
SECTION 3 PYTHON PROGRAMMING LAB

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3.0 INTRODUCTION

This is the lab course, wherein you will have the hands on experience. You have studied the support course material (BCS-094 Programming Using Python). In this part, Python programming under ANACONDA and Google Colabs environments are provided illustratively, subsequently you are supposed to apply the concepts and utilization of various software like KIVY, TKINTER, wxPython, SQLite, as mentioned in BCS-094. A list of programming problems is also provided at the end of each session. Please go through the general guidelines and the program documentation guidelines carefully.

3.1 OBJECTIVES

After completing this lab course you will be able to:

- ... develop the logic for a given problem;
- ... recognize and understand the syntax and construction of Python code;
- ... gain experience of Python as Object Oriented Programming Language;
- ... know the steps involved in executing the python code;
- ... understand function declaration and definition;
- ... understand how to deal with databases;
- ... understand how to develop Mobile applications;
- ... understand how to develop GUI applications;
- ... be able to apply all the concepts that have been covered in the theory course BCS-094; and
- ... know the alternative ways of providing solution to a given problem.

3.2 GENERAL GUIDELINES

- ... You should attempt all problems/assignments given in the list session wise.
- ... You may seek assistance in doing the lab exercises from the concerned lab instructor. Since the assignments have credits, the lab instructor is obviously not expected to tell you how to solve these, but you may ask questions concerning the Python language or a technical problem.
- ... For each program you should add comments above each function in the code, including the main function. This should also include a description of the function written, the purpose of the function, meaning of the argument used in the function and the meaning of the return value (if any).
- ... These descriptions should be placed in the comment block immediately above the relevant function source code.
- ... The comment block above the main function should describe the purpose of the program. Proper comments are to be provide where and when necessary in the programming.
- ... The program should be interactive, general and properly documented with real Input/ Output data.
- ... If two or more submissions from different students appear to be of the same origin (i.e. are variants of essentially the same program), none of them will be counted. You are strongly advised not to copy somebody else's work.
- ... It is your responsibility to create a separate directory to store all the programs, so that nobody else can read or copy.
- ... Observation book and Lab record are compulsory
- ... The list of the programs (list of programs given at the end, session-wise) is available to you in this lab manual. For each session, you must come prepare with the algorithms and the programs written in the Observation Book. You should utilize the lab hours for executing the programs, testing for various desired outputs and enhancements of the programs.
- ... As soon as you have finished a lab exercise, contact one of the lab instructor / in-charge in order to get the exercise evaluated and also get the signature from him/her on the Observation book.
- ... Completed lab assignments should be submitted in the form of a Lab Record in which you have to write the algorithm, program code along with comments and output for various inputs given.
- ... The total no. of lab sessions (3 hours each) are 10 and the list of assignments is provided session-wise. It is important to observe the deadline given for each assignment.

3.3 SALIENT FEATURE OF PYTHON

We learned from the concepts given in BCS-094 Programming Using Python, that Python is a high-level, general-purpose, interpreted high level programming language. It is dynamically typed and garbage-collected, and supports multiple programming paradigms like structured (particularly, procedural,) object-oriented, and functional programming, and due to its comprehensive standard library Python is often described as a "batteries included" language

The content coverage of this course helps to develop your skill in python programming from the fundamental level to advanced levels like mobile application development, GUI development, and also Database management. You will learn to apply concepts of Python Programming for solving various problems assigned in activities section of the respective units.

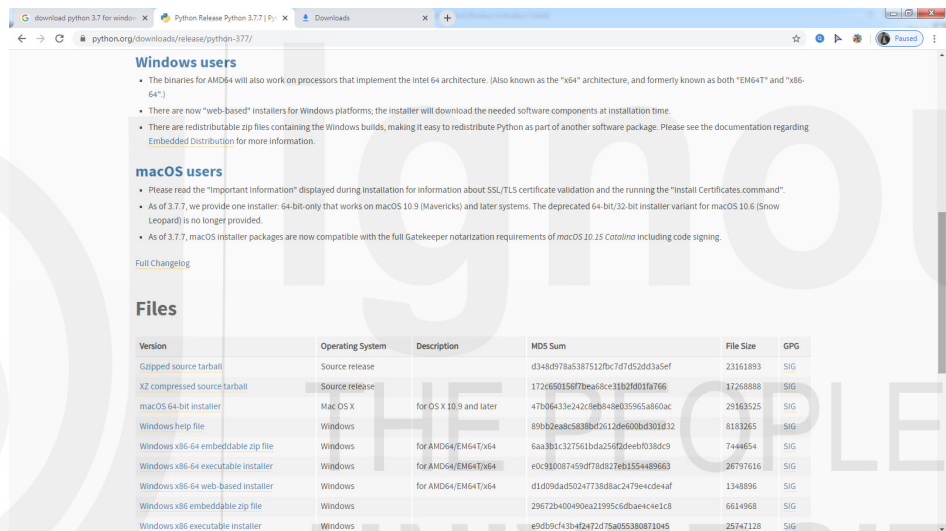
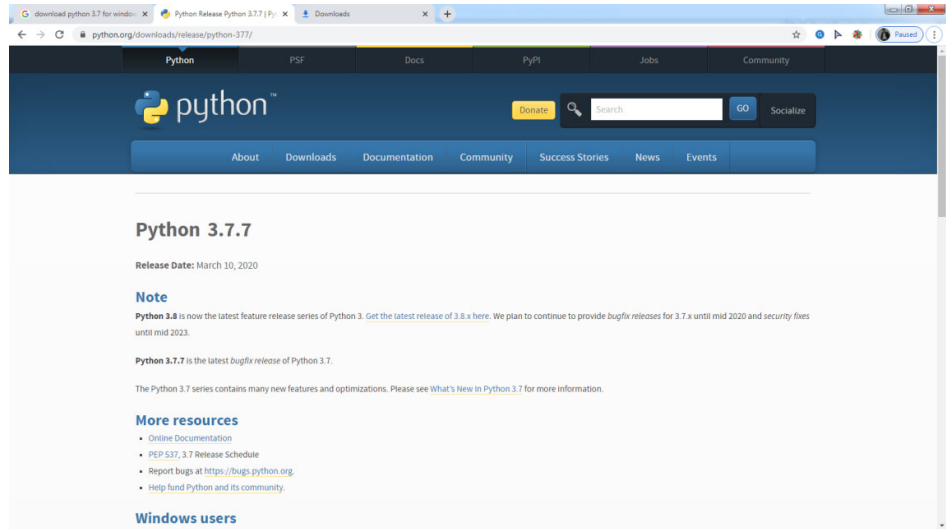
You will be learning about the Python application development by using various software like KIVY, TKINTER, wxPython, SQLite

3.4 WORKING WITH PYTHON

Now, after going through the content given in BCS-094, we are having a bit of clarity about the Python as a programming language. Further, the sections covered in BCS-094, helped us to learn about the various libraries and frameworks of Python. Now, we need to work on the IDEs (Integrated Development Environments) of Python, there are many IDEs like Jupyter Notebook, Spyder, VS Code, R Programming etc., all are collectively available in Anaconda (Anaconda is a free and open-source distribution of the Python and R programming languages for scientific computing (data science, machine learning applications, large-scale data processing, predictive analytics, etc.)), or you may also go for the cloud versions Like Google Colab Notebook, where you need not to have high configuration hardwares, only internet is required and through your gmail account you can work on Python using Jupyter notebook.

We will discuss in brief, some of the ways to work with Python, you may choose any or try all and other options too.

- 1) Just browse for <https://www.python.org> and perform following steps :
 - a) Download the latest version of Python for the operating system installed on your computer, as in my case its windows 64 bit, so I downloaded python-3.7.7 (python-3.7.7-amd64.exe) from <https://www.python.org/downloads/release/python-377/>
 - b) Now Run this exe file and install the Python, just click next and go ahead, till the setup installation is finished
 - c) Finally you are having an interface for Python programming



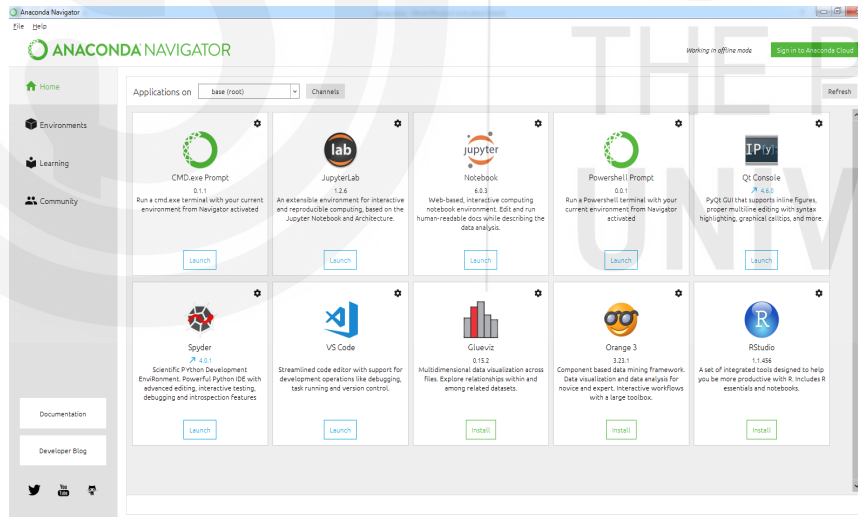
There is a variety of IDEs for python, Like Jupyter Notebook, Spyder, VS Code etc, and all are available at Anaconda (a free and open-source distribution of the Python and R programming languages for scientific computing (data science, machine learning applications, large-scale data processing, predictive analytics, etc.)). To start with Anaconda Just perform following steps.

- 1) Just browse <https://www.anaconda.com/> and perform following steps:
 - a) Click the Download button on the webpage of <https://www.anaconda.com/>
 - b) the distribution section <https://www.anaconda.com/distribution/> will open,
 - c) click the download option given on this page <https://www.anaconda.com/distribution/>
 - d) <https://www.anaconda.com/distribution/#download-section> will open, the option of 64bit and 32bit graphic installer for Python 3.x (currently 3.7) and 2.x (currently 2.7) are given under Anaconda 2020.02 for windows installer.

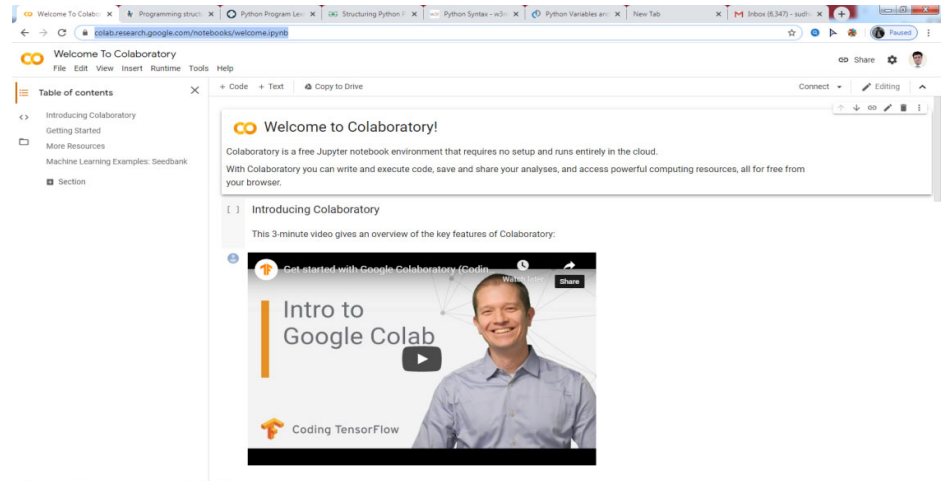
- e) It is recommended to download 64bit version of Python 3.x (currently 3.7),
- f) Anaconda3-2020.02-Windows-x86_64.exe will be downloaded.
- g) Now, just run the setup of this Anaconda3-2020.02-Windows-x86_64.exe , and click next-next, till the installation is completed.
- h) Finally, you will find Anaconda Navigators shortcut on your desktop, click on it and you can start working with any IDE be it Jupyter Notebook, Spyder, VS Code etc., even you can work with R-Programming.

Important: Before working with IDEs you need to understand how to work with them and which one is suitable, following are observations, currently:

- i) When you start Jupyter Notebook on windows (by clicking on the jupyter section, given in the anaconda Navigator), a browser will open in internet explorer, many a times Jupyter Notebook won't work here, then just copy the URL from the Internet Explorer and paste it in the Google Chrome, you will find that Jupyter Notebook starts working, other details regarding the writing, saving, execution of program, will be discussed later.
- j) Program execution in Jupyter is line by line and in VS Code and Spyder it goes sideways, even errors can also be seen sideways. Any ways all are good to work with Python.

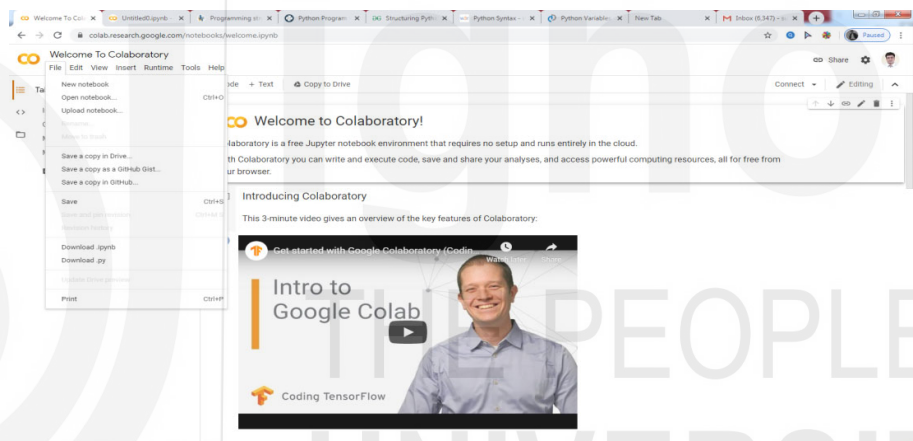


- 2) Many a times the learners may not be equipped with the systems having latest hardware configurations, as desired for the installation of Python, or their might be compatibility issues with operating system or may be due to any reason you are not able to install and start your work with Python. Under such circumstances the solution is Google Colab Notebook (<https://colab.research.google.com/notebooks/welcome.ipynb>), use this and just login with your gmail account and start your work on Jupyter Notebook, as simple as that.

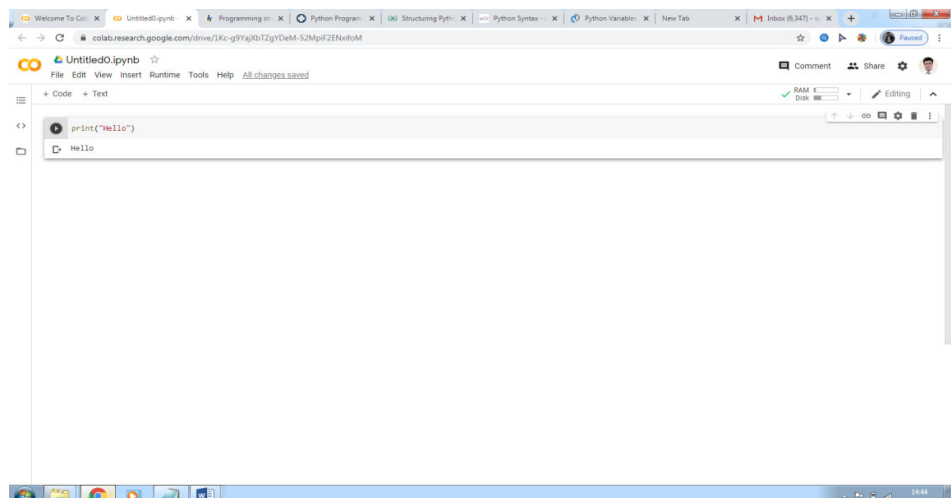


3.5 RUNNING PYTHON PROGRAMS

Just click file option and select new workbook, and new Jupyter notebook will open in Google Colab, now you may start your work



As here, I wrote my first program (`print("hello")`) to say “hello” to all of you , and executed it by simply pressing the play button, you may see just before the print command I wrote, and the output comes just beneath the statement `print("hello")`.



```
print('Hello world!')
x = 2021
print(x)
```

output
Hello World!
2021

3.6 LIST OF LAB ASSIGNMENTS – SESSION WISE

Let us try solving a different kind of a problem now. How do you solve an equation in Python?

Session-1

- 1) Write a program in python, that calculates the volume of a sphere (given as $\frac{4}{3} \pi r^3$), with radius r entered by the user. (Assume $\pi = 3.14$)
- 2) Write a program in python that prints a warning message if the weight of a customer's luggage exceeds the allowed limit of 25 kgs.
- 3) let us say a teacher decided to give grades to her students as follows:

a) Mark greater than or equal to 80	Excellent
b) Mark greater than or equal to 65 but less than 80	Good
c) Mark greater than or equal to 50 but less than 65	Pass
d) Mark less than 50	Fail

Write a program in python to print a grade according to a student's mark with multiple if statements

Session - 2

- 1) Write a program in python, to print even numbers in range 0 to 9 (last number not less than 10). Using while construct
- 2) Write a program in Python that prints the square of the numbers in the list, using for loop construct.
- 3) Write a program in Python that will print numbers from 1 to 10 only if the number is odd. When the number is even, it goes to the next iteration. When n becomes 7 it will finish the current while statement and run the next statement which is print ('all numbers printed').

Session - 3

- 1) Write a program in Python to perform the Simple slicing on the list ['a','b','c','d','e','f','g','h','i','j','k','l','m','n'], and extracts the characters from elements at index 3 to element at 7 (i.e. upper index - 1). Remember that indexing starts with 0.

- 2) Write a program in Python to Swap Two Numbers without Using Intermediate/Temporary Variable. Prompt the User for Input.
- 3) Write a program in Python that Accepts a Sentence and Calculate the Number of Digits, Uppercase and Lowercase Letters.

Session - 4

- 1) Write a program in Python to check if a given year is a leap year
- 2) Write a Program to Find
 - a) the Transpose of a Matrix
 - b) product of two matrices
 - c) sum of two matrices
- 3) Write a program in Python to display the Fibonacci Sequences up to nth term where n is provided by the user

Session - 5

- 1) Write a function in Python to find the factorial of a number(n), where n is provided by the user
- 2) Write a function in Python to calculate sum, difference, product of the two numbers passed as an argument to the function.
- 3) Write a function in Python which will accept a number within the range of 1 and 20, and find whether it is a prime number or not. If it is a prime number, function should return True and if not False.

Note that prime numbers are numbers which are divisible only by 1 and by the number it-self. What is the argument type that you use here?

Session - 6

- 1) Write Lambda function and Normal function in Python to get the average of two numbers.
- 2) Write a Python program to sort a list of tuples using Lambda.
- 3) Write program in Python to perform following file operations
 - a) display file contents
 - b) Create file and add contents to it.
 - c) read, write and append using *with* statement
 - d) to copy a file from 'original.txt' to 'duplicate.txt'
 - e) to delete a file

Session - 7

- 1) Write Python class to :
 - a) to convert an integer to a roman numeral
 - b) to convert a roman numeral to an integer.

- 2) Write a Python class which has two methods `get_String` and `print_String`. `get_String` accept a string from the user and `print_String` print the string in upper case
- 3) Write a Python class named `Circle` constructed by a radius and two methods which will compute the area and the perimeter of a circle.

Session -8

- 1) Write Python Program to perform following tasks
 - a) Create a database `TRAINING_DB` using SQLite
 - b) Set connection with `mysql.connector.connect`.
 - c) Create a table `EMP_TRAINING` in database `TRAINING_DB` with following data
`FIRST_NAME, LAST_NAME, AGE, GENDER, INCOME`.
 - d) change table structure / (add, edit, remove column of a table) at run time
 - i. add a column address in the `EMP_TRAINING` table.
 - ii. execute SQL `INSERT` statement to create a record into `EMP_TRAINING` table
 - iii. run the query to updates all the records having `GENDER` as 'M', and increase `AGE` of all the males by one year.
 - iv. delete all the records from `EMP_TRAINING` Table where `AGE` is less than 18

Session – 9

- 1) Perform the following :
 - ... Create a database using SQLite called 'ABC_Organization'
 - ... Create a table inside that database and name it 'Employee',
 - ... Create following fields in 'Employee' table
 - ... Insert an employee detail to the table (ex: EmployeeID : 105524, EmpFirstName : PQR, EmpLastName : Fernando, Gender : 1, NICNo : 895562987V)
 - ... Update the first name of the employee to 'PQWR' where employee id is 105524
 - ... Select fields EmpFirstName, EmpLastName as EmployeeName and NICNo from Employee table

Session – 10

- 1) Create the KIVY environment for mobile application development as discussed in Block-3 Unit 12 of BCS-094.
- 2) Develop a KIVY application to say HELLO WORLD.
- 3) Explore the link <https://kivy.org/docs/tutorials/firstwidget.html>, and execute the widget given

Session-11

- 1) Download the Kivy demos for Android by visiting <https://storage.googleapis.com/google-code-archive-downloads/v2/code.google.com/kivy/kivydemo-for-android.zip>
... Unzip the contents and go to the folder 'kivydemo-for-android'
... Copy all the subfolders here to /sdcard/kivy
... Run the Kivy launcher and select one of the Pictures, Showcase, Touchtracer, Cymunk or other demos

Session-12

- 1) Write a python program using TKINTER to display Hello World Message when button is pressed, as shown below



- 2) Write Python Program using TKINTER to demonstrate the working with following
 - a) Text Box
 - b) Check box
 - c) List box
- 3) Labels

Session 13

- 1) Write a GUI program using Tkinter libraries to input two boolean values (0 or 1) and select a boolean operation from set of boolean operations AND, OR, NAND, NOR, XOR. Result should be printed in a text box next to the boolean selection box.
- 2) Write a GUI program using Tkinter libraries to develop a simple calculator

Session 14

- 1) Write a GUI program using wxPython libraries to input 2 boolean values (0 or 1) and select a boolean operation from set of boolean operations AND, OR, NAND, NOR, XOR. Result should be printed in a text box next to the boolean selection box.
- 2) Write a GUI program using wxPython libraries to develop a simple calculator

Session 15

- 1) Write a GUI program using KIVY to input two boolean values (0 or 1) and select a boolean operation from set of boolean operations AND, OR,

NAND, NOR, XOR. Result should be printed in a text box next to the boolean selection box.

- 2) Develop a simple calculator using Python and KIVY

Session 16

- 1) Write a GUI program using KV Language to input two boolean values (0 or 1) and select a boolean operation from set of boolean operations AND, OR, NAND, NOR, XOR. Result should be printed in a text box next to the boolean selection box.
- 2) Develop a simple calculator using Python and KV Language

Session 17

- 1) Develop a mobile application and package it using Buldozer tool

Session 18

- 1) Install Python-for-android (P4A) on LINUX environment and Windows environment

Session 19

- 1) Install Kivy launcher and put your Kivy applications in the Kivy directory in your external storage directory

Session 20

- 1) Develop the following GUI using TKINTER

Visual indications of GUI which can be implemented by python language are illustrated in fig. 14.1.

