

Unit 1: Python Revisited

1. What are classes in python. Define properties and methods in a class. How methods differ from normal functions. Explain with examples.
2. Explain class inheritance using an example. What is MRO (Method Resolution Order) explain with an example.
3. What are double underscore methods or dunder methods. What is the use of these methods. Explain how they differ from normal methods. Give examples.
4. Write a class which implements addition, subtraction, multiplication and division using double underscore methods or dunder methods.
5. Write four classes with dunder methods implementing elementary operations and inherit all classes in fifth class and then implement functionality by creating objects (Same as 4 but use inheritance here).
6. Implement `__truediv__(self)` method for the division of two Complex numbers `comp1` and `comp2` made from the Complex class. Here Complex is user defined class.
7. What are `*args` (arguments) and `**kwargs` (keyword arguments). Where should you use these? Explain by providing examples of both.
8. Write a class Telematics which takes the name of students and their marks in `__init__(self, *args, **kwargs)` method and then converts it to a .csv file. Write another method named `search(self, name)` which takes name of student as an argument, searches it in the csv file and returns the marks of the student.
9. Write a class String,
 1. Which takes a string in its `__init__()` method.
 2. Define `__add__()` to add two String type objects.
 3. Define a `__iadd__()` method, which checks if length of stored string in the class object is less than 7 and then appends the string with a desired variable of String type, else does nothing.
 4. Write a class method `remove()` which takes a character as an argument, finds and removes it from the String type object. *Note* : You can not use any string data type attribute.
 5. Write a class method `reverse()`, which reverses the String type object.

Unit 2: Database Management

1. What is RDBMS. Explain giving examples of different RDBMS servers.

2. Discuss SQLite Database management server, what are its advantages over other DBMS. Also discuss its limitations.
3. What is an SQL query. Explain following in detail:
 - i) Create table ii) select iii) Where iv) Order by v) Group by vi) Case/when/then/else
4. What are aggregate functions. How will you use them? Explain in detail the following.
 - i) sum() ii) avg() iii) min() iv) max() v) count()
5. Create a table with following criteria:

Id	Integer primary key
Fname	Varchar
Lname	Varchar
Marks	Integer

6. Write a class Telematics which inherits a *class Connection* from module sqlite3. Make a table named *students* in it, table should have fname, lname and gender as columns. Then write,
 1. A `__init__()` method, which also initializes the Base class (*Connection*) with a database file (*telematics.db*). Then adds a table
 2. Write a method *add_data()* which takes the desired data and appends to the database.
 3. Write a method *search_data()* for searching a row using *fname*.
 4. Write a *delete_data()* method which deletes the data with *fname*.
7. Write SQL queries using following database file.
 1. Write a query which creates a table from table marks with the Names which start with 'a' or 'b'.
 2. Write a query which creates a table from table marks with students having marks = 10 or 20.
 3. Write queries which create a table and insert the middle values found in the table ordered by Name, Marks and DH1 in ASC order.
 4. Write queries which set the Marks of students to 15 when Marks < 20 and then put them in a different table.
 5. Write SQL query which selects those students which have sum of DH1 and DH2 marks > 5 but total marks < 20 and prints out Name, DH1, DH2, Marks.
8. Suppose you have two tables Electronics and Programming, table Programming has all the columns (id, Name, DH1, DH2, DH3 ...) filled, Electronics table has only two columns (id, Name), now write queries to
 1. Add a column in table Electronics named DH1.
 2. Update this column and set the values same as DH1 in Programming.
 3. Create a new table named *FinalStatus* from table Programming with all columns, also add a new column *Status* using *case* statement satisfying following criteria.

DH1	Status
5	Excellent
4	Very Good
3	Good
2	Average
1	Below Average
0	Fail

9. An experiment was performed and a database table (named *Experiment*) was created in the following manner:

Num	Voltage	Current	Resistance
...

1. Write a query to delete all the values from the table where resistance is negative.
2. Write a query which adds another column *Power* where $Power = Voltage * Current$

Unit 3: Data Visualisation

1. What is a Graphical User Interface. Explain PyQt5 module and its submodules (QtCore, QtWidgets, QtGui) in detail. Describe their functioning and give examples using their classes.
2. Create a simple “Hello World” GUI using PyQt5 using QLabel from QtWidgets.
3. Explain the functioning of the following in detail. Also write code.
 - i) QLabel
 - ii) QPushButton
 - iii) QMainWindow
 - iv) QWidget
4. What do you understand by a widget. “All classes in QtWidgets are widget in themselves”, what does this line mean. Explain by giving example code.
5. Write a Python program using PyQt5 Library which creates a window using QWidget class. Now embed two widgets QPushButton and QTextEdit in this window. Write something in the QTextEdit box. Now, implement a logic such that if the button is pressed the text on button changes to the text written in QTextEdit window.
6. What do you understand by Slots and Signals in PyQt5. Does it bother a sender, if the signal is being used for some purpose or not? Write code explaining your thoughts.
7. Write a program to plot the real time data coming from a source using PyQtGraph, use QTimer from QtCore to update this data after certain amount of time.
8. Write a small program to 2D plot using Plotly and Pyplot separately. What is the difference between the both plots? Which library do you find faster?
9. Write a python program same as 7 for plotting real time data using plotly or pyplot.

Unit 4: Integration

1. Write a program for library database management. Create a GUI using PyQt5 for user interface and at backend use SQLite3 for saving data in a table. Table may contain following values,

Book_id	Integer primary key
Book_Name	Varchar
Author_Name	Varchar
Book_Pages	Integer
Publication_Date	Date

2. Write a Database Management for Dayalbagh University. You can use different tables for different departments. Table may contain following values,

Id	Integer primary key
FName	Varchar
LName	Varchar
Gender	Char
Registration_Date	Date

3. Write a Database system for Inventory control management. Use Sqlite3 and PyQt5

Item_Id	Integer Primary Key
Item_Name	Varchar
Item_Description	Glob
Item_Price	Real

Unit 5: Neural Networks (Moving towards self-driving Cars)

1. What are neural networks. What is the difference between machine learning, deep learning and artificial intelligence.
2. Explain different squashing functions (Binary threshold, sigmoid, gaussian etc.).
3. What is a feature space. Explain their use in classification problems by giving examples.
4. Explain the Multi-Layered Perceptron model. How the weight update takes place using backpropagation algorithm.
5. Write a python program to solve AND and OR problem using Multi-Layered Perceptron model. Explain why XOR problem can not be solved using MLP.
6. Describe a convolution taken on an image. Explain convolutional neural networks, discuss their high efficiency in image classification problems.
7. Write a python program which takes values generated from a function and tries to predict next values taking some x values. Implement using Tensorflow and Keras.

8. Describe Carla simulator for self-driving cars. Write a python program for implementing a simple self-driving car in this simulator. Also write comments to explain each line of code.