / (a-b))
        except ZeroDivisionError:
                print ("a/b result in 0")
        else:
                print (c)

# Driver program to test above function
AbyB(2.0, 3.0)
AbyB(3.0, 3.0)
```

Output

```
-5.0 a/b result in 0
```

Exceptions

Finally Keyword in Python

Python provides a keyword finally, which is always executed after the try and except blocks. The final block always executes after normal termination of try block or after try block terminates due to some exception.

```
# Python program to demonstrate finally

# No exception Exception raised in try block
try:
        k = 5//0 # raises divide by zero exception.
        print(k)

# handles zerodivision exception
except ZeroDivisionError:
        print("Can't divide by zero")

finally:
        # this block is always executed
        # regardless of exception generation.
        print('This is always executed')
```

Output

```
Can't divide by zero
This is always executed
```

Exceptions

Raising Exception

The raise statement allows the programmer to force a specific exception to occur. The sole argument in raise indicates the exception to be raised. This must be either an exception instance or an exception class (a class that derives from Exception).

```
# Program to depict Raising Exception

try:
        raise NameError("Hi there") # Raise Error
except NameError:
        print ("An exception")
        raise # To determine whether the exception was
raised or not
```

```
Traceback (most recent call last): File
"/home/d6ec14ca595b97bff8d8034bbf212a9f.py", line
5, in <module> raise NameError("Hi there") # Raise
Error NameError: Hi there
```

Exceptions

Exception	Description
ArithmeticError	Raised when an error occurs in numeric calculations
AssertionError	Raised when an assert statement fails
AttributeError	Raised when attribute reference or assignment fails
Exception	Base class for all exceptions
EOFError	Raised when the input() method hits an "end of file" condition (EOF)
FloatingPointError	Raised when a floating point calculation fails
GeneratorExit	Raised when a generator is closed (with the close() method)
ImportError	Raised when an imported module does not exist
ValueError	Raised when there is a wrong value in a specified data type
ZeroDivisionError	Raised when the second operator in a division is zero

Exceptions

Exceptions

IndentationError	Raised when indentation is not correct
IndexError	Raised when an index of a sequence does not exist
KeyError	Raised when a key does not exist in a dictionary
KeyboardInterrupt	Raised when the user presses Ctrl+c, Ctrl+z or Delete
LookupError	Raised when errors raised cant be found
MemoryError	Raised when a program runs out of memory
NameError	Raised when a variable does not exist
NotImplementedError	Raised when an abstract method requires an inherited class to override the method
OSError	Raised when a system related operation causes an error
OverflowError	Raised when the result of a numeric calculation is too large
ReferenceError	Raised when a weak reference object does not exist

Exceptions

RuntimeError	Raised when an error occurs that do not belong to any specific exceptions
StopIteration	Raised when the next() method of an iterator has no further values
SyntaxError	Raised when a syntax error occurs
TabError	Raised when indentation consists of tabs or spaces
SystemError	Raised when a system error occurs
SystemExit	Raised when the sys.exit() function is called
TypeError	Raised when two different types are combined
UnboundLocalError	Raised when a local variable is referenced before assignment
UnicodeError	Raised when a unicode problem occurs
UnicodeEncodeError	Raised when a unicode encoding problem occurs