MASTER OF COMPUTER APPLICATIONS

SEMESTER 1

PYTHON PROGRAMMING

Unit 4

Functions and Modules

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1. INTRODUCTION

After going through the intricacies of control structures in Unit 3, where you learned how to steer the flow of your Python programs with conditional statements and loops, we're about to embark on an equally thrilling journey in Unit 4. Control structures laid the foundation for making decisions and repeating tasks, setting the stage for further modularizing and organizing code, which is precisely what we're diving into next.

Unit 4 explores the world of Functions and Modules in Python, a pivotal chapter in your journey in Python Programming. Functions are the building blocks of reusable code, allowing you to encapsulate tasks into neat, callable units. You'll learn not just to define your own functions but also to understand and leverage Python's rich assortment of built-in functions, elevating your code's efficiency and readability. Modules, on the other hand, bring a higher level of structure and organization, enabling you to group related functions and variables together, thereby making your code more modular and manageable. This unit doesn't stop at the basics; it goes on to explore the nuanced world of Python packages, providing you with the tools to organize larger projects into coherent, navigable structures.

To make the most of this unit, experiment with defining your own functions, both simple and complex, to solidify your understanding. Explore Python's standard library modules, and try importing them into your projects. As you progress, challenge yourself to organize your code into modules and packages, considering how best to structure your projects for clarity and ease of use. Remember, the aim is not just to learn but to apply these concepts in a way that enhances your coding projects, making them more modular, reusable, and, ultimately, more professional. Welcome to the transformative world of functions and modules!

1.1. Learning Objectives:

At the end of this unit, you will be able to:

- ❖ *Define and utilize Python functions to encapsulate code for reusability and improved readability.*
- ❖ *Differentiate between built-in, user-defined, and anonymous functions to select the most appropriate type for a given task.*
- ❖ *Apply the import statement to incorporate modules and enhance functionality with minimal code duplication.*
- ❖ *Organize code logically into modules and packages for better maintainability and scalability of Python projects.*
- ❖ *Evaluate and implement best practices for using virtual environments to manage project-specific dependencies efficiently.*

2. INTRODUCTION TO FUNCTIONS

Repetition in any type of code for any objective is very problematic, both for the programmer and the reader. Repetition of codes in any program makes the program unclear and rough. Even though the code works and completes the objective for which it was created, it still causes many problems and errors due to its unclear structure.

A structured code not only takes less space but is also very easy to read and interpret and generates fewer errors to deal with. Therefore, it was crucial to introduce a method that eliminates the use of codes multiple times in any program. Functions are created for this purpose. Once you understand something that has to be repeated multiple times in a program, you can simply define a function and call it multiple times in a program whenever you want that activity to be performed.

Efficient use of functions in a code can increase the effectiveness of that program. Whenever we set activities to be executed from time to time in a program, we create a function and assign that set of values to it along with a name. This way, whenever we need those sets of actions to be executed, we have to call that function and let it do the work.

Python programming language already has numerous built-in functions in its huge standard library such as sort(), title(), print(), range(), len(), and much more that makes programming fun and easy. You can also create your functions using the keyword def and assign the set of actions to it that you want to be executed.

The key to solving complex programs is to break them into smaller parts and tackle one part at a time. This method allows the programmer to focus on one task at a time and organize their code by creating small functions to carry out the tasks in an ordered manner. This eliminates the possibility of having a complex and difficult solution to an already complex problem. Functions make coding easier for programmers. This also ensures less error than usual.

2.1. Types of Functions

As we learned, functions are meant to carry out specific tasks in a given program when called for execution. They might need or do not need input at all. The function can either return a single value or multiple values. All this depends upon the type of function used in the program. There are three types of functions in Python, which are as follows:

Built-in functions

These types of functions are already built into Python. There are numerous functions pre-defined for the benefit of the programmers. Some examples for built-in functions in Python are print(), help(), len(), max(), min(), format(), input(), range(), type(), map(), reduce(), and filter().

- `print()`: This function is used to output data to the standard output device (screen).

  ```
  print("Hello, World!")
  ```

  This will output `Hello, World!` to the console.

- `help()`: This function is used to display the documentation of modules, functions, classes, keywords, etc.

  ```
  help(print)
  ```

  This will display the documentation of the `print` function.

- `len()`: This function returns the number of items (length) in an object. The argument can be a sequence (such as a string, bytes, tuple, list, or range) or a collection (such as a dictionary, set, or frozen set).

  ```
  print(len("Hello, World!"))
  ```

  This will output `13`.

- `max()`: This function returns the largest item in an iterable or the largest of two or more arguments.

  ```
  print(max(1, 2, 3, 4, 5))
  ```

  This will output `5`.

- `min()`: This function returns the smallest item in an iterable or the smallest of two or more arguments.

  ```
  print(min(1, 2, 3, 4, 5))
  ```

  This will output `1`.

- `format()`: This function formats specified values and insert them inside the string's placeholder. The placeholder is defined using curly braces: `{}`.

  ```
  print("Hello, {}!".format("World"))
  ```

  This will output `Hello, World!`.

- `input()`: This function allows user input.

  ```
  name = input("Enter your name: ")

  print("Hello, {}!".format(name))
  ```

  This program will ask for your name and then output `Hello, <Your Name>!`.

- `range()`: This function returns a sequence of numbers, starting from 0 by default, and increments by 1 (also by default), and stops before a specified number.

  ```
  for i in range(5):

  print(i)
  ```

  This will output the numbers `0` through `4`.

- `type()`: This function returns the type of the specified object.

  ```
  print(type(123))
  ```

  This will output `<class 'int'>`.

- `map()`: This function applies a given function to all items in an input list.

  ```
  numbers = [1, 2, 3, 4, 5]
  squared = list(map(lambda x: x ** 2, numbers))
  ```

```
print(squared)
```

This will output `[1, 4, 9, 16, 25]`, which are the squares of the numbers in the original list.

- `reduce()`: This function is a part of `functools` module. `reduce()` function is for performing some computation on a list and returning the result. It applies a rolling computation to sequential pairs of values in a list.

```
from functools import reduce
numbers = [1, 2, 3, 4, 5]
product = reduce((lambda x, y: x * y), numbers)
print(product)
```

This will output `120`, which is the product of the numbers in the list.

- `filter()`: This function constructs an iterator from elements of an iterable for which a function returns true.

```
    numbers = [1, 2, 3, 4, 5, 6]
    even_numbers = list(filter(lambda x: x % 2 == 0, numbers))
print(even_numbers)
```

This will output `[2, 4, 6]`, which are the even numbers from the original list.

User-Defined functions

These are the functions that the programmers create then and there at the start of programming to solve the present problem or perform any activity. We'll dive deeper on this topic in the upcoming sections.

Anonymous functions

Anonymous functions in Python are known as "lambda" functions. They are called "anonymous" because they are functions that are defined without a name. The syntax for a lambda function is as follows:

```
lambda parameters: expression
```

The parameters represent the input to the function.

The expression defines the operation to be executed.

Here’s an example using a lambda function to add two numbers:

```
add_numbers = lambda a, b: a + b

print(add_numbers(2, 3))  # Output: 5
```

Note that we assigned the lambda function to a variable (add_numbers) so we can easily invoke it.

Lambda functions are particularly useful when you need a small, concise function for a specific task. They’re commonly used with functions like map(), filter(), and reduce().

Example: A lambda function that returns the square of a number.

```
square = lambda x: x ** 2

print(square(5))  # Output: 25
```

In this example, `x` is the argument and `x ** 2` (x squared) is the expression.

For instance, you can use a lambda function to square all numbers in a list:

```
numbers = [1, 2, 3, 4, 5]
squared = list(map(lambda x: x ** 2, numbers))
print(squared)  # Output: [1, 4, 9, 16, 25]
```

In this example, the `map()` function applies the lambda function to each element of the list `numbers`, and returns a new list `squared` that contains the squares of the numbers.

2.2. Benefits of Function in Python

Several benefits of functions in Python is given below:

- Functions eliminate the repetition of code.
- It makes the codes reusable.
- It makes the code structured and manageable.

- Large work can be done in a few lines of code and using a function.
- The generation of errors is reduced with the length of the program.
- Codes are much easier to read if they are structured and simple.
- Clarity if the code is greatly increased.
- Functions make solving complex problems easy when divided and tackled in parts.

3. BUILT-IN FUNCTIONS

3.1. Date and Time

Time is a complex and crucial factor. It is one of the foundations of a structured world and universe. Without something like time to keep in check the events, the world will erupt into chaos and disorder. Not a single platform, organisation or country could move forward without order and structure. Therefore it is necessary to know how to implement date and time in any software, or service that you would be working at.

Python programming language has many built-in libraries in which date and time module are also present. Several built-in functions are present in the time module that are used to carry out different operations using time. These functions can do the conversion, representation and several other implementations that are necessary for life. Here are some terms listed out that you need to understand before knowing the functions.

To carry out these operations, we must be aware of the starting point. Epoch in Python corresponds to the measurement of time starting from January 1, 1970. Epoch is generally known as the starting point of the time.

The total number of seconds passed since epoch is referred to as seconds since the epoch. Leap seconds are not included in seconds since the epoch.

UTC is referred to as Coordinated Universal Time. This same term was known as Greenwich Mean Time or GMT.

The times presented in the output by these functions are in floating numbers. Let us discuss the functions from the time module one by one.

time.time()

The time.time() function returns the number of seconds passed after epoch. Suppose one needs to finds out the number of seconds passed since epoch(the beginning of time), then this function comes in handy. Simply apply the time.time() and get the results in a floating number. The syntax for this particular function is given below.

time.time()

An example of this can be seen below.

```
#applying the time.time() function and print the return
import time
seconds passed since epoch = time.time()
print(seconds passed since epoch)
```

In this particular example, the time module is imported from the built-in libraries of the Python programming language. The return of the function is stored and then printed to know the value of output. This is the most basic function of the time module.

time.localtime()

The function, time.localtime(), is used to convert the number of seconds elapsed since epoch and returns the value in local time using the function struct_time(). The syntax for the function is given below.

time.localtime([secs])

The parameter required for this function is optional. The parameter is in the form of integer or floating value. If secs is not specified for the function, then the current time will be calculated using the time.time() function. The return of this function is an object of class time.struct_time. An example for the above function is given below.

```
#applying the time.local time() function and print the return
import time
#no parameter will be provided in this example
object = time.localtime()
#print the object to verify the return type
print(object)
```

In this particular example, after importing the time module to use its function, an object is created to get the return in the localtime and the return is obtained by using the print function.

Since we get the output in the form of values returned through time.struct_time, it is important we know all the values of attributes used and know the terms more clearly. The table given below presents all the values in order.

Index	Attributes	Values
0	tm_year	example -1995, 2003 or 2015
1	tm_mon	1, 2, 3, ..., 12
2	tm_mday	1, 2, 3, ..., 31
3	tm_hour	0, 1, 2, ..., 23
4	tm_min	0, 1, 2, ..., 59
5	tm_sec	0, 1, 2, ..., 61
6	tm_wday	0, 1, 2, ..., 6; Monday: 0
7	tm_yday	1, 2, 3, ..., 366
8	tm_isdst	0, 1, or -1

You can use both the attributes and indices to access the above values for programs.

asctime()

The time.struct_time and the time.localtime() return values in tuple form. The asctime() function is used to convert the tuple returned from these functions to string form. The syntax can be seen below.

time.asctime([t])

The parameter t represents a tuple or a time.struct_time object that is returned by either time.localtime() or time.gmtime(). This is entirely optional and the default value of this parameter is the current time given by time.localtime(). The return type of the following function is presented in the form below.

Day Month Date Hour:Min:Sec Year

An example is presented below for a better understanding of the function.

```
#time module is imported first
import time

#parameter t is not given
```

```
#current time is given by time.localtime()

#conversion of current time (tuple) returned by time.localtime() to the form(string) Day Mon Date Hour:Min:Sec Year
str = time.asctime()
print(str)
```

The output of the given code is presented below.

```
Thu Apr 01 12:16:23 2021
```

This is a very good example to understand the function and working of this time function. The values that we obtain through time.struct_time object can be easily converted by the use of this simple function.

sleep()

During the execution of the program on any device, sometimes the flow of the program needs to stop for time being. The time is specified and for this purpose, the sleep() function is used.

It is a flexible and convenient way of halting a program for specific needs for the desired period. the syntax for this function is given below.

sleep(sec)

The parameter sec refers to the number of seconds the program has to be suspended. This parameter is necessary because, without it, Python will not know how many seconds the program has to be halted. The return for this function is nothing, void. It may seem like a useless function but it has any uses that will get know by looking at the examples given below.

```
#importing the time module
import time
#printing a sentence
print("This sentence is printed right now.")
#printing a sentence after 10 seconds
time.sleep(10)
```

```
print("This sentence is printed after 10 seconds.")
```

In this program, the first sentence will be printed immediately. however, there will be a delay of 10 secs before printing the second sentence. Let's look at some applications of this built-in function.

Creating date objects

Creating a date object means an object which represents a day, month and year. We can take the help of the date class to create a date object. Take a look at the examples given below to understand better.

```
#importing the time module
import time
#creating a date object x
x = datetime.date(2021, 1, 4)
#printing the variable x
print(x)
```

The output will be as follows.

```
2021-01-04
```

In this example, the date object is created from the date class and stored in a variable. The date contains three arguments, that is, day, month, and year. you have to note that the variable x here is the date object that is created using the date class and the date constructor.

We can also import the date class from the DateTime module as demonstrated below.

```
#importing the date class from the DateTime module
from DateTime import date
#creating a date object y
y = date(2021, 2, 4)
#printing the output
print(y)
```

There is also a second method you can use for creating the date objects to get the current date. You can take the help of the classmethod named today() for that purpose. Let us take a look at how can we do it.

```
#importing the date class from the DateTime module
from datetime import date
t = date.today()
print("The current date", t)
```

In this example, the output will be the current date.

You can create date objects with these methods as required in your program. You must not forget to import the modules require or Python will generate an error because it will not recognize the functions.

Comparison of two dates

Two variables are compared with the help of comparison operators. The comparison operators are <, >. =, <=, >=, !=, and so on. The most basic condition to compare two objects is that they should belong to the same group. For example, you cannot compare a string and a number, or a list or a number. Comparison is done between the elements of the same group.

Let us look through some examples to know more about the comparison of the two dates.

```
#import datetime module
import datetime

#create dates in the format (dd/mm/yyyy)
x = datetime.datetime(2021, 3, 2)
y = datetime.datetime(2021, 5, 2)

#comparison of the dates
a = x > y
b = x < y
c = x != y
```

```
#print the values
print("x is greater than y:", a)
print("x is less than y:", b)
print("x is not equals to y:", c)
```

The output of the above program will be the boolean values and is demonstrated below.

```
x is greater than y: TRUE

x is less than y: FALSE

x is not equal to y: TRUE
```

You can also sort the dates and put them into a list or tuple. Comparison operators make this easy.

3.2. Miscellaneous Functions

There are numerous built-in functions in various classes and methods, each one useful in its way. Still some functions are used for several different tasks and they are discussed below one by one.

abs()

This function is used to present the absolute value of the given number. The syntax for the abs() function is given below.

```
abs(num)
```

The parameter num (which can be a floating-point number, complex number, or an integer) is given by the programmer to the function. abs() will then take out the absolute value of the number and display the output to the programmer.

For integers and floating-point numbers, the function displays the absolute value. In the case of complex numbers, it returns the magnitude part of the complex number to the user. An example of the use of the function is presented below.

```
#enter a floating point number
float =  -87.03
```

```
#print the absolute value
print("The absolute value of the floating number is:", abs(float))

#enter an integer
integer =  67

#print the absolute value
print("The absolute value of the integer is:", abs(integer))

#enter a complex number
complex =  4 + 3j

#print the absolute value
print("The absolute value of the complex number is:", abs(complex))
```

Output

```
The absolute value of the floating number is: 87.03

The absolute value of the integer is: 67

The absolute value of the complex number is: 5.0
```

all()

The all() function returns the boolean value

- TRUE if all the present elements are TRUE and
- FALSE if all the present elements are FALSE

The syntax of all() function is given below.

```
all(iterable)
```

As shown, the parameter used can be the elements of a list, tuple, dictionary, or string.

Truth Table for all() function:

When	Return Value
All are true	TRUE
All are false	FALSE
Only one is true	FALSE
Only one is false	FALSE
Empty	TRUE

Example of all() function for strings:

```
#create a set
set1 = {1, 0, 0, 0 ,1}
a = all(set1)
print(a)
```

The output of the above code will be boolean value FALSE.

bin()

The bin() function converts the decimal number into a binary number which is a very important task in Python. This function comes in handy when we want to do a quick conversion for any program or code. it reduces the length of the code and any complex codes that are required for this conversion.

The syntax for this function is given below.

```
bin(num)
```

The num parameter can be any integer that has to be converted to a binary number for some operation. The return value is in the type of a binary string of integer values. Error is raised when a floating-point number is given in the argument. Let us look at an example for this function.

```
#function returning string
def binary(a):
    x = bin(a)
```

```
print("The binary number obtained from the conversion is:", binary(2))
```

The output of the following code is given below.

```
0b10
```

In the output, "b" represents binary

bool()

The bool() functions either return a boolean value or converts the given value to a boolean value. The syntax for the boolean value is given below.

```
bool([x])
```

This function requires a single parameter that is evaluated to give the results awaited. If nothing is passed as a parameter to the function then the default value, that is, FALSE is printed. The function does one of the two things after receiving the parameter:

- It prints TRUE if the parameter given by the programmer is TRUE.
- It prints FALSE if the parameter given by the programmer is FALSE.

Some of the conditions for which this function returns FALSE is listed below. Other than these, it returns the boolean value TRUE.

- nothing is passed as a parameter.
- a false value is passed to the function.
- zero is passed in any form to the function.
- empty values are passed such as (), {}, [], etc.
- objects of classes returning 0 or FALSE.

Take a look at the example given below.

```
#create string
str = "I can code very well."
print(bool(str))
```

The output of the above code is given below.

```
TRUE
```

bytes()

Interconversion of data types in Python can be done by using the bytes() function. It is useful for converting data types using its coding schemes. it converts the given object into an immutable object of the right size and data. The syntax for the bytes() function is given below.

```
bytes(source, encoding, errors)
```

The parameter source is the object which is to be converted. Encoding is the parameter that is required for the object in the string. The error provides the method to handle the errors generated if the conversion is not successful. It returns an immutable object in Unicode characters according to the source type. Look at the example given below.

```
#create a string
str = "Python is the best"
x = bytes(string, 'utf-8')
print (x)
```

The output for the above code is given below.

```
CPython is the best.
```

callable()

Callable is a term that means something that can be called. In Python, the callable() function returns the boolean value TRUE if the argument appears callable and FALSE if it does not. The syntax for this function is given below.

```
callable(object)
```

The object passed into the function is checked whether it is callable or not and then the corresponding boolean value is returned.

Check out the below example to know the task of this function.

```
def func():
    return 10

# an object is created of func()
let = func
print(callable(let))

# a test variable
num = 5 * 10
print(callable(num))
```

The output is given below.

```
TRUE

FALSE
```

compile()

Can you remember when you used to compile the source code in C language and then the code was executed? This function does the same thing. It takes in a source code and returns a code object which will be ready for execution. The syntax for this function is presented below.

compile(source, filename, mode, flags=0, dont_inherit=False, optimize=-1)

The parameters are discussed below.

- The source can be a string, a byte string, or an AST object.
- The filename is the file from which you read the code and name you can give yourself.
- The mode can be either eval, exec, or single.

  Eval: single expression containing the source.

  Exec: a set of code containing statements, functions, class, and so on.

  Single: a single Python statement

- Flags are optional and take care of the future statements that are likely to affect the compilation of the source.
- Optimize(optional) provides the optimization level of the compiler.

Here is an example of this function.

x = 20

# eval is used for single statement

a = compile('x', 'test', 'single')

exec(a)

The output is as follows.

20

exec()

This function in Python is responsible for the dynamic execution of the program for either string or object code. the syntax for these functions is given below.

exec(object, globals, locals)

The object parameter can be a string or object code. Globals is optional and can be a dictionary. Locals are also optional and can be a mapping object.

prog = 'print("The sum of 3 and 17 is", (3+17))'

exec(prog)

The output is as follows.

20

sum()

This function is the most used and common. It returns the sum of the elements(numbers) in a list, tuple, dictionary, or any set. the syntax is presented below.

```
sum(iterable, start)
```

The iterable refers to the elements present in the set, list, tuple, or dictionary. The tables should be numbers only. The start is optional and is added to the sum of the iterables. The default value is 0 if anything is not given. The example is given below.

```
numbers = [1,2,5]
Sum = sum(numbers)
print(Sum)
Sum1 = sum(numbers, 10)
print(Sum1)
```

The output is given below.

```
8

18
```

any()

The any() returns the boolean value TRUE for even a single true element in the iterable and FALSE if all the elements in the iterable are false. The syntax for the given function is presented below.

```
any(iterable)
```

The iterable can be a set, list, dictionary, or tuple. Let us look at the given example.

ascii()

This function returns a string of representation of the object and escapes the non-ASCII characters in the string using \x, \u or \U escapes. The syntax of the function is given below.

```
ascii(object)
```

The object is iterable of which printable representation is returned.

For example for the input:

```
ascii("µ")
```

Output :

```
'\xb5'
```

help()

This function is used to display the documentation of the functions, keywords, module, or classes, etc. The syntax of the function is given below

```
help([object])
```

4. USER DEFINED FUNCTIONS

Now that we have covered the concept, types, and benefits of the functions, let's move on to the next section. By creating a function, in Python we mean defining the function. To define a function, the def keyword is used. It marks the start of the function header. You have to take care of indentation while defining the function in Python. It will immediately raise an error if the indentation of the function is off even a bit.

Whenever you define a function, you have to name it to call it in the program. The name of the function has to be unique because this name will identify the function in the program. You have to follow the naming conventions for naming a function as follows:

- The keywords defined in Python cannot be used as a name for any function.
- Spaces are not allowed in naming a function.
- The first character can be the uppercase alphabet, lowercase alphabet, or "_" character.
- The next characters can be the combination of uppercase, lowercase alphabet, numbers, or "_" character.
- Remember that special characters such as "$," "#," "%," "!", "@" are not allowed in the naming of the function.

The next important thing in defining a function is the parameter or the input which is passed or given to the function(this is optional). Then comes the ":" colon that marks the end of the function header.

Now comes the body where you can write some python statements to allocate some action to the function. Remember that all the statements inside the body of the function must have the same indentation level. Python places heavy emphasis on indentation therefore, you should take extra care on this part.

Syntax for defining the function is:

```
#defining a function
def func_name(par1, par2):
    #define the action of the function(optional)
    statement(s)
```

A return statement to get a return value from the function is also optional but is very useful.

Example [Without Parameters]:

```
# Define a function that prints a greeting message
def greet():
  print("Hello, world!")

# Call the function
greet()
```

Example [With Parameters0:

```
# Define a function that takes two numbers as parameters and returns their sum
def add(x, y):
  return x + y

# Call the function with 3 and 5 as arguments and print the result
print(add(3, 5))
```

4.1. Calling a Function

When it is time to execute a function you have created, you call it. Invoking a function is used to execute the specific activities that have been defined within it. When you invoke a function, the program's control is transferred to that function temporarily. The function has control over the execution of the programme. Upon completion of the duties specified within the function, the program will go to the next line following the function call.

To call any function, you must use the unique name used to define the function. Type the name of the function and provide values of the parameters, if any. This will prompt the function to take control of the program for that time and execute the commands given in the body of the function.

The syntax for calling a function is given below:

```
#calling a function defined in the previous section
```

```
func_name(val1, val2)
```

The expression present inside the statement gets assessed and then a value is returned when the function is called. This will activate the series of commands associated with the function created with this name.

Example:

```
#defining of function
def func_new():
    print('I was invisible and now I am visible.')

#calling of function
func_new()
```

Output is as follows:

```
I was invisible and now I am visible.
```

4.2. Return Statement of a Function

Return statement in a function is the way to exit the function when needed and go back to the initial call line. The syntax for return is given below.

```
#writing the return statement
return [expression]
```

The use of a return statement in defining a function is optional and depends on the tasks required to be done. The return statement can be used several times depending on the complexity of the problem. An example is given below for you to understand the use of the return statement better.

Example 1:

```
#when no return is given
def praise(name):
    “”” this function praises the person whose name is passed as a parameter”””
    print(“Well done” + name + “!”)
```

```
#calling the function to praise ‘Tanmay.’
praise(‘Tanmay’)
```

The output of the given code is as follows:

```
Well done Tanmay!
```

Example .2:

```
#when return statement is present
def mod(number):
#this fuction returns the mod values of any number
   if number >= 0:
      return number
   else :
      return -number
print(mod(4))
print(mod(-5))
#calling the mod function
mod(4)
mod(-5)
```

The output of the above code is as follows:

```
4
5
```

4.3. Parameters in a Function

The parameter is the unbound variable used in defining the function. People often get confused about the difference between the parameter and the argument. If you define a function like def func(name), then the name is the parameter, whereas when you call the function, then the actual values used for the parameter is known as the argument. Parameters can appear in the function's body, whereas when the function is called, then the argument or the specific value given by the programmer takes its place in processing for the output.

There is no rule to limit the number of parameters to be present in a function. One can have as many parameters in the function as required. The main function of parameter variables is to transfer arguments in the function. There are two types of parameters in functions:

- Input parameter: They transfer the absolute values given by the user to the functions.
- Output/Return parameter: They return multiple values from the function but are not used very frequently because they confuse.

Several parameters or a parameter list explain the types of values or arguments a function will receive.

Example:

```
#defining a function
def func_new1(obj):
    print("I have a" + obj)

#calling the function
func_new1("computer")
```

Output of the above code :

```
I have a computer
```

4.4. Call By Reference

The Python programming language uses the 'Call by Object Reference' or 'Call by Assignment'. When mutable arguments are passed into the functions, meaning that the values can be changed in the functions and the change will be reflected in the output, then it is called call by reference. Let us see an example for the same to get a clear idea of the concept.

Example:

```
#demonstration of call by reference
def add(list):
    mylist.append(10)
    print("List inside functions:",list)
mylist=[2,4,6,8]
add(mylist)
print("List outside the function:",mylist)
```

The output is as follows:

```
List inside the function: [2,4,6,8,10]
List outside the function: [2,4,6,8,10]
```

You already know that we can add items to a list after it is made. Thus, we called it by reference to add the number. The changed list was reflected in the output.

4.5. Variable-Length Functions

You may need to put variable amounts of argument in a function that you are defining. A particular operator can be used in declaring a parameter that allows a variable number of arguments. That operator is an asterisk "*." There are two types of parameters in a function that allows a variable number of arguments. One will accept the numerous variable arguments that will be eventually stored in a tuple The other parameter will accept the variable number of arguments and the key for every value given as input when the function is called. The other one stores the keys and the values in a dictionary.

Let us talk about the first type here, and we can discuss the second type of parameter in the next section. In the first type, we use to put the asterisk in front of the parameter or use the standard parameter *argsto accept variable amounts of arguments. The syntax for this can be seen below.

Example:

```
def func_name( *args ):
    #body of the function
```

Let’s see an example to understand this concept.

```
def biggest_number(*num):
     #this function returns the biggest number
```

```
    return max(num)

#calling the function
print(biggest_number(33,66))
print(biggest_number(7,99,82,44))
print(biggest_number(55,93,30,65,72,32))
```

The output is as follows:

```
66
99
93
```

4.6. Keyword and Variable arguments

The Keyword and variables Arguments or **kwargs is the second type of parameter that we discussed in the previous section. By using this parameter, we can accept both the variable amounts of arguments and the key to every argument. Only arguments will not be allowed into the function if this type of parameter is used. A key to each argument should also be given, and else it will not be accepted. Take a look at the example for keywords arguments given below.

Example:

```
#using keyword argument
def func(name, activity):
    “””this function tells which person is doing what at the moment”””
    print(name + “is” + activity)
#calling the function
func(name = “Arya”, activity  = “dancing” )
func(name = “Ananya”, activity  = “singing” )
func(name = “Aditya”, activity  = “playing” )
```

The output is as follows:

```
Arya is dancing
```

Ananya is singing

Aditya is playing

5. IMPORT STATEMENT

The import statement is a critical feature in Python, allowing for the modularisation of code by importing modules and their functionalities into your script. This facilitates code reuse, improves program structure, and grants access to a vast ecosystem of standard and third-party libraries.

When you import a module, Python searches for the module in a specific set of locations:

1. The directory of the script you are running.
2. The directories listed in the PYTHONPATH environment variable, if set.
3. The standard library directories.
4. The site-packages directory for third-party packages.

The search order forms the basis of Python's module resolution protocol.

5.1. Import Variants

1. Basic Import: Importing a module in its entirety makes all its attributes accessible using the dot notation.
   ```
   import math
   print(math.pi)  # Accessing the pi constant from the math module
   ```

2. Import with Alias: Simplifies module references, particularly useful for modules with long names or to avoid naming conflicts.
   ```
   import numpy as np
   array = np.array([1, 2, 3])  # Using an alias for numpy
   ```

3. Selective Import: Imports specific attributes from a module, reducing memory usage and improving readability.
   ```
   from datetime import datetime
   current_time = datetime.now()  # No need to prefix with datetime.
   ```

4. Wildcard Import:

Wildcard imports in Python use the syntax from module import *, allowing all symbols (functions, variables, classes, etc.) defined in a module to be imported directly into the importing module's symbol table. While convenient, wildcard imports should be used judiciously due to several important considerations.

Syntax and Usage

from math import *

After this import statement, you can directly use any function or variable from the math module without the math. prefix.

Considerations and Drawbacks

1. Namespace Pollution: Wildcard imports add all public symbols from the imported module into the local namespace, which can lead to an overcrowded namespace, making it harder to track the origin of various symbols.
2. Readability and Maintainability: With wildcard imports, it becomes unclear which names in the code are coming from the imported module, reducing code readability and making maintenance more challenging.
3. Overriding Existing Names: If the imported module contains names that match those in the local namespace, the local names will be overridden, potentially leading to unexpected behavior.
4. Difficulty in Identifying Dependencies: Wildcard imports obscure which specific functions or classes are actually needed from the module, complicating the task of understanding module dependencies.

Appropriate Use Cases

Despite the drawbacks, there are situations where wildcard imports might be appropriate:

- Interactive Sessions: In a Python shell or Jupyter notebook, for exploratory data analysis or quick testing, where convenience outweighs the need for namespace cleanliness.
- Module Internal Use: Within a module, to aggregate functions from sub-modules in the module's __init__.py, simplifying the import path for users of your module.

Example

Without wildcard import:

```
import math

result = math.sqrt(16) + math.cos(math.pi)
```

With wildcard import:

```
from math import *

result = sqrt(16) + cos(pi)
```

4.2. Module Reloading

In development, especially in interactive sessions, changes to module source code won't be reflected in the session without reloading the module. This is where importlib.reload() comes into play:

```
import importlib
import my_module
importlib.reload(my_module)  # Reloads 'my_module' after source code changes
```

4.3. Handling Import Errors

Using a try-except block can gracefully handle scenarios where an import might fail, perhaps due to missing third-party libraries:

```
try:
    import pandas as pd
except ImportError:
    print("Pandas library not found. Install using pip to proceed.")
```

4.4. The __name__ Attribute

When a module is imported, Python sets the __name__ attribute of the module to its name. However, in the script that is run directly, __name__ is set to '__main__'. This allows for a common pattern to execute some code only if the file was run directly, not when imported:

```
# my_module.py
def main():
    print("This is a script, not a module.")


if __name__ == '__main__':
    main()
```

4.5. Best Practices for Using Import Statements

- Keep all import statements at the top of the file for visibility.
- Use full names or meaningful aliases for clarity and maintenance.
- Prefer selective imports to improve readability and performance.
- Avoid wildcard imports in larger scripts to prevent namespace conflicts.
- Use try-except blocks to manage optional dependencies gracefully.

The import statement is a powerful tool in Python, enhancing modularity and code organization. By understanding its nuances and adhering to best practices, you can leverage external libraries and modules efficiently, making your Python projects more functional and maintainable.

6. MODULES AND PACKAGES

Modules and packages are the backbone of Python's approach to modular programming, allowing developers to organize and reuse their code efficiently. This section dives deeper into creating, using, and understanding modules and packages in Python.

6.1. Modules

Modules in Python are a key concept for code reusability and organization. A module is essentially a file containing Python definitions, functions, classes, and variables. Creating and using modules allows you to logically organize your Python code, making it more readable and maintainable.

Creating a Module

To create a module in Python, you simply need to save your Python code into a file with a .py extension. This file can contain function definitions, class definitions, variables, and runnable code.

Example: Let's create a simple module named calculator.py that contains basic arithmetic functions.

```
# calculator.py

def add(a, b):
    """Return the sum of a and b."""
    return a + b

def subtract(a, b):
    """Return the difference between a and b."""
    return a - b

def multiply(a, b):
    """Return the product of a and b."""
    return a * b
```

```
def divide(a, b):
    """Return a divided by b."""
    if b == 0:
        raise ValueError("Cannot divide by zero.")
    return a / b
```

In this example, calculator.py is our module, and it defines four functions: add, subtract, multiply, and divide.

Using a Module

Once you have created a module, you can use it in other Python scripts by importing it with the import statement. When you import a module, Python executes the module and makes its functions, classes, and variables available in the importing script.

Importing the Entire Module: Use the import statement followed by the module name (without the .py extension).

```
# main.py

import calculator

# Use functions from the calculator module
result = calculator.add(10, 5)
print("10 + 5 =", result)

result = calculator.divide(10, 2)
print("10 / 2 =", result)
```

Selective Import: You can also choose to import specific attributes from a module using the from ... import ... syntax. This allows you to use the imported items directly without prefixing them with the module name.

```
# main.py
```

```
from calculator import add, subtract

# Directly use the imported functions
result = add(20, 15)
print("20 + 15 =", result)

result = subtract(20, 5)
print("20 - 5 =", result)
```

Module Search Path

When you import a module, Python searches for the module in the following locations, in order:

1. The directory from which the input script was run or the current directory if interactive.
2. The list of directories contained in the PYTHONPATH environment variable, if set.
3. The list of standard library directories.
4. The site-packages directory for third-party packages.

If Python cannot find the module in any of these locations, an ImportError is raised.

Best Practices for Creating Modules

- **Modularity:** Keep your modules focused on a specific aspect of your program's functionality. Each module should provide a coherent set of related functions, classes, or variables.
- **Naming Conventions:** Use short, lowercase names for modules and underscore_separation for multi-word names. This improves readability and follows Python's naming conventions.
- **Documentation:** Document your modules, functions, and classes using docstrings. This helps other developers (and future you) understand the purpose and usage of your module.

- **Testing:** Include unit tests for your modules to ensure reliability and ease of maintenance. Python's built-in unittest framework can be helpful for this purpose.

6.2. Packages

Packages in Python are a way of structuring Python's module namespace by using "dotted module names". A package can be composed of modules and subpackages, creating a hierarchy that organizes modules in a clear and consistent manner. This hierarchical structure makes it easier to manage and scale large applications by grouping related modules together.

Basic Concepts of Packages

A package in Python is essentially a directory that contains a special file named __init__.py, along with one or more module files and, potentially, other subdirectories (subpackages). The presence of the __init__.py file signifies to Python that the directory should be treated as a package. This file can be empty, or it can contain valid Python code that initializes the package.

Example: Consider a package named my_project structured as follows:

```
my_project/
  __init__.py
  module_a.py
  module_b.py
  sub_package/
    __init__.py
    module_c.py
```

In this example, my_project is the package, module_a and module_b are modules within the package, and sub_package is a subpackage containing module_c.

Creating a Package

1. Create a Directory: Start by creating a directory for your package. The name of this directory will be the name of your package.

2. Add __init__.py: Inside the package directory, create an __init__.py file. This file can be left empty or include initialization code for your package.
3. Add Modules: Add Python files (module_a.py, module_b.py, etc.) to your package directory. Each file represents a module within your package.
4. Subpackages: If your package is complex, you can create subdirectories (subpackages) inside your package directory, each with its own __init__.py file and modules.

Using Packages

Packages allow you to import modules and their contents in a hierarchical manner, which helps in keeping the namespace organized.

- Importing a Module from a Package: Use the dot (.) notation to import a module from a package:

  import my_project.module_a

  You can then access functions and variables within module_a using the dot notation.

- Selective Import from a Package: If you only need specific functions or classes from a module within a package, you can use the from ... import ... syntax for a more concise import:

  from my_project.module_b import some_function

- Importing Subpackages: You can import modules from subpackages using the same dot notation extended to include the subpackage:

  from my_project.sub_package import module_c

Package Initialization

The __init__.py files in packages and subpackages can include initialization code that runs during the package import process. This can be used to set up package-level data, import specific modules or classes into the package's namespace, or perform any initialization tasks required by the package.

Best Practices for Organizing Packages

- Logical Structure: Organize your modules and subpackages in a way that reflects their logical relationships and functionalities.
- Avoid Deep Nesting: While packages can nest subpackages to arbitrary depths, deep nesting can make your package structure complicated and harder to navigate. Aim for a balance between flat and deeply nested structures.
- Use Clear Naming: Names of packages, modules, and subpackages should be clear and descriptive, following Python's naming conventions.
- Document Your Packages: Provide clear documentation for your packages, including descriptions of modules, classes, and functions. This will help users and future maintainers understand the structure and purpose of your package.

6.3. Absolute vs. Relative Imports in Python

In Python, modules can be imported using either absolute or relative paths. The choice between absolute and relative imports often depends on the project's structure, readability, and maintainability preferences.

Absolute Imports

Absolute imports use the full path (from the project's root folder) to the module or package being imported. They are clear and straightforward, making it easy to tell exactly where the imported module resides in the project hierarchy.

Advantages:

- Clarity: Absolute imports explicitly show the path to the module, making it easier to understand where the imported module comes from.
- Consistency: They work the same way regardless of where the import statement is executed, leading to fewer surprises.
- Less Ambiguity: Absolute imports reduce the risk of namespace conflicts, especially in large projects with deep directory structures.

Example:

Suppose you have the following project structure:

```
project/
  package/
    __init__.py
    module_a.py
  main.py
```

To import module_a in main.py, you would use:

```
# main.py
from package import module_a
```

Relative Imports

Relative imports use the relative path from the current module to the module being imported. They start with one or more dots (.), where each dot represents a level up in the directory structure.

Advantages:

- Conciseness: Relative imports can be shorter, especially in deeply nested package structures.
- Package Portability: They make it easier to move the entire package to a different location or project without modifying import statements.
- Disadvantages:
- Potential for Confusion: Relative imports can become confusing in complex project structures, making it less clear where the imported module is located.
- Limitations: They cannot be used in a script intended to be executed as the main module. Python 3 does not allow relative imports in a module that's run directly.

Example:

Given the same project structure as above, if module_a wants to import something from a sibling module module_b located in the same package, you could use:

```
# module_a.py
from . import module_b  # Importing sibling module 'module_b'
```

Or, to import from the parent package:

```
# module_a.py
from ..package import another_module  # Importing from a parent package
```

Choosing Between Absolute and Relative Imports

- Project Size and Complexity: For small projects, absolute imports usually suffice and provide clarity. As projects grow and develop deep package structures, relative imports may help reduce verbosity.
- Maintainability and Readability: Absolute imports tend to be more readable and maintainable, especially for new developers joining a project.
- Portability: If you plan to package your project for distribution and foresee the need to restructure your package hierarchy, relative imports can offer more flexibility.

6.4. Organizing Large Projects

For larger Python projects, organizing your code into a well-defined package structure is not just beneficial—it's necessary for maintainability, scalability, and collaboration. As your project grows, a flat module structure becomes unwieldy. Adopting a hierarchical package structure, where related modules are grouped into sub-packages, enhances modularity and clarity.

Structuring Your Project

- Top-Level Packages: At the top level, define packages that represent broad areas of your project's functionality. For example, a web application might have authentication, database, api, and frontend packages.
- Sub-Packages: Within each top-level package, further divide your modules into sub-packages that represent more specific functionalities or components. For instance, the database package could include models, schemas, and migrations sub-packages.
- __init__.py Files: Use __init__.py files not only to mark directories as Python packages but also to simplify imports and define a clear public API for each package. You can import specific classes and functions in __init__.py to allow them to be accessed directly from the package level.

Example:

Consider a project structure for a web application:

```
my_web_app/
    authentication/
        __init__.py
        login.py
        register.py
    database/
        __init__.py
        models/
            __init__.py
            user.py
            product.py
        connection.py
    api/
        __init__.py
        user_api.py
        product_api.py
    frontend/
        __init__.py
        templates/
        static/
```

In this structure, each functional area of the application is encapsulated within its package, promoting separation of concerns and making the codebase easier to navigate.

6.5. Distributing Packages

Distributing Python packages allows other developers to easily reuse your code. The Python Package Index (PyPI) serves as a repository for Python packages, facilitating their distribution. Packaging and distributing involve several steps, primarily centered around the setuptools library.

Creating a setup.py File

The setup.py file is the build script for setuptools. It tells setuptools about your package (its name, version, description, dependencies, etc.).

Example setup.py:

```
from setuptools import setup, find_packages

setup(
    name='my_web_app',
    version='0.1.0',
    author='Your Name',
    author_email='your.email@example.com',
    packages=find_packages(),
    install_requires=['flask', 'sqlalchemy', 'requests'],  # External dependencies
    entry_points={
        'console_scripts': [
            'my_web_app = my_web_app.main:main',
        ],
    },
)
```

Uploading to PyPI

After defining setup.py, use twine to upload your package to PyPI:

```
twine upload dist/*
```

This makes your package installable via pip install my_web_app.

6.6. Virtual Environments and Dependencies

Virtual environments in Python are self-contained directories that contain all the necessary executables and packages for a particular project. Using virtual environments (venv or virtualenv) ensures that each project has its own set of dependencies, avoiding conflicts between projects.

Creating a Virtual Environment:

```
python -m venv my_project_env
```

Activating the Virtual Environment:

- On Unix or MacOS: source my_project_env/bin/activate
- On Windows: my_project_env\Scripts\activate

With the environment activated, any Python or pip commands will use the versions contained within the environment, keeping dependencies project-specific.

Leveraging Standard Library Modules

Python's standard library is a treasure trove of modules that can perform a wide variety of tasks—file I/O (os, io), networking (socket, http), date/time manipulation (datetime), and more. Before you start coding a solution from scratch, review the standard library documentation. Chances are, Python includes something that meets your needs.

Example Usage:

To read and write JSON data, instead of implementing your own parser, use the json module:

```
import json

# Convert a Python dictionary to a JSON string
user_data = {"name": "John Doe", "age": 30}
json_string = json.dumps(user_data)

# Convert a JSON string back to a Python dictionary
user_data_parsed = json.loads(json_string)
```

This approach not only saves development time but also ensures that you're using well-tested, efficient implementations.

The effective use of modules and packages in Python is fundamental to building scalable, maintainable, and organized codebases, especially as projects grow in complexity. Modules allow for the segregation of functionalities into logical, reusable components, while packages offer a hierarchical structure to group these modules, enhancing project organization and readability.

7. SUMMARY

This unit delved into the critical concepts of Functions and Modules in Python, offering a comprehensive guide to enhancing code reusability, organization, and scalability. The unit begins with an introduction to functions, explaining their necessity for avoiding code repetition and ensuring clear, manageable programs. It distinguishes between built-in functions provided by Python's extensive standard library and user-defined functions that programmers create to tackle specific problems. The discussion extends to anonymous functions or lambda functions, showcasing their utility in concise code writing, especially when used with map(), filter(), and reduce() functions.

The unit progresses to defining and calling functions, underscoring the importance of parameters (arguments) and the return statement to pass data and receive output from functions. The concept of variable-length arguments (*args and **kwargs) is introduced, enabling functions to accept an arbitrary number of arguments, thus offering greater flexibility.

Scope of variables is covered to clarify local and global variable distinctions and their accessibility within different parts of a program. This section is pivotal for understanding how variables are bound and how their values are maintained across various segments of code.

The unit then explores the import statement, a key feature for leveraging Python's modularity by incorporating modules into scripts. This segment elucidates different import techniques, including importing entire modules, specific attributes, and using aliases for convenience and clarity. The discussion on wildcard imports and the importlib module provides insights into advanced importing strategies and dynamic module reloading.

Modules and Packages, the cornerstone of Python's approach to modular programming, are thoroughly examined. This part guides on creating custom modules by saving Python code in .py files and using them in other scripts through the import statement. It emphasizes organizing code into packages, a hierarchical structure of modules, to manage complex projects efficiently. Best practices for creating modules and packages, such as maintaining modularity, adhering to naming conventions, and documenting code, are highlighted to encourage writing clean, maintainable, and scalable code.

Finally, the unit addresses organizing large projects, distributing packages via PyPI, leveraging virtual environments for dependency management, and making the most of Python's standard library. These advanced topics prepare learners to handle larger Python projects with ease, ensuring code is not just functional but also well-structured and aligned with professional standards.

8. GLOSSARY

- Functions: Blocks of organized, reusable code designed to perform a single, related action. Functions enhance code reusability and clarity.
- Built-in Functions: Predefined functions in Python's standard library, such as print(), len(), and range(), available without the need for import statements.
- User-Defined Functions: Functions created by programmers using the def keyword to perform specific tasks tailored to their program's requirements.
- Lambda Functions: Anonymous functions defined with the lambda keyword, used for creating small, one-time, and inline function objects in Python.
- Parameters (Arguments): Values passed to a function to influence its operation. Parameters are defined in the function's declaration, while arguments are the actual values provided during function calls.
- Return Statement: Used in a function to send the function's result back to the caller and terminate the execution of the function.
- Variable-Length Arguments: Special parameters (*args for non-keyword arguments and **kwargs for keyword arguments) that allow functions to accept an arbitrary number of arguments.
- Scope of Variables: Determines the part of a program where variables can be accessed. Python has local and global scopes, defining variable accessibility within functions and throughout the program, respectively.
- Import Statement: Used to include the functionality of a module into your script, making its functions, classes, and attributes available for use.
- Modules: Files containing Python definitions and statements. A module can define functions, classes, and variables intended to be used in other Python programs.
- Packages: Directories of Python modules containing an __init__.py file, used to organize modules into a hierarchical namespace, facilitating better structure and scalability for larger projects.
- Alias: A shorthand created with the as keyword when importing a module, allowing it to be referred to under a different name.

- Wildcard Imports: Using from module import *, which imports all public names from a module directly into the importing module's namespace. Generally discouraged due to the potential for namespace pollution and readability issues.
- __init__.py File: An empty or executable file required to make Python treat directories containing it as Python Packages.
- Virtual Environments: Tools that create isolated Python environments for each project, ensuring dependencies required by different projects do not interfere with each other.
- PyPI (Python Package Index): A repository for Python packages where users can upload their packages and install packages created by others using pip.

9. SELF-ASSESSMENT QUESTIONS

1. What is the correct syntax to define a user-defined function in Python?
   A) function myFunc():
   B) def myFunc():
   C) function:def myFunc()
   D) define myFunc():
2. How do you call a function named calculateSum?
   A) call calculateSum()
   B) calculateSum().call
   C) calculateSum()
   D) function calculateSum()
3. Which of the following is NOT a built-in function in Python?
   A) print()
   B) import()
   C) len()
   D) range()
4. What does a lambda function in Python lack compared to a normal function?
   A) A name
   B) Return statement
   C) Parameters
   D) A body

5. What is the purpose of the return statement in a function?
   A) To print the output of the function
   B) To exit the program
   C) To send the function's result back to the caller
   D) To declare a variable
6. Which keyword allows a function to accept an arbitrary number of arguments?
   A) *args
   B) **kwargs
   C) &params
   D) #args
7. What is the correct way to import a module named math?
   A) #import math
   B) import math
   C) include math
   D) using math
8. What is the scope of a variable defined inside a function?
   A) Global scope
   B) Local scope
   C) External scope
   D) Module scope
9. How do you import a specific function, sqrt, from the math module?
   A) import sqrt from math
   B) from math import sqrt
   C) import math.sqrt
   D) from math get sqrt
10. What is the function of the __init__.py file in a Python package?
    A) Initializes the Python interpreter
    B) Contains the list of modules in the package
    C) Signals that the directory is a Python package
    D) Initializes variables for the package
11. Which of the following is true for wildcard imports in Python?

A) They are encouraged for clarity

B) They import only selected functions from a module

C) They can lead to namespace pollution

D) They are the only way to import modules

12. How would you create an alias for the numpy module as np?

A) import numpy as np

B) import numpy rename to np

C) from numpy use as np

D) alias numpy np

13. What is the purpose of virtual environments in Python?

A) To enhance the Python interpreter's performance

B) To isolate project-specific dependencies

C) To compile Python code faster

D) To create new Python versions

14. Where does Python look for modules to import?

A) Only in the current directory

B) In the PYTHONPATH environment variable

C) In the list of standard library directories

D) All of the above

15. What will be the output if you try to import a module that does not exist?

A) A warning

B) ImportError

C) NameError

D) SyntaxError

10. TERMINAL QUESTIONS

1. What is the primary purpose of defining functions in Python?
2. How can you define a function with no parameters in Python?
3. What is a lambda function in Python? Provide a simple example.
4. Explain the difference between parameters and arguments in the context of functions.
5. What does the import statement do in Python?
6. How do you create a virtual environment in Python? List the steps.
7. What is the difference between a module and a package in Python?
8. How can wildcard imports affect your Python code?
9. Describe the use of the __init__.py file in Python packages.
10. What are the benefits of using virtual environments in Python projects?
11. Explain how you can use the *args and **kwargs in function definitions. Provide examples.
12. Describe the process of importing a specific function from a module and using it in your code.
13. How can you handle errors that might occur during module import in Python? Provide an example with a try-except block.
14. Discuss the implications of namespace pollution caused by wildcard imports and how to avoid it.
15. Outline the steps to package and distribute a Python project using setuptools.
16. Compare and contrast absolute and relative imports in Python, with examples.
17. How would you structure a large Python project with multiple modules and packages? Provide a sample structure.
18. Describe how the __name__ attribute works in Python and how it's used to check if a script is being run directly or imported.
19. Explain how to use the standard library's json module to serialize and deserialize data. Provide code examples.
20. Discuss the role of documentation in Python modules and packages, and how it can be provided using docstrings.

11. ANSWERS

Self-Assessment Questions

1. B) def myFunc():
2. C) calculateSum()
3. B) import()
4. A) A name
5. C) To send the function's result back to the caller
6. A) *args
7. B) import math
8. B) Local scope
9. B) from math import sqrt
10. C) Signals that the directory is a Python package
11. C) They can lead to namespace pollution
12. A) import numpy as np
13. B) To isolate project-specific dependencies
14. D) All of the above
15. B) ImportError

Terminal Questions

1. Answer Reference: Introduction to Functions section.
2. Answer Reference: Defining and Calling Functions section.
3. Answer Reference: Introduction to Functions section, under Anonymous functions.
4. Answer Reference: Defining and Calling Functions section.
5. Answer Reference: Import Statement section.
6. Answer Reference: Virtual Environments and Dependencies section.
7. Answer Reference: Modules and Packages section.
8. Answer Reference: Wildcard Imports section.
9. Answer Reference: Modules and Packages section.
10. Answer Reference: Virtual Environments and Dependencies section.

11. Answer Reference: Defining and Calling Functions section, under Variable-Length Functions and Keyword Arguments.
12. Answer Reference: Import Statement section.
13. Answer Reference: Import Statement section, under Handling Import Errors.
14. Answer Reference: Wildcard Imports section.
15. Answer Reference: Distributing Packages section.
16. Answer Reference: Absolute vs. Relative Imports section.
17. Answer Reference: Organizing Large Projects section.
18. Answer Reference: Import Statement section, under The __name__ Attribute.
19. Answer Reference: Leveraging Standard Library Modules section.
20. Answer Reference: Best Practices for Creating Modules and Organizing Packages sections.