MODEL TEST PAPER (SOLVED) – 2

Time Allowed: 3 hrs **Maximum Marks: 70**

General Instructions:

- Please check this question paper contains 37 questions.
- All questions are compulsory. However, internal choices have been provided in some questions. Attempt only one of the choices in such questions.
- The paper is divided into 5 Sections—A, B, C, D and E.
- Section A consists of 21 questions (1 to 21). Each question carries 1 Mark.
- Section B consists of 7 questions (22 to 28). Each question carries 2 Marks.
- Section C consists of 4 questions (29 to 32). Each question carries 3 Marks.
- Section D consists of 2 case study type questions (33 to 34). Each question carries 4 Marks.
- Section E consists of 3 questions (35 to 37). Each question carries 5 Marks.
- All programming questions are to be answered using Python language only.
- In case of MCQ, text of the correct answer should also be written.

Section A (21 × 1 = 21 Marks)

1. State whether the following statement is True or False: [1]

The `dropna()` method removes rows or columns containing missing values.

Ans. True

2. What will be the output of the following SQL command? [1]

```
SELECT SUBSTRING ('DATABASE', 1, 4);
```

(a) `DATA` (b) `BASE`

(c) `TABE` (d) `DABA`

Ans. (a) `DATA`

3. Rachit received a message claiming he had won a lottery and was asked to share his bank details to receive the prize money. This is an example of which type of cybercrime? [1]

(a) Cyberstalking (b) Identity Theft

(c) Phishing (d) Software Piracy

Ans. (c) Phishing

4. Which function is used to read data from a CSV file into a Pandas DataFrame? [1]

(a) `read_table()` (b) `read_csv()`

(c) `open_csv()` (d) `load_csv()`

Ans. (b) `read_csv()`

5. Which device is commonly used to share a single internet connection among multiple computers? [1]

(a) Hub (b) Repeater

(c) Router (d) Bridge

Ans. (c) Router

6. What is the purpose of the `POWER(x, y)` function in SQL? [1]

(a) Adds x and y (b) Multiplies x by y

(c) Raises x to the power of y (d) Divides x by y

Ans. (c) Raises x to the power of y

7. A musician composes an original song and wants to prevent others from copying or distributing it without permission. Which IPR applies here? [1]

(a) Patent (b) Trademark

(c) Copyright (d) Industrial Design

Ans. (c) Copyright

8. A Pandas Series is capable of holding _____ data of any type. [1]

(a) only numeric (b) only string

(c) only float (d) homogeneous

Ans. (d) homogeneous

9. Consider a table named Employees that has one primary key and two alternate keys. How many candidate keys does the table have? [1]

(a) 1 (b) 2

(c) 3 (d) 4

Ans. (c) 3

10. Which protocol is used to receive emails from a mail server? [1]

(a) SMTP (b) HTTP

(c) POP3 (d) FTP

Ans. (c) POP3

11. Which SQL function is used to find the maximum value in a column? [1]

(a) `MAX()` (b) `MIN()`

(c) `COUNT()` (d) `AVG()`

Ans. (a) `MAX()`

12. _____ is used to select a column named `age` from a Pandas DataFrame `df`? [1]

(a) `df(age)` (b) `df[age]`

(c) `df["age"]` (d) None of these

Ans. (c) `df["age"]`

13. Cybercrimes such as hacking and identity theft are covered under the _____. [1]

(a) Consumer Protection Act (b) Information Technology Act, 2000

(c) Copyright Act (d) Banking Regulation Act

Ans. (b) Information Technology Act, 2000

14. Which SQL keyword is used to remove duplicate rows from the result set? [1]

(a) `UNIQUE` (b) `DISTINCT`

(c) `REMOVE` (d) `DELETE`

Ans. (b) `DISTINCT`

15. Which of the following Python commands selects all rows except the first one? [1]

(a) `df.iloc[1:]` (b) `df.loc[1:]`

(c) `df.iloc[:1]` (d) Both (a) and (b)

Ans. (d) Both (a) and (b)

16. Which network topology uses a central hub or switch to connect all devices? [1]

(a) Ring (b) Bus

(c) Star (d) Mesh

Ans. (c) Star

17. What is the use of the TRIM() function in SQL? [1]

(a) To remove leading and trailing spaces

(b) To remove leading spaces

(c) To remove trailing spaces

(d) To remove leading and trailing spaces including in between spaces

Ans. (a) To remove leading and trailing spaces

18. Which of the following statements creates a DataFrame from a dictionary of lists? [1]

(*Note:* pd is an alias for pandas.)

(a) `pd.DataFrame()`

(b) `pd.Series()`

(c) `pd.DataFrame({'A':[1,2],'B':[3,4]})`

(d) `pd.read_csv()`

Ans. (c) `pd.DataFrame({'A':[1,2],'B':[3,4]})`

19. Which of the following is an aggregate function in SQL? [1]

(a) `LOWER()` (b) `COUNT()`

(c) `SUBSTR()` (d) `LENGTH()`

Ans. (b) `COUNT()`

Questions 20 and 21 are Assertion(A) and Reason(R) type questions. Choose the correct options as:

(a) Both (A) and (R) are True and (R) is the correct explanation for (A).

(b) Both (A) and (R) are True but (R) is not the correct explanation for (A).

(c) (A) is True but (R) is False.

(d) (A) is False but (R) is True.

20. **Assertion (A):** The command `df.shape` returns the number of rows and columns in a DataFrame. [1]

Reason (R): `df.shape` returns a tuple representing `(columns, rows)` of the DataFrame.

Ans. (c) (A) is True but (R) is False.

21. **Assertion (A):** The DELETE command removes records from a table without removing the table structure. [1]

Reason (R): The DELETE command is used to remove specific rows from a table using a condition.

Ans. (a) Both (A) and (R) are True and (R) is the correct explanation for (A).

Section B (7 × 2 = 14 Marks)

22. (a) What is a series in Pandas? Mention any one property of series. [2]

OR

(b) List any two differences between NumPy and Pandas DataFrame.

Ans. (a) Series is a one-dimensional structure capable of holding homogeneous data type. It is mutable in nature.

OR

(b) (i) A NumPy array requires homogeneous data while Pandas DataFrame can have different data types.

(ii) Pandas DataFrame is used when data is in tabular format, whereas Numpy is used for numeric array-based data manipulation.

23. What happens when e-waste is dumped in the landfill? List any two benefits of e-waste management. [2]

Ans. When e-waste is dumped in the landfill, it leaches out when water passes through it, picking up trace elements. The contaminated landfill water then reaches natural groundwater with increased toxic levels and can be very harmful if it enters any drinking water source. Therefore, if not managed properly, it can cause several problems to the environment and living organisms.

The two benefits of e-waste management are as follows:

(a) It saves the environment and natural resources.

(b) It allows for recovery of precious metals.

24. Sujata wants to create a Pandas DataFrame showing city-wise population as shown below: [2]

	Population
Delhi	19000000
Mumbai	20000000
Chennai	10000000

Help her complete the code.

Note: `city_data` is a dictionary.

```
import _____ as pd
city_data = _____
df = pd._____(city_data,_____)
print(df)
```

Ans.
```
import pandas as pd
city_data = {'Population':[19000000,20000000,10000000]}
df = pd.DataFrame(city_data, index=['Delhi','Mumbai','Chennai'])
print(df)
```

25. (a) Kavya is learning web development and wants to know why websites are stored on special computers instead of normal PCs. Explain the role of web servers in storing and serving website content. [2]

OR

(b) What is meant by topology? Name some popular topologies.

Ans. (a) Web server is a computer software that accepts client request and responds with the required content or an error message. It runs continuously, handles many requests at once and ensures that the website is always available and loads quickly.

OR

(b) Topology is a way of connecting devices with each other, either physically or logically. Two or more devices make a link and two or more links form a topology. Some popular topologies are Bus topology, Star topology, Tree topology, etc.

26. Write SQL queries to perform the following: [2]

(a) Display the name of the month for the date '2026-02-15'.

(b) Find and display the position of the substring "SQL" in the string "Learning SQL is fun".

Ans. (a)
```
SELECT MONTHNAME('2026-02-15');
```

(b)
```
SELECT INSTR("Learning SQL is fun", ("SQL",);
```

27. What is cyber trolling? Write down two ways of cyber trolling. [2]

Ans. Cyber trolling is an act of cybercrime where a person intentionally starts arguments or upsets others by posting provocative comments.

The two ways of cyber trolling are as follows:

(a) The use of rude, abusive or offensive comments on online forums, social media platforms or blog posts with the intent to provoke others.

(b) The use of irrelevant or repetitive messages in email inboxes, social media feeds or online forums, often causing annoyance or disrupting conversations.

28. (a) Write the output of the following code: [2]

```
import pandas as pd
product = pd.Series(['Pen', 'Notebook', 'Eraser'])
price = pd.Series([10, 40, 5])
df = pd.DataFrame({'Item': product, 'Cost': price})
df.rename(columns={'Cost': 'Price'}, inplace=True)
print(df)
```

OR

(b) Write the output of the following code:

```
import pandas as pd
languages = pd.Series(['C', 'C++', 'Python'])
level = pd.Series(['Beginner', 'Intermediate', 'Advanced'])
df = pd.DataFrame({'Language': languages, 'Level': level})
df.drop(index=1, inplace=True)
print(df)
```

Ans. (a)

```
    Item        Price
0   Pen         10
1   Notebook    40
2   Eraser      5
```

OR

(b)

```
    Language    Level
0   C           Beginner
2   Python      Advanced
```

Section C (4 × 3 = 12 Marks)

29. Aditi has developed a mobile application that helps farmers predict weather conditions. She fears that other developers may copy her app and publish it under a different name. [3]

(a) Explain the terms Intellectual Property and Intellectual Property Rights (IPR).

(b) Under which specific category of IPR will Aditi's mobile application be protected?

(c) Explain the importance of IPR in protecting digital creations.

Ans. (a) Intellectual Property (IP) refers to creations of the mind like literary works, inventions, artistic works, etc. Intellectual Property Rights (IPR) are legal rights granted to creators or inventors to protect their original works from unauthorized use.

(b) Aditi's mobile application will be protected under Copyright.

(c) Intellectual Property Rights (IPR) safeguard digital creations by preventing unauthorized copying or misuse. They give creators exclusive ownership, enable financial benefits and encourage innovation and creativity.

30. (a) Write a Python program to create a Pandas Series using a NumPy ndarray, where the city names are the indices and the population (in lakh) are the values in the Series. [3]

```
Delhi      190
Mumbai     210
Chennai    100
Kolkata    150
```

OR

(b) Write a Python program to create the Pandas DataFrame displayed below using a list of dictionaries.

```
    Subject    Credits
0   Maths      5
1   Physics    4
2   Chemistry  5
```

Ans. (a)

```
import numpy as np
import pandas as pd
population = np.array([190, 210, 100, 150])
cities = ['Delhi', 'Mumbai', 'Chennai', 'Kolkata']
series = pd.Series(population, index=cities)
print(series)
```

OR

(b)

```
import pandas as pd
data = [
{'Subject': 'Maths', 'Credits': 5},
{'Subject': 'Physics', 'Credits': 4},
{'Subject': 'Chemistry', 'Credits': 5}
]
df = pd.DataFrame(data)
print(df)
```

31. (a) Write an SQL statement to create a table named **TEACHERS**, with the following specifications: [2+1]

Column Name	Data Type	Key
TeacherID	Numeric	Primary Key
TName	Varchar(30)	
JoinDate	Date	
Salary	Float(6,2)	

(b) Write an SQL query to insert the following data into the **TEACHERS** table:

```
501, 'Neha Verma', '2018-04-12', 55.75
```

Ans. (a)
```
CREATE TABLE TEACHERS
(
TEACHERID INTEGER PRIMARY KEY,
TNAME VARCHAR(30),
JOINDATE DATE,
SALARY FLOAT(6,2)
);
```

(b)
```
INSERT INTO TEACHERS VALUES(501,'Neha Verma','2018-04-12',55.75);
```

32. (a) Consider the following two tables: [3]

Table 1: CUSTOMER, which stores **Cust_ID, Cust_Name, City_ID** and **Balance**.

Cust_ID	Cust_Name	City_ID	Balance
C101	Amit	CT1	25000
C102	Neha	CT2	18000
C103	Rahul	CT1	30000
C104	Pooja	CT3	22000
C105	Karan	CT2	20000

Table 2: CITY, which stores **City_ID** and **City_Name**.

City_ID	City_Name
CT1	Delhi
CT2	Mumbai
CT3	Jaipur

Write appropriate SQL queries for the following:

I. List the names of customers, sorted in ascending order.

II. Display the city names in uppercase where customer balance is more than 22000.

III. Display the names of customers along with city name and balance.

OR

(b) Consider the following table **VEHICLE,** which stores **VehicleID, OwnerName, VehicleType** and **Price**.

Table: VEHICLE

VehicleID	OwnerName	VehicleType	Price
501	Amit	Car	800000
502	Rohan	Bike	120000
503	Neha	Car	950000
504	Aman	Truck	1500000
505	Rohan	Bike	110000

I. Which attribute in the table can be considered as the Primary Key? Provide justification for your answer.

II. Write a suitable SQL query to add a new column, `RegistrationDate` of DATE data type to the table.

III. Write the output of the following SQL query:

```
SELECT VehicleType, COUNT(*) FROM VEHICLE GROUP BY VehicleType;
```

Ans. (a) I.
```
SELECT CUST_NAME FROM CUSTOMERS ORDER BY CUST_NAME;
```

II.
```
SELECT UPPER(CITY_NAME) FROM CUSTOMERS C, CITY T WHERE C. CITY_ID =
T. CITY_ID AND BALANCE>22000;
```

III.
```
SELECT CUST_NAME, BALANCE, CITY_NAME FROM CUTOMERS C, CITY T WHERE
C.CITY_ID=T.CITY_ID;
```

OR

(b) I. VehicleID in the table can be considered as the primary key because it uniquely identifies each record in VEHICLE table.

II. `ALTER TABLE VEHICLE ADD RegistrationDate DATE;`

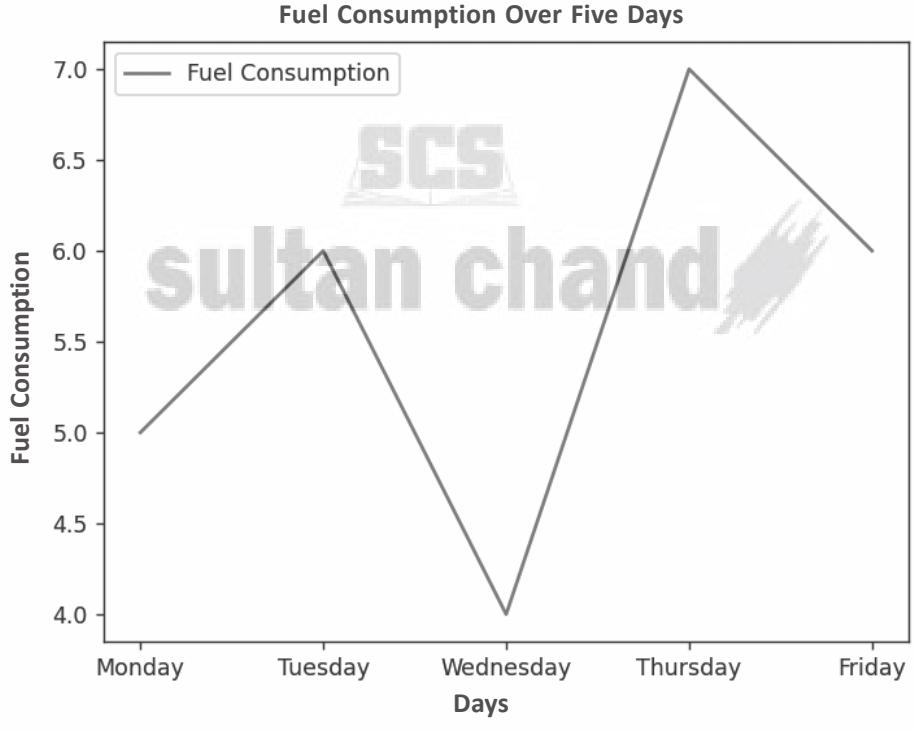
III.

VehicleType	COUNT(*)
Car	2
Bike	2
Truck	1

Section D (2 × 4 = 8 Marks)

33. Manish, a transport analyst, is working on a Python program to create a line graph that represents the fuel consumption (in litres) of a vehicle over five days. However, some parts of his code are incomplete. Help Manish by filling in the blanks in the following Python program. [4]

Day	Fuel Consumption (in Litres)
Monday	5
Tuesday	6
Wednesday	4
Thursday	7
Friday	6



Help Manish to complete the code.

```
_________ as plt                          # Statement-1
Days = ['Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday']
Fuel = [5, 6, 4, 7, 6]
_____________________________             # Statement-2
plt.xlabel('Days')
plt.ylabel('Fuel Consumption')
_____________                             # Statement-3
_____________________                     # Statement-4
plt.legend()
plt.show()
```

(a) Write a suitable code for the import statement in the blank against Statement-1.

(b) Write a suitable code in the blank against Statement-2, which plots the line graph with the appropriate data and includes a label for the legend.

(c) Fill in the blank against Statement-3 with the correct Python code to set the title of the graph.

(d) Fill in the blank against Statement-4 with an appropriate Python code to save the graph as an image file named fuel_consumption.png.

Ans.
```
import matplotlib.pyplot as plt #Statement-1
Days = ['Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday']
Fuel = [5, 6, 4, 7, 6]
plt.plot(Days, Fuel, label='Fuel Consumption') #Statement-2
plt.xlabel('Days')
plt.ylabel('Fuel Consumption')
plt.title('Fuel Consumption Over Five Days') #Statement-3
plt.savefig('fuel_consumption.png') #Statement-4
plt.legend()
plt.show()
```

34. (a) Rohit, who works as a database administrator, has created a table **GiftItems** as shown below: [4]

Table: GiftItems

ItemID	ItemName	Category	Price	Manufacture_Date
101	Teddy Bear	Toys	750	2022-05-12
102	Photo Frame	Decor	450	2021-11-28
103	Chocolate Box	Food	600	2023-01-15
104	Wall Clock	Decor	1200	2020-08-07
105	Toy Car	Toys	500	2022-12-30

Write suitable SQL queries for the following:

I. Display the ItemName and Category in uppercase, sorted alphabetically by ItemName.

II. Display the ItemID along with the month of manufacture.

III. Calculate and display the average price of all gift items.

IV. Display the Category and the number of items in each category.

OR

(b) Consider the following table and write the output of the given SQL queries.

Table: LIBRARY

BookID	BookName	Author	IssueDate	Price	Category
801	Python Programming	John Smith	2021-03-15	550	Technology
802	Data Structures	NULL	2020-01-22	650	Technology
803	World History	R. Sharma	NULL	450	History
804	English Literature	M. Brown	2019-03-10	500	Literature
805	Science Today	A. Verma	2021-05-05	400	Science

Write the output of the following SQL queries:

I. `SELECT BookName, LENGTH(BookName) FROM LIBRARY WHERE BookID < 804;`

II. `SELECT UPPER(BookName) FROM LIBRARY WHERE MONTH(IssueDate) = 3;`

III. `SELECT AVG(Price) FROM LIBRARY;`

IV. `SELECT Category, COUNT(*) FROM LIBRARY GROUP BY Category;`

Ans. (a) I. `SELECT UPPER(ItemName), UPPER(Category) FROM GiftItems ORDER BY ItemName;`

II. `SELECT ItemID, MONTHNAME(Manufacture_Date) FROM GiftItems;`

III. `SELECT AVG(Price) FROM GiftItems;`

IV. `SELECT Category, COUNT(*) FROM GiftItems GROUP BY Category;`

OR

(b)

I.

BookName	LENGTH(BookName)
Python Programming	18
Data Structures	15
World History	13

II.

UPPER(BookName)
PYTHON PROGRAMMING
ENGLISH LITERATURE

III.

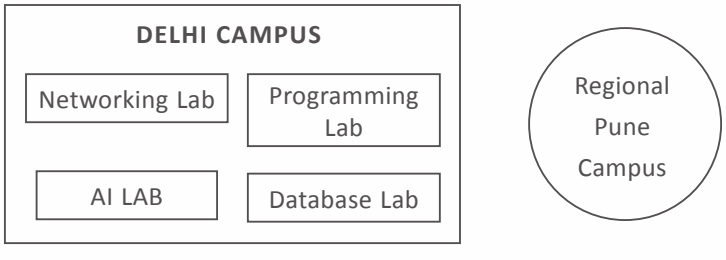
Avg(Price)
510

IV.

Category	Count (*)
Technology	2
History	1
Literature	1
Science	1

Section E (3 × 5 = 15 Marks)

35. XYZ University is planning to set up a computer network across its Campus IT centre. The University has its main Campus in Delhi and a Regional Campus in Pune. The Delhi Campus consists of four labs: Networking Lab, Programming Lab, AI Lab and Database Lab. [5]



The distances between these labs, as well as between Delhi and Pune campuses, are as follows:

From	To	Distance(in metres)
Networking Lab	Programming Lab	50
Networking Lab	AI lab	45
Networking Lab	Database Lab	90
Programming Lab	AI Lab	60
Programming Lab	Database Lab	80
AI Lab	Database Lab	40
Delhi Campus	Pune Campus	1200 kilometres

The number of computers in each lab/campus is as follows:

Networking Lab	80
Programming Lab	60
AI Lab	50
Programming Lab	40
Pune Campus	100

As a network engineer, you have to propose solutions to various queries listed as (a) to (e).

(a) Suggest the most suitable lab in the Delhi Campus to install the server. Also, give a reason to justify your suggested location.

(b) Which hardware device would you recommend to connect all the computers within each lab?

(c) Draw a suitable cable layout of wired network connectivity between the labs in the Delhi Campus.

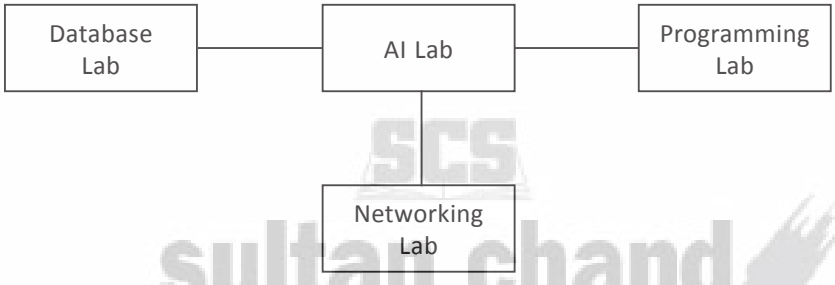
(d) Suggest the most appropriate type of network (LAN, MAN, WAN) to connect the Delhi main Campus and Pune Regional Campus.

(e) When a signal is transmitted through a wire from Networking Lab to Database Lab, its strength reduces. Which device would you suggest the university use to solve this problem?

Ans. (a) Networking Lab is the most suitable lab in the Delhi Campus to install the server due to maximum number of computers.

(b) Switch/Hub

(c)



(d) WAN (Wide Area Network)

(e) Repeater

36. Consider the DataFrame `df` shown below: [5]

	PatientName	Department	Fees
0	Rohan	Cardiology	5000
1	Meera	Neurology	4500
2	Aarav	Orthopaedics	7000
3	Nisha	Paediatrics	6000
4	Aditya	Cardiology	5500

Write Python statements for the following tasks:

(a) Print the first four rows of the DataFrame `df`.

(b) Add a new column named `"DaysAdmitted"` with values `[5, 3, 7, 2, 4]`.

(c) Delete the column `"Fees"` from the DataFrame.

(d) Rename the column `"Department"` to `"Dept"`.

(e) Display only the `"PatientName"` and `"Fees"` columns from the DataFrame.

Ans. (a)
```
print(df.head(4))
```

(b)
```
df['DaysAdmitted'] = [5, 3, 7, 2, 4]
```

(c)
```
df.drop('Fees', axis=1, inplace=True)
```

(d)
```
df.rename(columns={'Department':'Dept'}, inplace=True)
```

(e)
```
print(df[['PatientName', 'Fees']])
```

37. (a) Write suitable SQL queries for the following tasks: [5]

I. To extract the first three characters from the `Fruit_Name` column in the `Fruits` table.

II. To display the total quantity of fruits ordered from the `Quantity_Kg` column in the `Orders` table.

III. To display the year of the order dates from the `Order_Date` column in the `Orders` table.

IV. To display the `City` column from the `Suppliers` table after removing leading and trailing spaces.

V. To display the current date.

OR

(b) Write suitable SQL queries for the following:

I. To display the total number of characters in the string `'CardiologyDepartment'`.

II. Find the position of the first occurrence of the letter 'i' in the `Medicine_Name` column of the `Medicines` table.

III. To display the total sum of the `Salary` column from the `Staff` table.

IV. Calculate the square of the `Tariff` for each room in the `Booking` table.

V. To display the average run rate from the `Run_Rate` column in the `Sports` table.

Ans. (a) I.
```
SELECT LEFT(Fruit_Name, 3) FROM Fruits;
```
II.
```
SELECT SUM(Quantity_Kg) FROM Orders;
```
III.
```
SELECT YEAR(Order_Date) FROM Orders;
```
IV.
```
SELECT TRIM(City) FROM Suppliers;
```
V.
```
SELECT CURDATE();
```

OR

(b) I.
```
SELECT LENGTH('CardiologyDepartment');
```
II.
```
SELECT INSTR(Medicine_Name, 'i') FROM Medicines;
```
III.
```
SELECT SUM(Salary) FROM Staff;
```
IV.
```
SELECT POW(Tariff, 2)FROM Booking;
```
V.
```
SELECT AVG(Run_Rate) FROM Sports;
```