A
Training and Seminar report
On

" PYTHON"

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PREFACE

The objective of a practical training is to learn something about industries practically and to be familiar with a working style of a technical worker to adjust simply according to industrial environment. As a part of academic syllabus of four year degree course in ECE, every student is required to undergo practical training of 45 days. We are student of 3rd year ECE and this report is written on the basis of practical knowledge acquired by our batch of two students during the period of practical training taken at "**TechGrid Technologies Private Limited Jaipur**".

This report deals with the equipments their relation and their general operating principle. Sincere efforts have been made to present this report on Python - A Programming and Scripting Language

Inspire of all our best efforts, some unintentional errors might have eluded, it is requested to neglect them.

ACKNOWLEDGEMENT

“Any serious and lasting achievement or success, one can never achieve without the help, guidance and co-operation of so many people involved in the work.

This report documents the work done during the summer training done in Embedded Systems under the supervision of Mr. Siddharth Sir who gave me an opportunity to take professional training in Techgrid Technologies, Jaipur.

I would like to express deep gratitude to Dr.Lokesh Kumar Bansal, Head of Department (Electronics and communication), Jaipur Engineering College & Research Centre, Jaipur(Rajasthan) without whose permission the training would not be possible. I would also like to thank Mr. Ashish sharma, Training & Placement Officer, ECE. Department, JECRC, Jaipur who recommended me for this training.

I have tried my best to keep report simple yet technically correct. I hope I succeed in my attempt.

ABSTRACT

The objective of a practical training is to learn something about industries practically and to be familiar with a working style of a technical worker to adjust simply according to industrial environment . This report deals with the equipments their relation and their general operating principle.

Python, an interpreted language which was developed by Guido van Rossum came into implementation in 1989. The language supports both object oriented and procedure oriented approach. Python is designed to be a highly extensible language. Python works on the principle of “there is only one obvious way to do a task” rather than “there is more than one way to solve a particular problem”. Python is very easy to learn and implement. The simpler syntax, uncomplicated semantics and approach with which Python has been developed makes it very easier to learn. A large number of python implementations and extensions have been developed since its inception.

Training Cover provides both six weeks as well as six months industrial training in Python. Python is divided into two parts as “Core Python” and “Advance Python”. Accordingly all the basic and advanced topics are discussed in both of the modules.

COMPANY PROFILE

TechGrid Technologies provide professional services to a Global Client. Our expert teams of business analysts, application developers, web designers, quality assurance specialists and online marketing experts have accomplished various projects from numerous domains and varying complexity levels. TechGrid Technologies has a large team of designers, developers and project managers with adequate business and technical expertise to design, implement and maintain solutions of any complexity. We provide complete development services in tune with the latest technologies and industry trends.

TECHGRID helps client's derive the measurable business value that they have always been looking for from business and IT investments.

TRANSFORM:-We can transform the fundamental shape of our client business. Regardless of which team you engage with, we have a best-practice process for delivering value. We ensuring that client's receive the business value were we promised.

OPTIMIZE:-Beyond transformation and innovation, it boils down to execution - delivering on time, on budget and "on value". We can optimize your core operations to drive best-in-class efficiency and help fund the transformation and innovation.

INNOVATE:-We can inject a level of product and service innovation into your business to create new revenue opportunities through collaboration and co-creation.

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Chapter 1

INTRODUCTION

1.1 PYTHON

Python is a **high-level, interpreted**, **interactive** and **object-oriented scripting language**. Python is designed to be highly readable. It uses English keywords frequently where as other languages use punctuation, and it has fewer syntactical constructions than other languages.

- **Python is Interpreted:** Python is processed at runtime by the interpreter. You do not need to compile your program before executing it. This is similar to PERL and PHP.
- **Python is Interactive:** You can actually sit at a Python prompt and interact with the interpreter directly to write your programs.
- **Python is Object-Oriented:** Python supports Object-Oriented style or technique of programming that encapsulates code within objects.
- **Python is a Beginner's Language:** Python is a great language for the beginner-level programmers and supports the development of a wide range of applications from simple text processing to WWW browsers to games.

1.2 History of Python

Python was developed by Guido van Rossum in the late eighties and early nineties at the National Research Institute for Mathematics and Computer Science in the Netherlands.

Python is derived from many other languages, including ABC, Modula-3, C, C++, Algol-68, SmallTalk, and Unix shell and other scripting languages.

Python is copyrighted. Like Perl, Python source code is now available under the GNU General Public License (GPL).

Python is now maintained by a core development team at the institute, although Guido van Rossum still holds a vital role in directing its progress.

1.3 Python Features

Python's features include:

- **Easy-to-learn:** Python has few keywords, simple structure, and a clearly defined syntax. This allows the student to pick up the language quickly.
- **Easy-to-read:** Python code is more clearly defined and visible to the eyes.
- **Easy-to-maintain:** Python's source code is fairly easy-to-maintain.
- **A broad standard library:** Python's bulk of the library is very portable and cross-platform compatible on UNIX, Windows, and Macintosh.

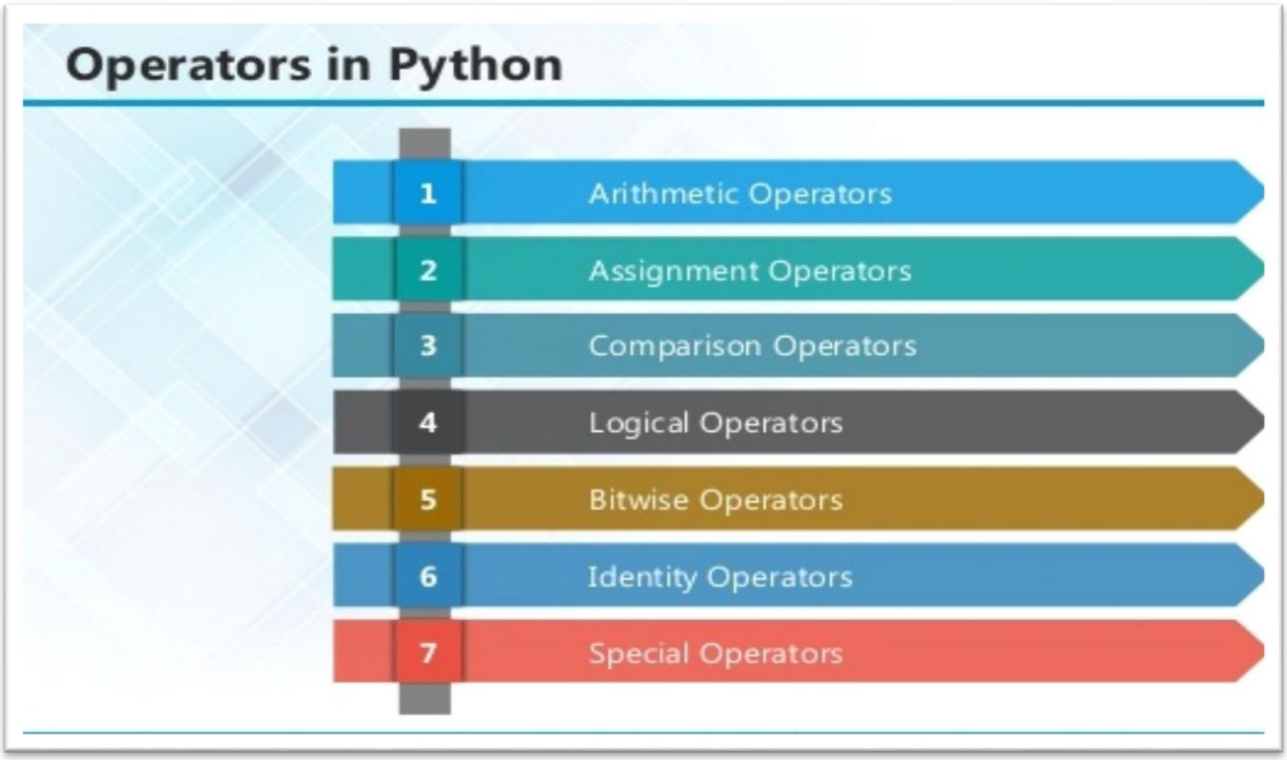
- **Interactive Mode:** Python has support for an interactive mode which allows interactive testing and debugging of snippets of code.
- **Portable:** Python can run on a wide variety of hardware platforms and has the same interface on all platforms.
- **Extendable:** You can add low-level modules to the Python interpreter. These modules enable programmers to add to or customize their tools to be more efficient.
- **Databases:** Python provides interfaces to all major commercial databases.
- **GUI Programming:** Python supports GUI applications that can be created and ported to many system calls, libraries and windows systems, such as Windows MFC, Macintosh, and the X Window system of Unix.
- **Scalable:** Python provides a better structure and support for large programs than shell scripting.

Python has a big list of good features:

- It supports functional and structured programming methods as well as OOP.
- It can be used as a scripting language or can be compiled to byte-code for building large applications.
- It provides very high-level dynamic data types and supports dynamic type checking.
- IT supports automatic garbage collection.
- It can be easily integrated with C, C++, COM, ActiveX, CORBA, and Java.

Chapter 2

OPERATORS



2.1 ARITHMETIC OPERATORS

Operator	Description	Example
+ Addition	Adds values on either side of the operator.	a + b = 30
- Subtraction	Subtracts right hand operand from left hand operand.	a – b = -10
* Multiplication	Multiplies values on either side of the operator	a * b = 200
/ Division	Divides left hand operand by right hand operand	b / a = 2
% Modulus	Divides left hand operand by right hand operand and returns remainder	b % a = 0
** Exponent	Performs exponential (power) calculation on operators	a**b =10 to the power 20
//	Floor Division - The division of operands where the result is the quotient in which the digits after the decimal point are removed. But if one of the operands is negative, the result is floored, i.e., rounded away from zero (towards negative infinity):	9//2 = 4 and 9.0//2.0 = 4.0, -11//3 = -4, -11.0//3 = -4.0

2.2ASSIGNMENT OPERATOR

Operator	Description	Example
=	Assigns values from right side operands to left side operand	c = a + b assigns value of a + b into c
+= Add AND	It adds right operand to the left operand and assign the result to left operand	c += a is equivalent to c = c + a
-= Subtract AND	It subtracts right operand from the left operand and assign the result to left operand	c -= a is equivalent to c = c - a
*= Multiply AND	It multiplies right operand with the left operand and assign the result to left operand	c *= a is equivalent to c = c * a
/= Divide AND	It divides left operand with the right operand and assign the result to left operand	c /= a is equivalent to c = c / ac /= a is equivalent to c = c / a

%= Modulus AND	It takes modulus using two operands and assign the result to left operand	c %= a is equivalent to c = c % a
**= Exponent AND	Performs exponential (power) calculation on operators and assign value to the left operand	c **= a is equivalent to c = c ** a
//= Floor Division	It performs floor division on operators and assign value to the left operand	c //= a is equivalent to c = c // a

2.3 IDENTITY OPERATOR

Operator	Description	Example
is	Evaluates to true if the variables on either side of the operator point to the same object and false otherwise.	x is y, here **is** results in 1 if id(x) equals id(y).
is not	Evaluates to false if the variables on either side of the operator point to the same object and true otherwise.	x is not y, here **is not** results in 1 if id(x) is not equal to id(y

2.4 COMPARISON OPERATOR

Operator	Description	Example
& Binary AND	Operator copies a bit to the result if it exists in both operands	(a & b) (means 0000 1100)
| Binary OR	It copies a bit if it exists in either operand.	(a | b) = 61 (means 0011 1101)
^ Binary XOR	It copies the bit if it is set in one operand but not both.	(a ^ b) = 49 (means 0011 0001)
~ Binary Ones Complement	It is unary and has the effect of 'flipping' bits.	(~a) = -61 (means 1100 0011 in 2's complement form due to a signed binary number.
<< Binary Left Shift	The left operands value is moved left by the number of bits specified by the right operand.	a << 2 = 240 (means 1111 0000)
>> Binary Right Shift	The left operands value is moved right by the number of bits specified by the right operand.	a >> 2 = 15 (means 0000 1111)

2.5 LOGICAL OPERATOR

Operator	Description	Example
and Logical AND	If both the operands are true then condition becomes true.	(a and b) is true.
or Logical OR	If any of the two operands are non-zero then condition becomes true.	(a or b) is true.
not Logical NOT	Used to reverse the logical state of its operand.	Not(a and b) is false.

2.6 Membership Operators

Operator	Description	Example
in	Evaluates to true if it finds a variable in the specified sequence and false otherwise.	x in y, here in results in a 1 if x is a member of sequence y.
not in	Evaluates to true if it does not finds a variable in the specified sequence and false otherwise.	x not in y, here not in results in a 1 if x is not a member of sequence y.

Python Operators Precedence

Operator	Description
**	Exponentiation (raise to the power)
~ + -	Complement, unary plus and minus (method names for the last two are +@ and -@)
* / % //	Multiply, divide, modulo and floor division
+ -	Addition and subtraction
>> <<	Right and left bitwise shift
&	Bitwise 'AND'
^ |	Bitwise exclusive `OR' and regular `OR'
<= < > >=	Comparison operators
<> == !=	Equality operators
= %= /= //= -= += *= **=	Assignment operators
is is not	Identity operators
in not in	Membership operators
not or and	Logical operators

Chapter 3

COLLECTION IN PYTHON

3.1 LIST

The list is a most versatile data type available in Python which can be written as a list of comma-separated values (items) between square brackets. Important thing about a list is that items in a list need not be of the same type.

Creating a list is as simple as putting different comma-separated values between square brackets. For example −

```
list1 = ['physics', 'chemistry', 1997, 2000];
list2 = [1, 2, 3, 4, 5 ];
list3 = ["a", "b", "c", "d"]
```

Basic List Operations

Lists respond to the + and * operators much like strings; they mean concatenation and repetition here too, except that the result is a new list, not a string.

Python Expression	Results	Description
len([1, 2, 3])	3	Length
[1, 2, 3] + [4, 5, 6]	[1, 2, 3, 4, 5, 6]	Concatenation
['Hi!'] * 4	['Hi!', 'Hi!', 'Hi!', 'Hi!']	Repetition
3 in [1, 2, 3]	True	Membership

for x in [1, 2, 3]: print x,	1 2 3	Iteration

Built-in List Functions & Methods:

Python includes the following list functions −

SN	Function with Description
1	**cmp(list1, list2)** Compares elements of both lists.
2	**len(list)** Gives the total length of the list.
3	**max(list)** Returns item from the list with max value.
4	**min(list)** Returns item from the list with min value.
5	**list(seq)** Converts a tuple into list.

Python includes following list methods

SN	Methods with Description
1	**list.append(obj)** Appends object obj to list
2	**list.count(obj)** Returns count of how many times obj occurs in list
3	**list. extend(seq)** Appends the contents of seq to list
4	**list.index(obj)** Returns the lowest index in list that obj appears
5	**list.insert(index, obj)** Inserts object obj into list at offset index
6	**list.pop(obj=list[-1])** Removes and returns last object or obj from list
7	**list.remove(obj)** Removes object obj from list
8	**list.reverse()** Reverses objects of list in place
9	**list.sort([func])** Sorts objects of list, use compare function if given

3.2 TUPLES

A tuple is a sequence of immutable Python objects. Tuples are sequences, just like lists. The differences between tuples and lists are, the tuples cannot be changed unlike lists and tuples use parentheses, whereas lists use square brackets.

Creating a tuple is as simple as putting different comma-separated values. Optionally we can put these comma-separated values between parentheses also. For example −

```
tup1 = ('physics', 'chemistry', 1997, 2000);

tup2 = (1, 2, 3, 4, 5 );

tup3 = "a", "b", "c", "d";
```

The empty tuple is written as two parentheses containing nothing −

```
tup1 = ();
```

To write a tuple containing a single value you have to include a comma, even though there is only one value −

```
tup1 = (50,);
```

Like string indices, tuple indices start at 0, and they can be sliced, concatenated, and so on.

- **Accessing Values in Tuples:**

To access values in tuple, use the square brackets for slicing along with the index or indices to obtain value available at that index. For example –

```
tup1 = ('physics', 'chemistry', 1997, 2000);

tup2 = (1, 2, 3, 4, 5, 6, 7 );

print "tup1[0]: ", tup1[0]

print "tup2[1:5]: ", tup2[1:5]
```

When the code is executed, it produces the following result −

```
tup1[0]:  physics
tup2[1:5]:  [2, 3, 4, 5]
```

Updating Tuples:

Tuples are immutable which means you cannot update or change the values of tuple elements. We are able to take portions of existing tuples to create new tuples as the following example demonstrates −

```
tup1 = (12, 34.56);
tup2 = ('abc', 'xyz');
tup3 = tup1 + tup2;
print tup3
```

When the above code is executed, it produces the following result −

```
(12, 34.56, 'abc', 'xyz')
```

Delete Tuple Elements

Removing individual tuple elements is not possible. There is, of course, nothing wrong with putting together another tuple with the undesired elements discarded.

To explicitly remove an entire tuple, just use the **del** statement. For example:

```
tup = ('physics', 'chemistry', 1997, 2000);
print tup
del tup;
print "After deleting tup : "
print tup
```

Basic Tuples Operations:

Python Expression	Results	Description
len((1, 2, 3))	3	Length
(1, 2, 3) + (4, 5, 6)	(1, 2, 3, 4, 5, 6)	Concatenation
('Hi!',) * 4	('Hi!', 'Hi!', 'Hi!', 'Hi!')	Repetition
3 in (1, 2, 3)	True	Membership
for x in (1, 2, 3): print x,	1 2 3	Iteration

Built-in Tuple Functions

SN	Function with Description
1	**cmp(tuple1, tuple2)**:Compares elements of both tuples.
2	**len(tuple)**:Gives the total length of the tuple.
3	**max(tuple)**:Returns item from the tuple with max value.
4	**min(tuple)**:Returns item from the tuple with min value.
5	**tuple(seq)**:Converts a list into tuple.

3.2 DICTIONARY

Each key is separated from its value by a colon (:), the items are separated by commas, and the whole thing is enclosed in curly braces. An empty dictionary without any items is written with just two curly braces, like this: {}.

Keys are unique within a dictionary while values may not be. The values of a dictionary can be of any type, but the keys must be of an immutable data type such as strings, numbers, or tuples.

Accessing Values in Dictionary:

To access dictionary elements, you can use the familiar square brackets along with the key to obtain its value. Following is a simple example −

```
dict = {'Name': 'Zara', 'Age': 7, 'Class': 'First'}


print "dict['Name']: ", dict['Name']
print "dict['Age']: ", dict['Age']
```

Result –

```
dict['Name']:  Zara
dict['Age']:  7
```

Updating Dictionary

We can update a dictionary by adding a new entry or a key-value pair, modifying an existing entry, or deleting an existing entry as shown below in the simple example −

```
dict = {'Name': 'Zara', 'Age': 7, 'Class': 'First'}


dict['Age'] = 8; # update existing entry
dict['School'] = "DPS School"; # Add new entry
print "dict['Age']: ", dict['Age']
print "dict['School']: ", dict['School']
```

Result −

```
dict['Age']:  8
dict['School']:  DPS School
```

Delete Dictionary Elements

We can either remove individual dictionary elements or clear the entire contents of a dictionary. You can also delete entire dictionary in a single operation.

To explicitly remove an entire dictionary, just use the **del** statement. Following is a simple example –

```
dict = {'Name': 'Zara', 'Age': 7, 'Class': 'First'}


del dict['Name']; # remove entry with key 'Name'
dict.clear();     # remove all entries in dict
del dict ;        # delete entire dictionary


print "dict['Age']: ", dict['Age']
print "dict['School']: ", dict['School']
```

Built-in Dictionary Functions & Methods –

Python includes the following dictionary functions −

SN	Function with Description
1	**cmp(dict1, dict2)** Compares elements of both dict.
2	**len(dict)** Gives the total length of the dictionary. This would be equal to the number of items in the dictionary.
3	**str(dict)** Produces a printable string representation of a dictionary
4	**type(variable)** Returns the type of the passed variable. If passed variable is dictionary, then it would return a dictionary type.

Python includes following dictionary methods −

SN	Methods with Description
1	**dict.clear()**:Removes all elements of dictionary *dict*
2	**dict. Copy()**:Returns a shallow copy of dictionary *dict*
3	**dict.fromkeys()**:Create a new dictionary with keys from seq and values *set* to *value*.
4	**dict.get(key, default=None)**:For *key* key, returns value or default if key not in dictionary
5	**dict.has_key(key)**:Returns *true* if key in dictionary *dict*, *false* otherwise
6	**dict.items()**:Returns a list of *dict*'s (key, value) tuple pairs
7	**dict.keys()**:Returns list of dictionary dict's keys
8	**dict.setdefault(key, default=None)**:Similar to get(), but will set dict[key]=default if *key* is not already in dict
9	**dict.update(dict2)**:Adds dictionary *dict2*'s key-values pairs to *dict*
10	**dict.values()**:Returns list of dictionary *dict*'s values

Chapter 4

FUNCTIONS IN PYTHON

A function is a block of organized, reusable code that is used to perform a single, related action. Functions provide better modularity for your application and a high degree of code reusing. Python gives you many built-in functions like print(), etc. but you can also create your own functions. These functions are called *user-defined functions.*

Defining a Function

Simple rules to define a function in Python.

- 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.

```
def functionname( parameters ):
   "function_docstring"
   function_suite
   return [expression]
```

Calling a Function

Defining a function only gives it a name, specifies the parameters that are to be included in the function and structures the blocks of code.Once the basic structure of a function is finalized, you can execute it by calling it from another function or directly from the Python prompt. Following is the example to call printme() function −

```
# Function definition is here
def printme( str ):
   "This prints a passed string into this function"
   print str
   return;
# Now you can call printme function
printme("I'm first call to user defined function!")
printme("Again second call to the same function")
```

When the above code is executed, it produces the following result −

```
I'm first call to user defined function!
Again second call to the same function
```

Function Arguments

You can call a function by using the following types of formal arguments:

- Required arguments
- Keyword arguments
- Default arguments
- Variable-length arguments

Scope of Variables

All variables in a program may not be accessible at all locations in that program. This depends on where you have declared a variable.

The scope of a variable determines the portion of the program where you can access a particular identifier. There are two basic scopes of variables in Python −

Global variables Local variables

Global vs. Local variables

Variables that are defined inside a function body have a local scope, and those defined outside have a global scope.

This means that local variables can be accessed only inside the function in which they are declared, whereas global variables can be accessed throughout the program body by all functions. When you call a function, the variables declared inside it are brought into scope. Following is a simple example −

```
total = 0; # This is global variable.
# Function definition is here
def sum( arg1, arg2 ):
   # Add both the parameters and return them."
   total = arg1 + arg2; # Here total is local variable.
   print "Inside the function local total : ", total
   return total;
sum( 10, 20 );
print "Outside the function global total : ", total
```

Result −

```
Inside the function local total :  30
Outside the function global total :  0
```

Chapter 5

PYTHON MODULES

A module allows you to logically organize your Python code. Grouping related code into a module makes the code easier to understand and use. A module is a Python object with arbitrarily named attributes that you can bind and reference.Simply, a module is a file consisting of Python code. A module can define functions, classes and variables. A module can also include runnable code.

Example:

The Python code for a module named *aname* normally resides in a file named *aname.py*. Here's an example of a simple module, support.py

```
def print_func( par ):
   print "Hello : ", par
   return
```

The *import* Statement

The *import* has the following syntax:

```
import module1[, module2[,... moduleN]
```

When the interpreter encounters an import statement, it imports the module if the module is present in the search path. A search path is a list of directories that the interpreter searches before importing a module. For example, to import the module support.py, you need to put the following command at the top of the script −

A module is loaded only once, regardless of the number of times it is imported. This prevents the module execution from happening over and over again if multiple imports occur.

Packages in Python

A package is a hierarchical file directory structure that defines a single Python application environment that consists of modules and sub packages and sub-sub packages.

Consider a file *Pots.py* available in *Phone* directory. This file has following line of source code −

```
def Pots():
   print "I'm Pots Phone"
```

Similar way, we have another two files having different functions with the same name as above −

- *Phone/Isdn.py* file having function Isdn()
- *Phone/G3.py* file having function G3()

Now, create one more file __init__.py in *Phone* directory −

- Phone/__init__.py

To make all of your functions available when you've imported Phone,to put explicit import statements in __init__.py as follows −

```
from Pots import Pots
from Isdn import Isdn
from G3 import G3
```

After you add these lines to __init__.py, you have all of these classes available when you import the Phone package.

```
# Now import your Phone Package.
import Phone
Phone.Pots()
Phone.Isdn()
Phone.G3()
```

RESULT:

```
I'm Pots Phone
I'm 3G Phone
I'm ISDN Phone
```

In the above example, we have taken example of a single functions in each file, but you can keep multiple functions in your files. You can also define different Python classes in those files and then you can create your packages out of those classes.

Chapter 6

PYTHON FILES I/O

This chapter covers all the basic I/O functions available in Python.

Printing to the Screen

The simplest way to produce output is using the *print* statement where you can pass zero or more expressions separated by commas. This function converts the expressions you pass into a string and writes the result to standard output as follows −

```
print "Python is really a great language,", "isn't it?"
```

Result:

```
Python is really a great language, isn't it?
```

Reading Keyboard Input

Python provides two built-in functions to read a line of text from standard input, which by default comes from the keyboard. These functions are −

- raw_input
- input

The *raw_input* Function

The *raw_input([prompt])* function reads one line from standard input and returns it as a string (removing the trailing newline).

```
str = raw_input("Enter your input: ");
print "Received input is : ", str
```

This prompts you to enter any string and it would display same string on the screen. When I typed "Hello Python!", its output is like this −

```
Enter your input: Hello Python
Received input is :  Hello Python
```

The *input* Function

The *input([prompt])* function is equivalent to raw_input, except that it assumes the input is a valid Python expression and returns the evaluated result to you.

```
str = input("Enter your input: ");
print "Received input is : ", str
```

This would produce the following result against the entered input −

```
Enter your input: [x*5 for x in range(2,10,2)]
Recieved input is :  [10, 20, 30, 40]
```

Opening and Closing Files

Until now, you have been reading and writing to the standard input and output. Now, we will see how to use actual data files.

Python provides basic functions and methods necessary to manipulate files by default. You can do most of the file manipulation using a **file** object.

The *open* Function

Before you can read or write a file, you have to open it using Python's built-in *open()* function. This function creates a **file** object, which would be utilized to call other support methods associated with it.

Syntax

```
file object = open(file_name [, access_mode][, buffering])
```

Here are parameter details:

- **file_name:** The file_name argument is a string value that contains the name of the file that you want to access.
- **access_mode:** The access_mode determines the mode in which the file has to be opened, i.e., read, write, append, etc. A complete list of possible values is given below in the table. This is optional parameter and the default file access mode is read (r).
- **buffering:** If the buffering value is set to 0, no buffering takes place. If the buffering value is 1, line buffering is performed while accessing a file. If you specify the buffering value as an integer greater than 1, then buffering action is performed with the indicated buffer size. If negative, the buffer size is the system default(default behavior).

Here is a list of the different modes of opening a file −

Modes	Description
r	Opens a file for reading only. The file pointer is placed at the beginning of the file. This is the default mode.
rb	Opens a file for reading only in binary format. The file pointer is placed at the beginning of the file. This is the default mode.
r+	Opens a file for both reading and writing. The file pointer placed at the beginning of the file.
rb+	Opens a file for both reading and writing in binary format. The file pointer placed at the beginning of the file.

w	Opens a file for writing only. Overwrites the file if the file exists. If the file does not exist, creates a new file for writing.
wb	Opens a file for writing only in binary format. Overwrites the file if the file exists. If the file does not exist, creates a new file for writing.
w+	Opens a file for both writing and reading. Overwrites the existing file if the file exists. If the file does not exist, creates a new file for reading and writing.
wb+	Opens a file for both writing and reading in binary format. Overwrites the existing file if the file exists. If the file does not exist, creates a new file for reading and writing.
a	Opens a file for appending. The file pointer is at the end of the file if the file exists. That is, the file is in the append mode. If the file does not exist, it creates a new file for writing.
ab	Opens a file for appending in binary format. The file pointer is at the end of the file if the file exists. That is, the file is in the append mode. If the file does not exist, it creates a new file for writing.
a+	Opens a file for both appending and reading. The file pointer is at the end of the file if the file exists. The file opens in the append mode. If the file does not exist, it creates a new file for reading and writing.
ab+	Opens a file for both appending and reading in binary format. The file pointer is at the end of the file if the file exists. The file opens in the append mode. If the file does not exist, it creates a new file for reading and writing.

The *file* Object Attributes

Once a file is opened and you have one *file* object, you can get various information related to that file.

Here is a list of all attributes related to file object:

Attribute	Description
file.closed	Returns true if file is closed, false otherwise.
file.mode	Returns access mode with which file was opened.
file.name	Returns name of the file.
file.softspace	Returns false if space explicitly required with print, true otherwise.

Example

```
# Open a file
fo = open("foo.txt", "wb")
print "Name of the file: ", fo.name
print "Closed or not : ", fo.closed
print "Opening mode : ", fo.mode
print "Softspace flag : ", fo.softspace
```

This produces the following result −

```
Name of the file:  foo.txt
Closed or not :  False
Opening mode :  wb
Softspace flag :  0
```

The *close()* Method

The close() method of a *file* object flushes any unwritten information and closes the file object, after which no more writing can be done.Python automatically closes a file when the reference object of a file is reassigned to another file. It is a good practice to use the close() method to close a file.

Syntax

```
fileObject.close();
```

Example

```
# Open a file
fo = open("foo.txt", "wb")
print "Name of the file: ", fo.name
# Close opend file
fo.close()
```

Result −

```
Name of the file:  foo.txt
```

Reading and Writing Files

The *file* object provides a set of access methods to make our lives easier. We would see how to use *read()* and *write()* methods to read and write files.

The *write()* Method

The *write()* method writes any string to an open file. It is important to note that Python strings can have binary data and not just text.The write() method does not add a newline character ('\n') to the end of the string **Syntax**

```
fileObject.write(string);
```

Here, passed parameter is the content to be written into the opened file. **Example**

```
# Open a file
fo = open("foo.txt", "wb")
fo.write( "Python is a great language.\nYeah its great!!\n");

# Close opend file
fo.close()
```

The above method would create *foo.txt* file and would write given content in that file and finally it would close that file. If you would open this file, it would have following content.

```
Python is a great language.
Yeah its great!!
```

The *read()* Method

The *read()* method reads a string from an open file. It is important to note that Python strings can have binary data. apart from text data.

Syntax

```
fileObject.read([count]);
```

Here, passed parameter is the number of bytes to be read from the opened file. This method starts reading from the beginning of the file and if *count* is missing, then it tries to read as much as possible, maybe until the end of file.

Example

Let's take a file *foo.txt*, which we created above.

```
# Open a file
fo = open("foo.txt", "r+")
str = fo.read(10);
print "Read String is : ", str
# Close opend file
fo.close()
```

This produces the following result −

```
Read String is :  Python is
```

File Positions

The *tell()* method tells you the current position within the file; in other words, the next read or write will occur at that many bytes from the beginning of the file.

The *seek(offset[, from])* method changes the current file position. The *offset* argument indicates the number of bytes to be moved. The *from* argument specifies the reference position from where the bytes are to be moved.

If *from* is set to 0, it means use the beginning of the file as the reference position and 1 means use the current position as the reference position and if it is set to 2 then the end of the file would be taken as the reference position.

Example

Let us take a file *foo.txt*, which we created above.

```
# Open a file
fo = open("foo.txt", "r+")
str = fo.read(10);
print "Read String is : ", str

# Check current position
position = fo.tell();
print "Current file position : ", position

# Reposition pointer at the beginning once again
position = fo.seek(0, 0);
str = fo.read(10);
print "Again read String is : ", str
# Close opend file
fo.close()
```

This produces the following result −

```
Read String is :  Python is
Current file position :  10
Again read String is :  Python is
```

Renaming and Deleting Files

Python **os** module provides methods that help you perform file-processing operations, such as renaming and deleting files.

To use this module you need to import it first and then you can call any related functions.

The rename() Method

The *rename()* method takes two arguments, the current filename and the new filename.

Syntax

```
os.rename(current_file_name, new_file_name)
```

Example

Following is the example to rename an existing file *test1.txt*:

```
import os

# Rename a file from test1.txt to test2.txt
os.rename( "test1.txt", "test2.txt" )
```

The *remove()* Method

You can use the *remove()* method to delete files by supplying the name of the file to be deleted as the argument.

Syntax

```
os.remove(file_name)
```

Example

Following is the example to delete an existing file *test2.txt* −

```
#!/usr/bin/python
import os

# Delete file test2.txt
os.remove("text2.txt")
```

Directories in Python

All files are contained within various directories, and Python has no problem handling these too. The **os** module has several methods that help you create, remove, and change directories.

The *mkdir()* Method

You can use the *mkdir()* method of the **os** module to create directories in the current directory. You need to supply an argument to this method which contains the name of the directory to be created.

Syntax

```
os.mkdir("newdir")
```

Example

Following is the example to create a directory *test* in the current directory −

```
#!/usr/bin/python
import os

# Create a directory "test"
os.mkdir("test")
```

The *chdir()* Method

You can use the *chdir()* method to change the current directory. The chdir() method takes an argument, which is the name of the directory that you want to make the current directory.

Syntax

```
os.chdir("newdir")
```

Example

Following is the example to go into "/home/newdir" directory −

```
#!/usr/bin/python
import os
```

```
# Changing a directory to "/home/newdir"
os.chdir("/home/newdir")
```

The *getcwd()* Method

The *getcwd()* method displays the current working directory.

Syntax

```
os.getcwd()
```

Example

Following is the example to give current directory −

```
import os

# This would give location of the current directory
os.getcwd()
```

The *rmdir()* Method

The *rmdir()* method deletes the directory, which is passed as an argument in the method.

Before removing a directory, all the contents in it should be removed.

Syntax:

```
os.rmdir('dirname')
```

Example

Following is the example to remove "/tmp/test" directory. It is required to give fully qualified name of the directory, otherwise it would search for that directory in the current directory.

```
import os
# This would  remove "/tmp/test"  directory.
os.rmdir( "/tmp/test"  )
```

File & Directory Related Methods

There are three important sources, which provide a wide range of utility methods to handle and manipulate files & directories on Windows and Unix operating systems. They are as follows −

- File Object Methods: The *file* object provides functions to manipulate files.
- OS Object Methods: This provides methods to process files as well as directories.

Chapter 7

Python Exceptions Handling

Python provides two very important features to handle any unexpected error in your Python programs and to add debugging capabilities in them −

- **Exception Handling:** This would be covered in this tutorial. Here is a list standard Exceptions available in Python: Standard Exceptions.
- **Assertions:** This would be covered in Assertions in Python

List of Standard Exceptions −

EXCEPTION NAME	DESCRIPTION
Exception	Base class for all exceptions
StopIteration	Raised when the next() method of an iterator does not point to any object.
SystemExit	Raised by the sys.exit() function.
StandardError	Base class for all built-in exceptions except StopIteration and SystemExit.

ArithmeticError	Base class for all errors that occur for numeric calculation.
OverflowError	Raised when a calculation exceeds maximum limit for a numeric type.
FloatingPointError	Raised when a floating point calculation fails.
ZeroDivisionError	Raised when division or modulo by zero takes place for all numeric types.
AssertionError	Raised in case of failure of the Assert statement.
AttributeError	Raised in case of failure of attribute reference or assignment.
EOFError	Raised when there is no input from either the raw_input() or input() function and the end of file is reached.
ImportError	Raised when an import statement fails.
KeyboardInterrupt	Raised when the user interrupts program execution, usually by pressing Ctrl+c.
LookupError	Base class for all lookup errors.
IndexError KeyError	Raised when an index is not found in a sequence. Raised when the specified key is not found in the dictionary.
NameError	Raised when an identifier is not found in the local or global namespace.

UnboundLocalError EnvironmentError	Raised when trying to access a local variable in a function or method but no value has been assigned to it. Base class for all exceptions that occur outside the Python environment.
IOError IOError	Raised when an input/ output operation fails, such as the print statement or the open() function when trying to open a file that does not exist. Raised for operating system-related errors.
SyntaxError IndentationError	Raised when there is an error in Python syntax. Raised when indentation is not specified properly.
SystemError	Raised when the interpreter finds an internal problem, but when this error is encountered the Python interpreter does not exit.
SystemExit	Raised when Python interpreter is quit by using the sys.exit() function. If not handled in the code, causes the interpreter to exit.
TypeError	Raised when an operation or function is attempted that is invalid for the specified data type.
ValueError	Raised when the built-in function for a data type has the valid type of arguments, but the arguments have invalid values specified.
RuntimeError	Raised when a generated error does not fall into any category.
NotImplementedError	Raised when an abstract method that needs to be implemented in an inherited class is not actually implemented.

What is Exception?

An exception is an event, which occurs during the execution of a program that disrupts the normal flow of the program's instructions. In general, when a Python script encounters a situation that it cannot cope with, it raises an exception. An exception is a Python object that represents an error.

When a Python script raises an exception, it must either handle the exception immediately otherwise it terminates and quits.

Handling an exception

If you have some *suspicious* code that may raise an exception, you can defend your program by placing the suspicious code in a **try:** block. After the try: block, include an **except:** statement, followed by a block of code which handles the problem as elegantly as possible.

Chapter 8

Python Object Oriented

Python has been an object-oriented language since it existed. Because of this, creating and using classes and objects are downright easy. This chapter helps you become an expert in using Python's object-oriented programming support.

If you do not have any previous experience with object-oriented (OO) programming, you may want to consult an introductory course on it or at least a tutorial of some sort so that you have a grasp of the basic concepts.

However, here is small introduction of Object-Oriented Programming (OOP) to bring you at speed −

Overview of OOP Terminology

- **Class:** A user-defined prototype for an object that defines a set of attributes that characterize any object of the class. The attributes are data members (class variables and instance variables) and methods, accessed via dot notation.
- **Class variable:** A variable that is shared by all instances of a class. Class variables are defined within a class but outside any of the class's methods. Class variables are not used as frequently as instance variables are.
- **Data member:** A class variable or instance variable that holds data associated with a class and its objects.
- **Function overloading:** The assignment of more than one behavior to a particular function. The operation performed varies by the types of objects or argument

- **Instance variable:** A variable that is defined inside a method and belongs only to the current instance of a class.
- **Inheritance:** The transfer of the characteristics of a class to other classes that are derived from it.
- **Instance:** An individual object of a certain class. An object obj that belongs to a class Circle, for example, is an instance of the class Circle.
- **Instantiation:** The creation of an instance of a class.
- **Method :** A special kind of function that is defined in a class definition.
- **Object:** A unique instance of a data structure that's defined by its class. An object comprises both data members (class variables and instance variables) and methods.
- **Operator overloading:** The assignment of more than one function to a particular operator.

Creating Classes

The *class* statement creates a new class definition. The name of the class immediately follows the keyword *class* followed by a colon as follows −

```
class ClassName:
   'Optional class documentation string'
   class_suite
```

- The class has a documentation string, which can be accessed via *ClassName.__doc__*.
- The *class_suite* consists of all the component statements defining class members, data attributes and functions.

Class Inheritance

Instead of starting from scratch, you can create a class by deriving it from a preexisting class by listing the parent class in parentheses after the new class name.

The child class inherits the attributes of its parent class, and you can use those attributes as if they were defined in the child class. A child class can also override data members and methods from the parent.

Syntax

Derived classes are declared much like their parent class; however, a list of base classes to inherit from is given after the class name −

```
class SubClassName (ParentClass1[, ParentClass2, ...]):
   'Optional class documentation string'
   class_suite
```

Overriding Methods

You can always override your parent class methods. One reason for overriding parent's methods is because you may want special or different functionality in your subclass.

Example

```
class Parent:        # define parent class
   def myMethod(self):
      print 'Calling parent method'
class Child(Parent): # define child class
   def myMethod(self):
      print 'Calling child method'


c = Child()          # instance of child
c.myMethod()         # child calls overridden method
```

When the above code is executed, it produces the following result −

```
Calling child method
```

Base Overloading Methods

Following table lists some generic functionality that you can override in your own classes −

SN	Method, Description & Sample Call
1	**__init__ (self [,args...])** Constructor (with any optional arguments) Sample Call : *obj = className(args)*
2	**__del__(self)** Destructor, deletes an object Sample Call : *del obj*
3	**__repr__(self)** Evaluatable string representation Sample Call : *repr(obj)*
4	**__str__(self)** Printable string representation Sample Call : *str(obj)*
5	**__cmp__ (self, x)** Object comparison Sample Call : *cmp(obj, x)*

Overloading Operators

Suppose you have created a Vector class to represent two-dimensional vectors, what happens when you use the plus operator to add them? Most likely Python will yell at you.

You could, however, define the __*add*__ method in your class to perform vector addition and then the plus operator would behave as per expectation −

Example

```
class Vector:
   def __init__(self, a, b):
      self.a = a
      self.b = b

   def __str__(self):
      return 'Vector (%d, %d)' % (self.a, self.b)

   def __add__(self,other):
      return Vector(self.a + other.a, self.b + other.b)

v1 = Vector(2,10)
v2 = Vector(5,-2)
print v1 + v2
```

When the above code is executed, it produces the following result −

```
Vector(7,8)
```

Data Hiding

An object's attributes may or may not be visible outside the class definition. You need to name attributes with a double underscore prefix, and those attributes then are not be directly visible to outsiders.

Example

```
class JustCounter:
   __secretCount = 0
```

```
def count(self):
    self.__secretCount += 1
    print self.__secretCount

counter = JustCounter()
counter.count()
counter.count()
print counter.__secretCount
```

Result −

```
1
2
Traceback (most recent call last):
  File "test.py", line 12, in <module>
    print counter.__secretCount
AttributeError: JustCounter instance has no attribute '__secretCount'
```

Python protects those members by internally changing the name to include the class name. You can access such attributes as *object._className__attrName*. If you would replace your last line as following, then it works for you −

```
.....................
print counter._JustCounter__secretCount
```

When the above code is executed, it produces the following result −

```
1
2
2
```

Chapter 9

Python MySQL Database Access

The Python standard for database interfaces is the Python DB-API. Most Python database interfaces adhere to this standard.

You can choose the right database for your application. Python Database API supports a wide range of database servers such as −

- GadFly
- mSQL
- MySQL
- PostgreSQL
- Microsoft SQL Server 2000
- Informix
- Interbase
- Oracle
- Sybase

The DB API provides a minimal standard for working with databases using Python structures and syntax wherever possible. This API includes the following:

- Importing the API module.
- Acquiring a connection with the database.
- Issuing SQL statements and stored procedures.
- Closing the connection

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