इन्फॉर्मेटिक्स प्रैक्टिसेज
Informatics Practices

कक्षा / Class XII

2025-26

विद्यार्थी सहायक सामग्री
Student Support Material

केन्द्रीय विद्यालय संगठन~Kendriya Vidyalaya Sangathan

संदेश

विद्यालयी शिक्षा में शैक्षिक उत्कृष्टता प्राप्त करना एवं नवाचार द्वारा उच्च - नवीन मानक स्थापित करना केन्द्रीय विद्यालय संगठन की नियमित कार्यप्रणाली का अविभाज्य अंग है। राष्ट्रीय शिक्षा नीति 2020 एवं पी. एम. श्री विद्यालयों के निर्देशों का पालन करते हुए गतिविधि आधारित पठन-पाठन, अनुभवजन्य शिक्षण एवं कौशल विकास को समाहित कर, अपने विद्यालयों को हमने ज्ञान एवं खोज की अद्‌भुत प्रयोगशाला बना दिया है। माध्यमिक स्तर तक पहुँच कर हमारे विद्यार्थी सैद्धांतिक समझ के साथ-साथ, रचनात्मक - विशेषणात्मक एवं आलोचनात्मक चिंतन भी विकसित कर लेते हैं। यही कारण है कि वह बोर्ड कक्षाओं के दौरान विभिन्न प्रकार के मूल्यांकनों के लिए सहजता से तैयार रहते हैं। उनकी इस यात्रा में हमारा सतत योगदान एवं सहयोग आवश्यक है - केन्द्रीय विद्यालय संगठन के पांचों आंचलिक शिक्षा एवं प्रशिक्षण संस्थान द्वारा संकलित यह विद्यार्थी सहायक- सामग्री इसी दिशा में एक आवश्यक कदम है । यह सहायक सामाग्री कक्षा 9 से 12 के विद्यार्थियों के लिए सभी महत्वपूर्ण विषयों पर तैयार की गयी है। केन्द्रीय विद्यालय संगठन की विद्यार्थी सहायक-सामग्री अपनी गुणवत्ता एवं परीक्षा संबंधी - सामग्री संकलन की विशेषज्ञता के लिए जानी जाती है और शिक्षा से जुड़े विभिन्न मंचों पर इसकी सराहना होती रही है। मुझे विश्वास है कि यह सहायक सामग्री विद्यार्थियों की सहयोगी बनकर निरंतर मार्गदर्शन करते हुए उन्हें सफलता के लक्ष्य तक पहुँचाएगी।

शुभाकांक्षा सहित ।

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आयुक्त, केन्द्रीय विद्यालय संगठन

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INFORMATICS PRACTICES Subject Code - 065
Class XII (2025-26)

1. Prerequisite: Informatics Practices – Class XI

2. Learning Outcomes

At the end of this course students will be able to:

- **Create Series, Data frames and apply various operations.**
- **Visualize data using relevant graphs.**
- **Design SQL queries using aggregate functions.**
- **Import/Export data between SQL database and Pandas.**
- **Learn terminology related to networking and the internet.**
- **Identify internet security issues and configure browser settings.**
- **Understand the impact of technology on society including gender and disability issues**

3. Distribution of Marks and Periods

Unit No	Unit Name	Marks
1	Data Handling using Pandas and Data Visualization	25
2	Database Query using SQL	25
3	Introduction to Computer Networks	10
4	Societal Impacts	10
	Project	-
	Practical	30
	Total	**100**

4. Unit Wise syllabus

Unit 1: Data Handling using Pandas -I

Introduction to Python libraries- Pandas, Matplotlib;

Data structures in Pandas - Series and Data Frames.

Series: Creation of Series from – ndarray, dictionary, scalar value; mathematical operations; Head() and Tail() functions; Selection, Indexing and Slicing.

Data Frames: creation- from dictionary of Series, list of dictionaries, Text/CSV files, display; iteration; Operations on rows and columns: add, select, delete, rename;

Head and Tail functions; Indexing using Labels, Boolean Indexing;

Importing/Exporting Data between CSV files and Data Frames.

Data Visualization: Purpose of plotting; drawing and saving following types of plots using Matplotlib – line plot, bar graph, histogram

Customizing plots: adding label, title, and legend in plots.

Unit 2: Database Query using SQL:

Revision of database concepts and SQL commands covered in class XI

Math functions: POWER (), ROUND (), MOD ().

Text functions: UCASE ()/UPPER (), LCASE ()/LOWER (), MID ()/SUBSTRING ()/SUBSTR (), LENGTH (), LEFT (), RIGHT (), INSTR (), LTRIM (), RTRIM (), TRIM ().

Date Functions: NOW (), DATE (), MONTH (), MONTHNAME (), YEAR (), DAY (), DAYNAME ().

Aggregate Functions: MAX (), MIN (), AVG (), SUM (), COUNT (); using COUNT (*). Querying and manipulating data using Group by, Having, Order by.

Working with two tables using equi-join.

Unit 3: Introduction to Computer Networks

Introduction to networks, Types of network: PAN, LAN, MAN, WAN.

Network Devices: modem, hub, switch, repeater, router, gateway

Network Topologies: Star, Bus, Tree, Mesh.

Introduction to Internet, URL, WWW, and its applications- Web, email, Chat, VoIP.

Website: Introduction, difference between a website and webpage, static vs dynamic web page, web server and hosting of a website.

Web Browsers: Introduction, commonly used browsers, browser settings, add-ons and plug-ins, cookies.

Unit 4: Societal Impacts

Digital footprint, net and communication etiquettes, data protection, intellectual property rights (IPR), plagiarism, licensing and copyright, free and open source software (FOSS), cybercrime and cyber laws, hacking, phishing, cyber bullying, overview of Indian IT Act.

E-waste: hazards and management.

Awareness about health concerns related to the usage of technology.

Project Work : The aim of the class project is to create tangible and useful IT application. The learner may identify a real-world problem by exploring the environment. e.g. Students can visit shops/business places, communities or other organizations in their localities and enquire about the functioning of the organization, and how data are generated, stored, and managed. The learner can take data stored in csv or database file and analyze using Python libraries and generate appropriate charts to visualize.

Learners can use Python libraries of their choice to develop software for their school or any other social good. Learners should be sensitized to avoid plagiarism and violation of copyright issues while working on projects.

Teachers should take necessary measures for this. Any resources (data, image etc.) used in the project must be suitably referenced. The project can be done individually or in groups of 2 to 3 students. The project should be started by students at least 6 months before the submission deadline.

Practical Marks Distribution

S.No	Unit Name	Marks
1	**Programs using Pandas and Matplotlib**	**8**
2	**SQL Queries**	**7**
3	**Practical file (minimum of 15 programs based on Pandas, 4 based on Matplotlib and 15 SQL queries must be included)**	**5**
4	**Project Work (using concepts learned in class XI and XII)**	**5**
5	**Viva-Voce**	**5**
	Total	**30**

5. Suggested Practical List

5.1 Data Handling

1. Create a panda's series from a dictionary of values and a ndarray

2. Given a Series, print all the elements that are above the 75th percentile.

3. Create a Data Frame quarterly sales where each row contains the item category, item name, and expenditure. Group the rows by the category and print the total expenditure per category.

4. Create a data frame for examination result and display row labels, column labels data types of each column and the dimensions

5. Filter out rows based on different criteria such as duplicate rows.

6. Importing and exporting data between pandas and CSV file

5.2 Visualization

1. Given the school result data, analyses the performance of the students on different parameters, e.g subject wise or class wise.

2. For the Data frames created above, analyze, and plot appropriate charts with title and legend.

3. Take data of your interest from an open source (e.g. data.gov.in), aggregate and summarize it. Then plot it using different plotting functions of the Matplotlib library.

5.3 Data Management

1. Create a student table with the student id, name, and marks as attributes where the student id is the primary key.

2. Insert the details of a new student in the above table.

3. Delete the details of a student in the above table.

4. Use the select command to get the details of the students with marks more than 80.

5. Find the min, max, sum, and average of the marks in a student marks table.

6. Find the total number of customers from each country in the table (customer ID, customer Name, country) using group by.

7. Write a SQL query to order the (student ID, marks) table in descending order of the marks.

Index

UNIT 1: Data Handling Using Pandas and Data Visualisation
DATA HANDLING USING PANDAS –I

1.Introduction to Python libraries:

Python libraries contain a collection of built in modules which can be used in our programs. Examples for python libraries are 'numpy', 'pandas' and 'matplotlib'. Pandas (panel data) is a Python's library for data analysis.
It is the most famous Python library for data science that offers powerful and flexible data structures which make data analysis and manipulation easy. It is built on top of two core libraries – NumPy and Matplotlib that give us a single and convenient place for data analysis and visualization work. It is developed by **Wes McKinney**.

The library 'pandas' has three data structures namely **Series, DataFrame and Panel**.
Data Structure is an organization of data in a computer in such a way that it can be accessed efficiently.

Differences between 'pandas' and 'numpy' :

I. **pandas** DataFrame can have data of different types while **numpy** array can have homogeneous data (same type of data).
II. **pandas** is used when data is in tabular format and **numpy** is used when we have to manipulate numeric, array-like data.
- **pandas** are slightly slower due to higher abstraction where as **numpy** are very fast for numerical computation.
- **Pandas** supports multiple data types where as **numpy** supports only numerical data.

Command to install pandas:

To install pandas type: **pip install pandas**
Note : We can install Pandas using the pip command in your terminal, command prompt, or any Python environment that supports package installation.

Series Data Structure:

Series is like a one dimensional array having a sequence of homogenous data **with data labels called index**. Data can be of any type(int, float, string etc). By default the index starts with zero but other indexes are also permitted. Even if we use our own label, the default index will be available. Default index starts with 0 (first element), 1(second element), 2 (third element) and so on. It is a data structure with two arrays, out of them one array works as index (labels) and the second array works as original data.
Series size is immutable: Once a series is created, its size cannot be changed. If we add/delete an element, a new series is created by Python internally and new series object will be created.
Series Data is mutable : Series data can be changed.
Example:

```
import pandas as pd
# Create a Series
s = pd.Series([10, 20, 30])
```

OUTPUT :

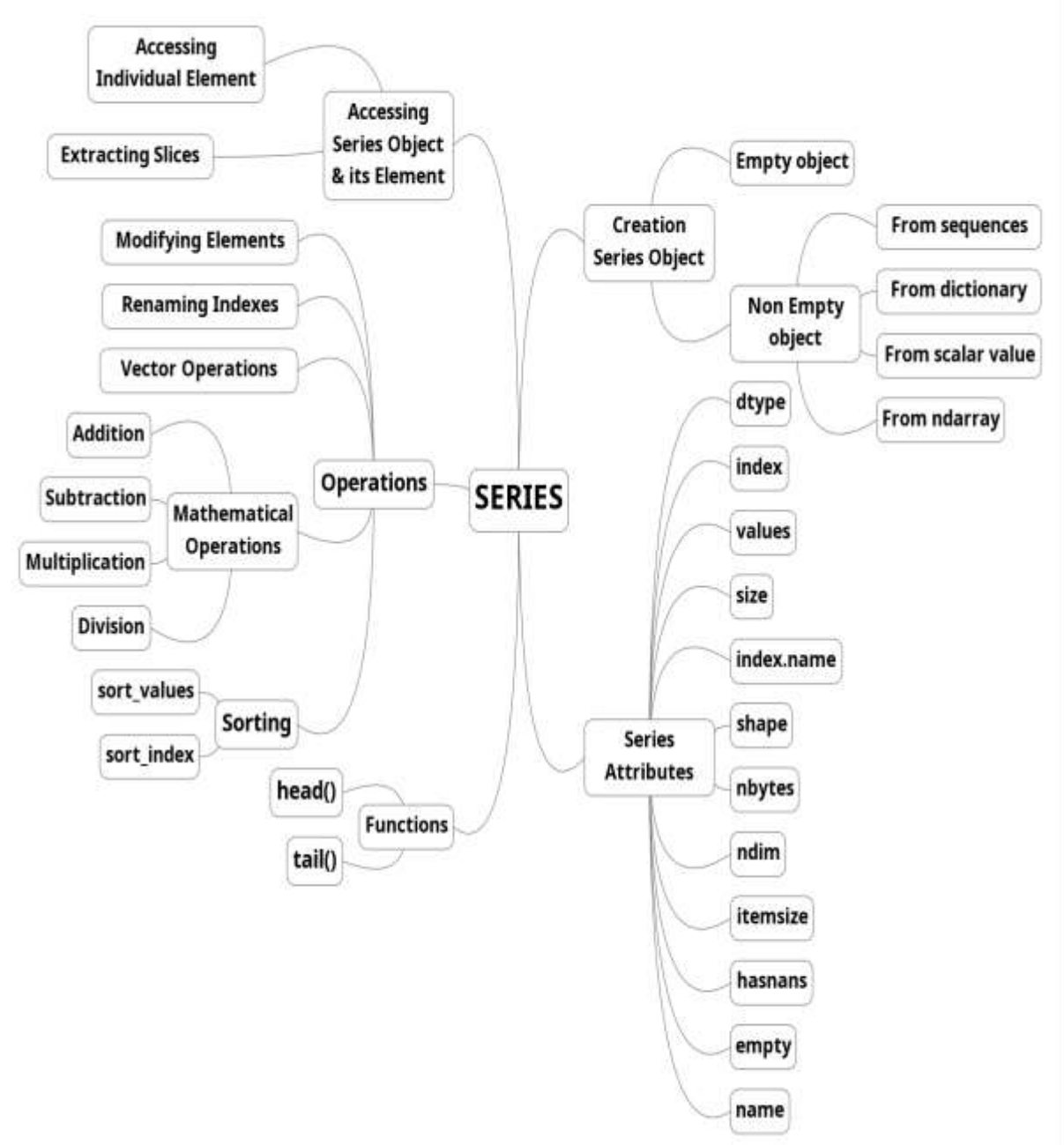
```
0   10
1   20
2   30
dtype: int64
```

As the data is mutable in series we can change the value at any index.
In this example the value of index 1 is modified.

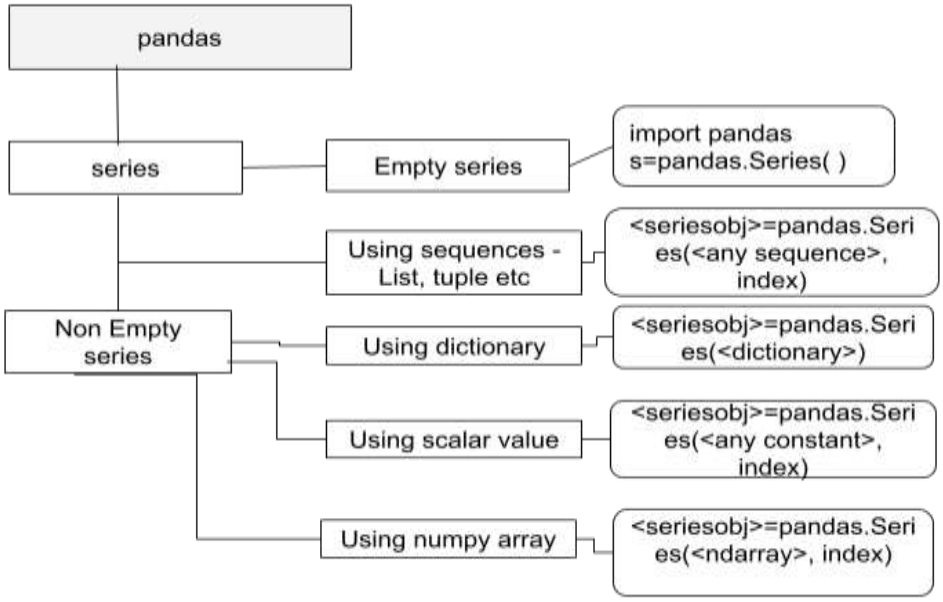
```
import pandas as pd
```

s = pd.Series([10, 20, 30]) # Create a Series
s[1] = 99
print(s)
OUTPUT :
```
0    10
1    99
2    30
dtype: int64
```

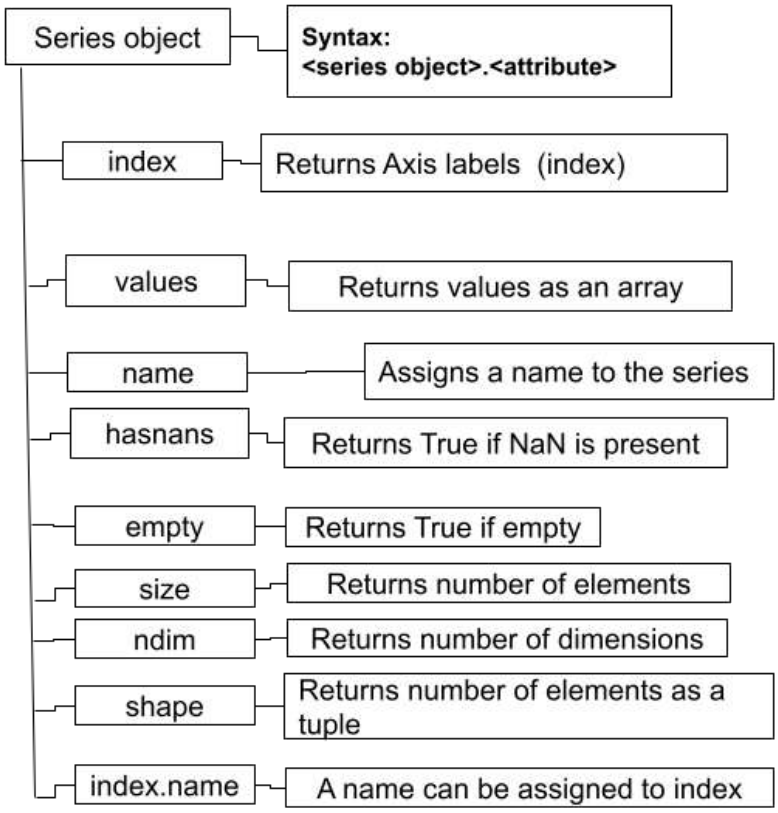
Concept Maps



Concept Map - Creating Series



Attributes of Series:



Creating Series Objects

Series Objects can be created by using the **Series( )** method and for this we have to **import the pandas library** using the code: **import pandas**

I. Creating an Empty Series

Syntax :- <Series Object Name>=pandas. Series( )

Example: import pandas as pd **#here, pd is a short name given to pandas**

S1=pd.Series( ) # S1 is an empty series.

II. Creating non-empty Series objects

Syntax:- <Series Object>=pandas. Series(data, index, dtype)

Here, **data** can be Python sequence like list, tuple or string or Python dictionary or scalar value or ndarray, **index** is a data label, **dtype** is datatype.

Specifying Data As A Python Sequence

- Here, data can be in the form of tuple, list or string.

PROGRAM: using a tuple and default index	**OUTPUT**
import pandas as pd s1=pd.Series((10,20,30,40)) print(s1)	0 10 1 20 2 30 3 40 dtype: int64
PROGRAM: series using a list, specifying index	**OUTPUT**
import pandas as pd s2=pd.Series(data=[10,20,30,40,50],index=["a","b","c","d","e"]) print(s2)	a 10 b 20 c 30 d 40 e 50 dtype: int64
PROGRAM: series using a list of strings	**OUTPUT**
import pandas as pd months=["Jan","Feb","March","April","May"] days=[31,28,31,30,31] s3=pd.Series(days,months) print(s3)	Jan 31 Feb 28 March 31 April 30 May 31 dtype: int64
PROGRAM: series using a sequence generated using range( )	**OUTPUT**

import pandas as pd s4=pd.Series(data=[i for i in range(1,10,2)],index=[i for i in \ range(1,6)]) print(s4) Note : When a statement is too long, we can use \ to continue it on the next line.	1 1 2 3 3 5 4 7 5 9 dtype: int64
PROGRAM: specifying index using range( )	**OUTPUT**
import pandas as pd s5=pd.Series(data=range(1,10,2),index=range(1,6)) print(s5)	1 1 2 3 3 5 4 7 5 9 dtype: int64
PROGRAM: Series with NaN values	**OUTPUT**
import pandas as pd import numpy as np s6=pd.Series([1,2,3,4,np.NaN,6]) print(s6)	0 1.0 1 2.0 2 3.0 3 4.0 4 NaN 5 6.0 dtype: float64

Specifying Data As a Scalar or Constant

a. Here, data is a scalar value / constant value.
b. This constant value shall be repeated to match the length of the index.

PROGRAM	**OUTPUT**
import pandas as pd s1=pd.Series(100, index=[10,20,30]) print(s1)	10 100 20 100 30 100 dtype: int64
s2=pd.Series(20,index=['a', 'b','c','d']) print(s2)	a 20 b 20 c 20 d 20 dtype: int64
s3=pd.Series("Wel-Come", index=["Ajay", "Vijay"]) print(s3)	Ajay Wel-Come Vijay Wel-Come dtype: object

Specifying Data As A Python Dictionary

A series object can be created by specifying indexes and values through a dictionary.

PROGRAM	OUTPUT
import pandas as pd s1=pd.Series({'A':40,'B':43,'C':45,'D':41}) print(s1) s2=pd.Series({"Jan":31,"Feb":28,"Mar":31}) print(s2)	A 40 B 43 C 45 D 41 dtype: int64 Jan 31 Feb 28 Mar 31 dtype: int64

Specifying Data as an 'ndarray' also known as numpy array

I. ndarray can be created from following function:

1. **array( ) function** ex:-np.array([1,2,3,4,5])

PROGRAM	OUTPUT
import pandas as pd import numpy as np print(pd.Series(np.array ([1,2,3,4,5])))	0 1 1 2 2 3 3 4 4 5 dtype: int64

2. **arange function** ex:-np.arange(1,6,2)

PROGRAM	OUTPUT
import pandas as pd import numpy as np print(pd.Series(np.arange(1,6,2)))	0 1 1 3 2 5 dtype: int64

3. **linspace function** ex:-np.linspace(10,20,5)

Note:**numpy.linspace( )** is a function in the NumPy library used to create an array of evenly spaced numbers over a specified range.

PROGRAM	OUTPUT
Example 1: import pandas as pd import numpy as np print(pd.Series(np.linspace(10,20,5))) **Note :** syntax : linspace(start, stop,num) 5 numbers equally spaced between 10 and 20 (inclusive): **Example 2:** import pandas as pd import numpy as np print(pd.Series(np.linspace(15,20,7)))	**Output of Example 1**: 0 10.0 1 12.5 2 15.0 3 17.5 4 20.0 dtype: float64 **Output of Example 2** 0 10.0 1 15.0 2 20.0 3 25.0 dtype: float64

4. **tile function** ex:-np.tile([1,2],3)

   Note: The **numpy.tile( )** function is used to **construct an array by repeating another array** a specified number of times.

PROGRAM	**OUTPUT**
import pandas as pd import numpy as np print(pd.Series(np.tile([1,2],3))) **Note : np.tile([1, 2], 3)** repeats the array [1, 2] three times**.**	0 1 1 2 2 1 3 2 4 1 5 2 dtype: int64

Attributes of Series Object

i) Some common attributes related to series object are described below and are accessed using the syntax:

<Series object>.<Attributename>

```
import pandas as pd
s1=pd.Series((10,20,30),index=['a','b','c'])
print(s1)
```

Attribute	**Description**	**OUTPUT**
Series.index	Returns index of the series. Ex.: s1.index	Index(['a', 'b', 'c'], dtype='object')
Series.values	Returns ndarray. Example: S1.values	[10 20 30]
Series.index.name	It can be used to assign new name to index s1.index.name="Newname" Ex.: s1.index.name='Roll number'	Roll number a 10 b 20 c 30 dtype: int64
Series.dtype	Return data type object. Ex.: s1.dtype	int64
Series.shape	Returns no. of elements including missing or empty values (NaN) in a form of tuple. E.g. s1.shape	(3,)
Series.nbytes	Returns no. of bytes taken by series object. Ex.: s1.nbytes	24
Series.ndim	Returns dimension (no. of axis) Ex.: s1.ndim	1
Series.size	Returns no. of elements in the series object. Ex. s1.size	3

Series.itemsize	Returns the no. of bytes allocated to each data item. Ex. s1.values.itemsize	8
Series.hasnans	Returns true if there are any NaN. Ex. S1.hasnans	False
Series.empty	Returns true if series object is empty. Ex. s1.empty	False
Series.name	Return or assign new name to series. Ex. s1.name = 'newname' s1.name='s2' print(s1)	Name: s2, dtype: float64

Accessing Elements of a Series

There are two common ways for accessing the elements of a series: **Indexing** and **Slicing**. Indexing means use index to access the elements. There are two types of indexes, positional index - an integer value and labelled index - any user defined label.

i) Accessing Individual Element from a Series

Syntax:- <Series Object Name>[<valid index>]
Consider S1=pd.Series([10,20,30,40,50])
Example:- S1[0]

PROGRAM	OUTPUT
import pandas as pd S1=pd.Series([10,20,30,40,50]) print(S1[0]) print(S1[3])	10 40

ii) Extracting Slices from Series Object

To extract slices, specify [start: stop: step] where start and stop signify the positions of elements not the indexes.

PROGRAM	OUTPUT
import pandas as pd s1=pd.Series(data=[10,20,30,40,50],index=[i for i in \ "ABCDE"]) print(s1) **Note** : When a statement is too long, we can use \ to continue it on the next line.	A 10 B 20 C 30 D 40 E 50 dtype: int64
print(s1[:4])	A 10 B 20 C 30 D 40 dtype: int64
print(s1[-4:])	B 20 C 30 D 40 E 50 dtype: int64

print(s1[:])	A 10 B 20 C 30 D 40 E 50 dtype: int64
print(s1[1:4])	B 20 C 30 D 40 dtype: int64
print(s1[::-1])	E 50 D 40 C 30 B 20 A 10 dtype: int64

iii) **Indexing and accessing can also be done using iloc[ ] and loc[ ] methods**

i) **iloc[ ]-** iloc is used for indexing or selection based on position, i.e we have to specify integer index for selection by position. It refers to position-based indexing.

ii) **Syntax:-** series.iloc[<row number / index range>]

iii) **loc[ ]-** loc is used for indexing or selection based on name, i.e. we have to specify row label / location-name. It refers to name-based or label-based indexing.

iv) **Syntax:-** series.loc[<list of row labels / row names>]

PROGRAM	**OUTPUT**
import pandas as pd s1=pd.Series(data=[10,20,30,40,50], index=['A','B','C','D','E']) print(s1.iloc[1:4])	B 20 C 30 D 40 dtype: int64
print(s1.loc["B":"E"])	B 20 C 30 D 40 E 50 dtype: int64

Operations on Series Object

A. Modifying Elements of Series Object

Syntax:

A. <SeriesObject>[<index>]=<new_data_value>

B. <SeriesObject>[**start:stop**]=<new_data_value>

PROGRAM	**OUTPUT**	
	Statement 1	**Statement 2**
import pandas as pd d1=[10,20,30,40,50] s1=pd.Series(d1) s1[1]=100 print(s1) #Statement 1 s1[3:5]=500 print(s1) # Statement 2	0 10 1 100 2 30 3 40 4 50 dtype: int64	0 10 1 100 2 30 3 500 4 500 dtype: int64

B. **Deleting Element from Series Object**

Syntax: <SeriesObject>.drop(<index to be removed>)

PROGRAM	**OUTPUT**	
	Statement 1	**Statement 2**

import pandas as pd
d1=[10,20,30,40,50]
s1=pd.Series(d1)
print(s1) #Statement 1
s1=s1.drop(2)
print(s1) #Statement 2
	0 10
	1 20
	2 30
	3 40
	4 50
	dtype: int64
		0 10
		1 20
		3 40
		4 50
		dtype: int64

Vector Operations on Series Objects

A. Vector operations means that if you apply a function or expression then it is individually applied on each item of the object.

B. Suppose S1 is a series object
(i) s1+2 (ii) s1*3 (iii) s1>15 (iv) s2=s1**2

PROGRAM	**OUTPUT**			
	St1	**St2**	**S3**	**S4**
import pandas as pd d1=[10,20,30,40,50] s1=pd.Series(d1) print(s1) # St 1 print(s1+2) #St 2 print(s1>15) #St3 print(s1**2) #St4	0 10 1 20 2 30 3 40 4 50 dtype: int64	0 12 1 22 2 32 3 42 4 52 dtype: int64	0 False 1 True 2 True 3 True 4 True dtype: bool	0 100 1 400 2 900 3 1600 4 2500 dtype: int64

Arithmetic operations on Series Objects

1. Arithmetic operations can also be performed between series objects like addition, subtraction, multiplication, division etc.
2. Output is NaN (i) when index of series do not match (ii) when indices matches but the data type on both the indices are different. (iii) If the data items of the two matching indexes are not compatible for the operations,

Addition and Subtraction operations on Series

PROGRAM	**OUTPUT**	
	St1	**St2**
import pandas as pd s1=pd.Series([10.5, 12.4, 21.4, 14.6]) s2=pd.Series([10.5,12.4, 21.4, 14.6], index=['a','b','c','d']) s3=pd.Series([20.15, 2.41, 21.14, 4.65]) s4=pd.Series([20.15, 2.41, 21.14, 4.65, 8.19, 97.6]) s5=pd.Series([11.5, 12.4, 1.4, 34.6], index=['a','b','c','d']) print(s1+s4) #St1 print(s1-s3) #St2	0 30.65 1 14.81 2 42.54 3 19.25 4 NaN 5 NaN dtype: float64	0 -9.65 1 9.99 2 0.26 3 9.95 dtype: float64

Multiplication and Division operations on Series

PROGRAM	OUTPUT	
	St1	St2
import pandas as pd s1=pd.Series([10.5,12.4,21.4,14.6]) s2=pd.Series([10.5,12.4,21.4,14.6],index=['a','b','c','d']) s3=pd.Series([20.15,2.41,21.14,4.65]) s4=pd.Series([20.15,2.41,21.14,4.65,8.19,97.6]) s5=pd.Series([11.5,12.4,1.4,34.6],index=['a','b','c','d']) print(s1*s3) #St1 print(s1/s3) #St1	0 -9.65 1 9.99 2 0.26 3 9.95 dtype: float64	0 0.521092 1 5.145228 2 1.012299 3 3.139785 dtype: float64

Filtering Entries in Series Objects

We can filter out entries from a series object using expressions that are of Boolean type (i.e. the expression that yield a Boolean value) as per following syntax:

<Series object>[<Boolean expression on Series Object>]

PROGRAM	OUTPUT		
	Statement1	Statement2	Statement3
import pandas as pd s1=pd.Series([10.5,2.4,21.4,1.6,98.9]) s2=pd.Series([10.5,12.4,21.4,4.6,98.9], index=['a','b','c','d','e']) print(s1>5) # Statement1 print(s1[s1>5]) #Statement2 print(s2<10) #Statement3	0 True 1 False 2 True 3 False 4 True dtype: bool	0 10.5 2 21.4 4 98.9 dtype: float64	a False b False c False d True e False dtype: bool

Sorting Series Values: Values of Series object can be sorted on the basis of values and indexes using **sort_values([ascending=True|False]),**

sort_index([ascending=True|False]).

where, argument ascending is optional. By default it is True.

PROGRAM	OUTPUT	
	Statement1	Statement2
#consider the series object s1 print(s1.sort_values( )) **#Statement 1** print(s1.sort_values(ascending=False)) **#Statement 2**	3 1.6 1 2.4 0 10.5 2 21.4 4 98.9 dtype: float64	4 98.9 2 21.4 0 10.5 1 2.4 3 1.6 dtype: float64

A. **<Series_object>.sort_index([ascending=True|False])>**

where, argument ascending is optional. By default it is True.

PROGRAM	OUTPUT	
	Statement1	Statement2
import pandas as pd s1=pd.Series([10.5,2.4,21.4,1.6,98.9]) print(s1.sort_index()) print(s1.sort_index(ascending=False))	0 10.5 1 2.4 2 21.4 3 1.6 4 98.9 dtype: float64	4 98.9 3 1.6 2 21.4 1 2.4 0 10.5 dtype: float64

The head and tail Functions

A. head() and tail () functions

The head(n) function is used to fetch first n rows from pandas object and tail(n) function returns last n rows from pandas object.

B. If n is missing or not provided then by default they will return first 5 rows and last 5 rows respectively.

C. Syntax:- 1. **<pandas obj>.head([n])**

2. **<pandas obj>.tail([n])**

Ex.:- **s1.head(3), s1.head(),s1.tail(4),s1.tail()**

PROGRAM	**OUTPUT**			
	St1	**St2**	**St3**	**St4**
import pandas as pd s1=pd.Series([10,2,21,1,98,2,3,5,6]) print(s1.head()) #St1 print(s1.head(7)) #St2 print(s1.tail()) #St3 print(s1.tail(3)) #St4	0 10 1 2 2 21 3 1 4 98 dtype: int64	0 10 1 2 2 21 3 1 4 98 5 2 6 3 dtype: int64	4 98 5 2 6 3 7 5 8 6 dtype: int64	6 3 7 5 8 6 dtype: int64

Multiple Choice Questions

1	**Which two data structures are commonly used in Pandas?** A. Array and Tuple B. List and Dictionary C. Series and DataFrame D. Stack and Queue **Answer: C. Series and DataFrame**
2	**What is a Series in Pandas?** A. A two-dimensional labeled array B. A one-dimensional array with labeled data C. A type of function in Pandas D. A spreadsheet file format **Answer: B. A one-dimensional array with labeled data**
3	**In a Pandas Series, what is the default type of index assigned to values?** A. Alphabetic labels B. Custom-defined names C. Numeric labels starting from one D. Numeric labels starting from zero **Answer: D. Numeric labels starting from zero**
4	**Which of the following best describes the index in a Pandas Series?** A. A row number in a table B. A name given to the Series C. A data label associated with each value in the Series D. The length of the Series **Answer: C. A data label associated with each value in the Series**
5	In Pandas library of Python, a one-dimensional array containing a sequence of values of any datatype is known as : A. DataFrame B. Histogram C. Series D. Panel

	Answer: C.Series
6	Which of the following command is used to display the first three elements of a series, 'S' ? A. S.head( ) B. S.head(4) C. S.Head( ) D. S.head(3) **Answer: D. S.head(3)**
7	Which of the following command is used to display the last three elements of a series, 'S' ? A. S.Tail B. S.tail( ) C. S.tail(3) D. S.Tail(3) **Answer: C. S.tail(3)**
8	Which attribute can be used to name the series? A. name B. index C. Name D. seriesname **Answer: A. name**
9	Which attribute returns a list of values in the series object? A. value B. values C. elements D. ditems **Answer: B . values**
10	Which attribute checks the existence of NaN value in a Series? A. len( ) B. count( ) C. values( ) D. hasnans( ) **Answer: D.hasnans( )**
11	**Which of the following can be used to create a Pandas Series?** A. List B. Dictionary C. Scalar value D. All of the above **Answer: D.All of the above**
12	**What will be the output of the following code?** **import pandas as pd** **s = pd.Series([10, 20, 30], index=['a', 'b', 'c'])** **print(s['b'])** **A.10 B. 20 C. b D. Error** **Answer: B. 20**
13	**What does the** dtype **property of a Series return?** A. Number of elements B. Data type of the Series elements C. Memory size D. None of the above **Answer: B. Data type of the Series elements**
14	**Which of the following statement will import pandas library?** A. import panndas as py B. import pandas as pd C. import panda as pd D. Import pandas as pd **Answer: B. import pandas as pd**
Short Answer Type Questions	
1	Find the output of the following Python code import pandas as pd S1=pd.Series([1,2,2,7,5], index=['a', 'b', 'c' , 'd' , 'e']) print(S1)

	print(S1.head(2) Answer: a 1 b 2 c 2 d 7 e 5 dtype: int64 a 1 b 2 dtype: int64
2	"Series has immutable index" . Explain? Answer: Once a series is created, the size or structure of index cannot be changed in place whereas the entire index can be replaced. One can not add more elements to a series or remove elements from the original series.

3	Give the output of the following code:
	import pandas as pd
	# Dictionary with names as keys and marks as values
	marks_dict = { 'Alice': 85, 'Bob': 78, 'Charlie': 92, 'David': 76, 'Eva': 89 }
	# Creating a Series from the dictionary
	marks_series = pd.Series(marks_dict)
	# Display the Series
	print("Student Marks:\n")
	print(marks_series)

	Answer: Student Marks: Alice 85 Bob 78 Charlie 92 David 76 Eva 89 dtype: int64
4	Consider the following series, 'Student' , and answer the questions that follow Alice 85 Bob 78 Charlie 92 David 76 Eva 89 dtype: int64 a) Display the values of this series b) Display the indexes c) Find how many elements are there in this series d) Display the mark of 'Alice'

	Answers: a) **print(Student.values)** b) **print(Student.index)** c) **print(Student.size)** d) **print(Student['Alice'])**
5	Consider the following series, 'Student' , and answer the questions that follow Alice 85 Bob 78 Charlie 92 David 76 Eva 89 dtype: int64 a) Increase the marks of all the students by 5 b) Display the details if mark is greater than 80 c) Display the marks of Alice, Eva d) Modify the marks of 'Alice'. New mark is 95 **Answers:** **a) Student = Student+5** **b) print(Student[Student>80])** **c) print(Student[['Alice', 'Ev**a']]) **d) Student['Alice'] = 95**
6	Write the output of the following code: import pandas as pd S1=pd.Series([10,15,16,12,18,19], index=['A', 'B', 'C', 'D', 'E', 'F']) print(S1[0:3]) print("_____") print(S1['A':'B']) print("_____ ") print(S1[0:5:2]) print("_____ ") print(S1['A':'F':2]) Answers: **A 10** **B 15** **C 16** **dtype: int64** **_____** **A 10** **B 15** **dtype: int64** **_____** **A 10** **C 16** **E 18** **dtype: int64** **_____** **A 10** **C 16** **E 18** **dtype: int64**
7	What do the keys and values in the dictionary represent in a Series?

Answer:
Keys become the **index labels** of the Series.
Values become the **data** (the elements) of the Series.

8 What is a Pandas Series?
Answer:
A Pandas Series is a one-dimensional labelled array capable of holding data of any type (integers, strings, floats, Python objects). It has both data and an index to label each element. Once created we can't add or remove elements in original Series.

9 Can the data type in a Series be mixed?
Answer:
A Series holds elements of a single data type. If mixed types are provided, Pandas will pick a common data type (usually object/string) for all elements.
Example :

```
import pandas as pd
s = pd.Series([10, "hello", 3.14, True])
print(s)
print("Data type:", s.dtype)
```

10 **How do we check for missing values in the Series?**
Answer:
Use the isnull() method, which returns a Boolean Series indicating where values are missing. Also 'hasnans' attribute can be used which will return True or False depending on the use of NaN values in the series.

11 How can you sort a Series by its index or values?
Answer:
Index: <seriesobject>.sort_index( )
Values: <seriesobject>.sort_values( )

12 What are the key features of a Pandas Series? How is it different from a NumPy array and a Python list?
Answer:
Key Features of a Pandas Series:

- One-dimensional labeled array.
- Supports different data types.
- Allows custom indexing.
- Supports vectorized operations.
- Handles missing data gracefully using NaN.

Comparison of List, ndarray and Series

Feature	Python List	NumPy Array	Pandas Series
Data Type	Mixed	Homogeneous	Homogeneous
Indexing	Positional only	Positional only	Customizable labels
Operations	Manual loop	Vectorized	Vectorized
Missing Values	Manual handling	Limited support	Built-in NaN
Library Dependency	None	Numpy	pandas

13 Give the output of the following:

```
import pandas as pd
S1=pd.Series([10,15,16,12,18,19], index=['A', 'B', 'C', 'D', 'E', 'F'])
S2=pd.Series([2,3,2,4,5,3], index=['A', 'B', 'C', 'D', 'F', 'G'])
```

	print(S1+S2) Answer: A 12.0 B 18.0 C 18.0 D 16.0 E NaN F 24.0 G NaN dtype: float64

Assertion and Reasoning based Questions

A: Assertion, R: Reason

Choose the correct option:

A. Both A and R are true, and R is the correct explanation of A.

B. Both A and R are true, but R is NOT the correct explanation of A.

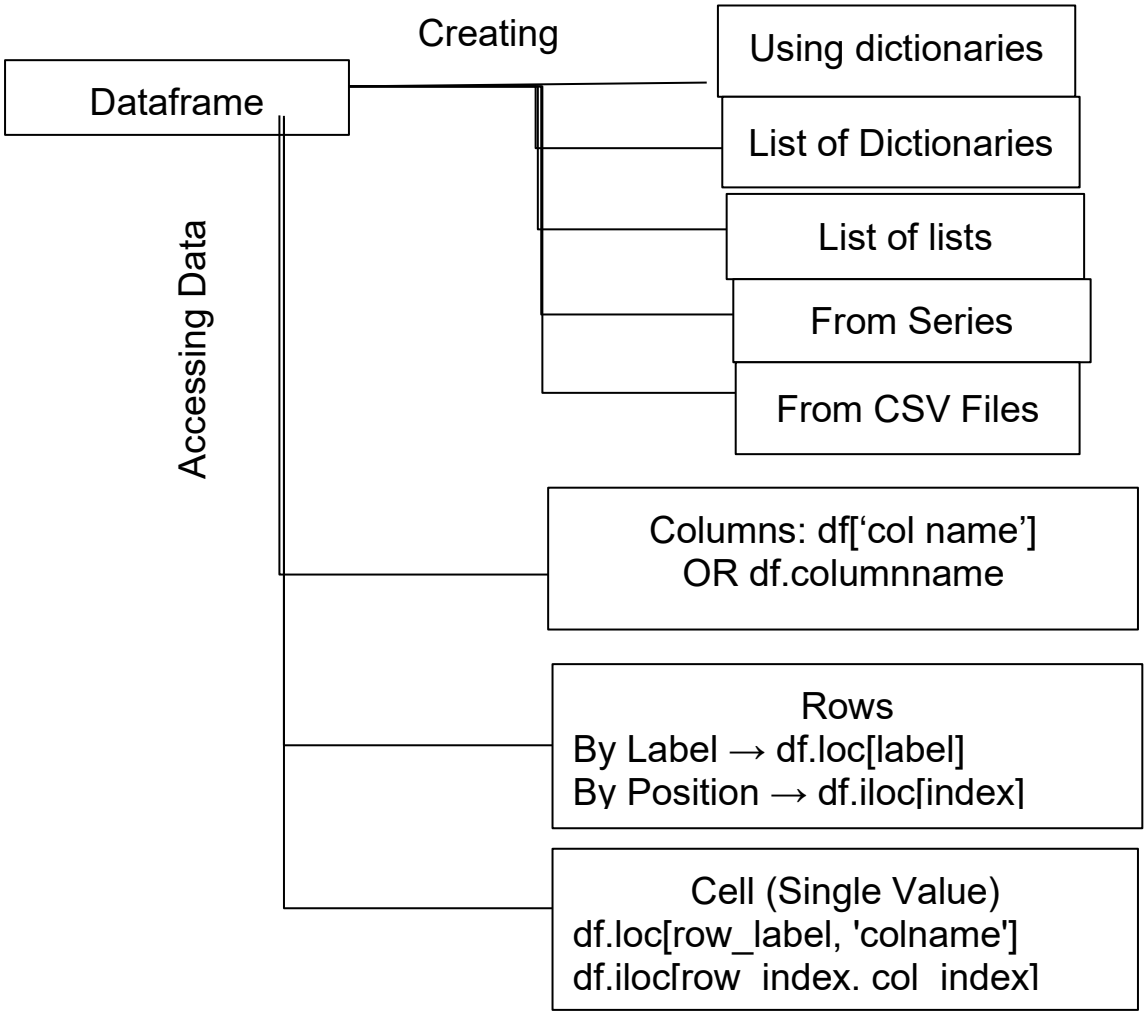
C. A is true, but R is false.

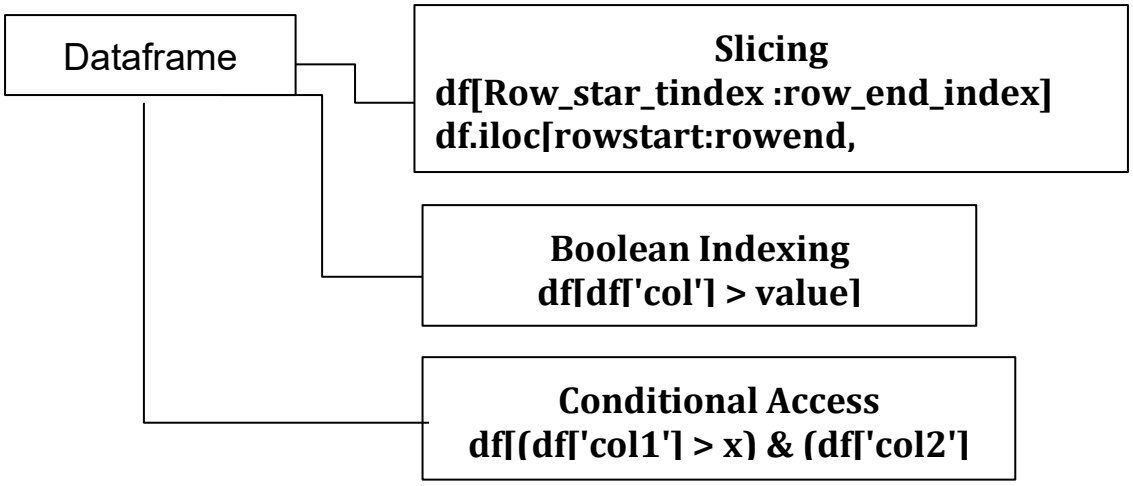
D. A is false, but R is true.

1	**Assertion (A):** A Pandas Series is fundamentally a two-dimensional labelled data structure. **Reason (R)**: It contains both a row and index **Answer: D. A is false, R is true**
2	**Assertion (A)**: When creating a Pandas Series from a NumPy array, the length of the index labels passed must match the size of the array to avoid a ValueError. **Reason (R):** If the lengths do not match, Pandas automatically fills the missing values with NaN to prevent errors **Answer: C. A is true, R is false.**
3	**Assertion (A):** The empty attribute of a Pandas Series returns True if the Series has no data values. **Reason (R):** This attribute is useful for quickly determining if a Series object has been initialized with any elements **Answer**: A. **A is true, R is a correct explanation for A** **Explanation**: The **empty** attribute prints True if the Series is empty and False otherwise. This attribute indeed serves to check whether a Series contains any values, making the reason a valid explanation for the assertion's purpose.
4	**Assertion (A):** In Pandas Series, positional indexing for slicing excludes the value at the end index position. **Reason (R):** This slicing behaviour is identical to how slicing with labeled indexes works, where the end label is also excluded. **Answer**: C. **A is true, R is false.**
5	**Assertion (A):** Mathematical operations between two Pandas Series automatically align data based on their labels. **Reason (R):** If a label is not found in one of the Series during an operation, the result for that label will be marked as NaN **Answer**: A. **A is true, R is a correct explanation for A**
6	**Assertion (A):** The head(n) method of a Pandas Series returns the last n members of the Series. **Reason (R):** By default, if n is not specified, head() returns the first 5 members **Answer**: D. **A is false, R is true**

Pandas Dataframe

Concept map: Creating Dataframe and accessing Data





Definition : A DataFrame is a data structure that organizes data into a 2-dimensional table of rows and columns. Dataframe helps us to store data in multiple columns.
Features: Two dimensional, size mutable, value mutable., row index and column index.
Example : Dataframe to store details of some **persons**

	Name	Age	City
0	Alice	25	New York
1	Bob	30	Los Angeles
2	Charlie	35	Chicago

In the above DataFrame named **persons**, where 0,1,2 are row indexes or row labels and Name, Age, City are column indexes or column labels.
In each column of a DataFrame, we can have data of different types. It is possible to change the data of a column or row (add new rows, columns or remove the existing rows and columns)
Dataframes are created using the DataFrame( ) method of pandas.

Creating Dataframes:

Creation- from dictionary of Series

Creating a pandas DataFrame from a dictionary of Series is straightforward. Each key in the dictionary represents a column name, and the Series associated with that key provides the data for the column.

Program	**Output**

import pandas as pd
name_series = pd.Series(['Alice', 'Bob', 'Charlie'])
age_series = pd.Series([25, 30, 35])
city_series = pd.Series(['New York', 'Los Angeles', 'Chicago'])
# Dictionary of Series 	
data_dict = { 'Name': name_series, 'Age': age_series, 'City': city_series}
# Creating DataFrame named df 	
df = pd.DataFrame(data_dict)
# Display the DataFrame 	
print(df)
	Name Age City
	0 Alice 25 New York
	1 Bob 30 Los Angeles
	2 Charlie 35 Chicago

Key Points:

The keys of the dictionary ('Name', 'Age', 'City') become the column names of the DataFrame. Each Series provides data for its respective column.

Creating Dataframe using list of dictionaries:

Each dictionary in the list represents a row in the DataFrame, and the keys in the dictionaries become the column names.

Program	Output
import pandas as pd data = [{'Name': 'Alice', 'Age': 25, 'City': 'New York'}, {'Name': 'Bob', 'Age': 30, 'City': 'Los Angeles'}, {'Name': 'Charlie', 'Age': 35, 'City': 'Chicago'}] **# Creating DataFrame** df = pd.DataFrame(data) **# Display the DataFrame** print(df)	Name Age City 0 Alice 25 New York 1 Bob 30 Los Angeles 2 Charlie 35 Chicago

Key Points:

The keys in the dictionary ('Name', 'Age', 'City') become the column names of the DataFrame. Each dictionary represents one row, and its values are placed in the corresponding columns.

Creating Dataframe using Text/CSV Files:

CSV stands for **Comma-Separated Values**. A CSV file is a **plain text file** used to store **tabular data** (like rows and columns in a spreadsheet), where **each line represents a row**, and **each value (or field) is separated by a comma**.

The pandas library provides the **read_csv()** function to create a Dataframe using the given file. CSV files can be created using various applications.

Suppose we have a CSV file named **data.csv** with the following content:

Name,Age, City
Alice,25,New York
Bob,30,Los Angeles
Charlie,35,Chicago

Program: create a dataframe using CSV File	Output

import pandas as pd
# Load data from CSV file 	
df = pd.read_csv('data.csv')
# Display the DataFrame 	
print(df)
	Name Age City
	0 Alice 25 New York
	1 Bob 30 Los Angeles
	2 Charlie 35 Chicago

Key Notes:

- The first row of the CSV file is automatically treated as column headers by default.
- You can specify a custom delimiter using the **sep** parameter, such as read_csv('data.csv', **sep**=';') if the file uses semicolons instead of commas.
- Additional options like skipping rows (**skiprows**), handling missing values (**na_values**), and specifying column data types (**dtype**) make the function highly versatile.

Accessing a column of a Dataframe:

Syntax: **<Datframename>[index]**
<dataframename>[[list of columns]]
Example: print(df[' Marks']) # here df is the dataframe and **Marks** is a column

Adding a New Column:

We can add a new column to the DataFrame by directly assigning values. The new column can contain a fixed value, values calculated based on existing columns, or values from another source.

Consider the DataFrame **'Marks'** given below:

	Name	Eng	Maths
1	Ramu	25	29
2	Sonu	23	27
3	Rita	24	26

To add one more column IP with marks 28,27,29 we can write the following code

Mark['IP'] = [28,27,29]

Assigning values to a new column label that does not exist will create a new column at the end. If the column already exists in the DataFrame then the assignment statement will update the values.

We can also change data of an entire column to a particular value in a DataFrame. For example, the code **Mark['Eng'] = 30** will set the value 30 in all the rows of the dataframe.

Adding new row to a Dataframe:

To add a new row, we can use the **.loc[ ]** method or the **append()** function. However, note that **append()** is being deprecated in newer versions of pandas, so **.loc[ ]** is preferred.
Adding row using loc[ ] :
Syntax: <dataframe_name>.loc['row label'] = [list of values]
Example: Consider the Dataframe, 'df', Given Below:

	Name	Eng	Maths	IP
0	Ramu	25	29	27
1	Sonu	23	27	24
2	Rita	24	26	26

Create above data frame using dictionary and then add a new row : ['dinesh',27,28,25]

```
import pandas as pd
Marks = { 'Name': ['Ramu', 'Sonu', 'Rita'],   'English': [24, 25, 29],    'Math': [26, 23, 27],
   'IP': [27, 24, 26] }
df = pd.DataFrame(Marks)                          # Create the DataFrame
print("before adding new row")
print(df)                                         # Display the DataFrame
df.loc[3]=['dinesh',27,28,25]                     # To add a new Row
print("after adding new row")
```

```
print(df)                          # Display the DataFrame after adding new row
```
OUTPUT :

before adding new row

	Name	English	Math	IP
0	Ramu	24	26	27
1	Sonu	25	23	24
2	Rita	29	27	26

after adding new row

	Name	English	Math	IP
0	Ramu	24	26	27
1	Sonu	25	23	24
2	Rita	29	27	26
3	dinesh	27	28	25

Note :

1. If the row label is already existing then it will update the row.
2. If we try to add a row with lesser values than the number of columns in the DataFrame, it results in a ValueError.

Deleting Rows or Columns from a DataFrame

We can use **drop( )** method to delete rows and columns. This method needs the row label or column label and axis. For deleting row axis value is 0 and for column it is 1.

Syntax:

1. **To delete a row :**
   <dataframaename> = <dataframename>.drop(<'rowlabel'>, axis=0)
2. **To delete a column :**
   <dataframaename> = <dataframename>.drop(<'columnlabel'>, axis=1)

Example: to delete the row 'BSt' from the above dataframe, Marks, we can write:

Marks = Marks.drop('BSt', axis = 0)

Similarly to delete the column, 'Sonu' we can write:

Marks= Marks.drop('Sonu', axis = 1)

To delete multiple columns, specify the list of columns instead of one column name.

Example:

Marks= Marks.drop(['Ramu' , 'Sonu'], axis =1) will delete the columns, Ramu and Sonu.

Renaming Columns or Rows

Use the rename( ) method to rename rows and columns. For this a dictionary is used to specify the old names and their new names.

Syntax: Renaming columns

<Dataframe_name>.rename(columns={'Oldname': 'New Name', 'Oldname': 'Newname'}, inplace=True)

Example:

Marks.rename(columns = {'Ramu': 'Ramu Raj', 'Sonu' : 'Sona'}, inplace = True)

Syntax: Renaming rows

<Dataframe_name>.rename(index={'Oldname': 'New Name', 'Oldname': 'Newname'}, inplace=True)

Example:

df.rename(index={0: 'Row_1', 1: 'Row_2'}, inplace=True)

Here df is the dataframe, Row_1 is the new row label for the existing label 0.

Note: inplace=True: Modifies the DataFrame directly. If inplace=False: it will create a new changed dataframe and the original DataFrame remains unchanged.

Head and Tail functions :

In a **pandas DataFrame**, the head() and tail() functions are used to quickly view the top or bottom rows of the data, which is especially helpful for large datasets.

head() Function

- **Purpose**: Displays the **first n rows** of the DataFrame.
- **Syntax**: **df.head(n)**

Default: If n is not specified, it shows the first **5 rows**.

Example:

```
import pandas as pd
df = pd.read_csv('data.csv')
print(df.head())        # First 5 rows
print(df.head(10))      # First 10 rows
```

tail() Function

- **Purpose**: Displays the **last n rows** of the DataFrame.
- **Syntax**: **df.tail(n)**

Default: If n is not specified, it shows the last **5 rows**.

Example:

```
print(df.tail())        # Last 5 rows
print(df.tail(3))       # Last 3 rows
```

Why Use Them?

- Quick inspection of data.
- Useful in **data exploration**, **debugging**, or **checking format** after loading or transforming data.

Indexing using Labels in dataframe

Indexing using **labels** in a pandas DataFrame is done primarily with the **.loc[]** accessor. It's a very flexible way to select rows, columns, or both, using **row and column labels** (not numeric positions).

Accessing Rows:

1. Accessing Rows by Index Position (iloc[ ])

The .i**loc[ ]** method allows you to access rows based on their integer index position (0-based indexing).

Syntax: <dataframename>.iloc[start : stop: step]

Examples:

1) Marks.iloc[0] will extract the first row.

2) Marks.iloc[0:3] will extract first, second and third rows(row 0, row 1 and row 2).

In the above example, index 3 is not included. Consider the rows with start index to stopindex-1

Accessing Rows by Labels (loc[ ])

The **.loc[ ]** method is used to access rows by labels (**index values**) or using conditions.

Access the row with label 1 from the dataframe, df:

print(df.loc[1])

To access rows where Age is greater than 25 from the dataframe df (Here 'Age' is a row label): **print(df.loc[df['Age'] > 25])**

Accessing Rows with iterrows( ):

The **iterrows( )** method allows us to iterate through rows as pairs of index and Series.
Example:
Consider the dataframe, df

	Name	Age
0	Alice	25
1	Bob	30
2	Charlie	35

Code :

```
for index, row in df.iterrows():
        print(f"Index: {index}, Name: {row['Name']}, Age: {row['Age']}")
```

Output:
Index: 0, Name: Alice, Age: 25
Index: 1, Name: Bob, Age: 30
Index: 2, Name: Charlie, Age: 35

loc[] – Indexing with Labels

Basic Syntax:

df.loc[row_label, column_label]

can select:

- A single row/column
- Multiple rows/columns
- A range of rows/columns (inclusive)
- With conditions (Boolean indexing)

Examples

```
import pandas as pd
data = {
   'Name': ['Alice', 'Bob', 'Charlie'],
   'Age': [25, 30, 35],
   'City': ['NYC', 'LA', 'Chicago'] }
df = pd.DataFrame(data, index=['a', 'b', 'c'])
print(df)
```

OUTPUT:

	Name	Age	City
a	Alice	25	NYC
b	Bob	30	LA
c	Charlie	35	Chicago

1.	Access a single row by label:	print(df.loc['a'])
2.	Access a specific value:	print(df.loc['b','City'])
3.	Access multiple rows and columns:	print(df.loc[['a', 'c'], ['Name', 'Age']])
4.	Label-based slicing (inclusive):	print(df.loc['a':'b'] # Rows 'a' and 'b'
5.	Conditional selection:	print(df.loc[df['Age'] > 25])

Comparison between Label-based indexing (.loc[]) and

Position-based indexing (.iloc[])

Feature	.loc[]	.iloc[]
Type of indexing	Label-based	Position-based (integer)
Access by	Row/column **names (labels)**	Row/column **index positions**
Inclusive slicing	Yes (start **to** end)	No (like Python, end is **exclusive**)
Returns	DataFrame / Series / value	DataFrame / Series / value
Raises error if label not found	Yes	Yes
Examples Side-by-Side		
Task	.loc[]	.iloc[]
Get row 'a'	df.loc['a']	df.iloc[0]
Get value (row 'b', col 'City')	df.loc['b', 'City']	df.iloc[1, 2]
Get first two rows	df.loc['a':'b'] # (inclusive)	df.iloc[0:2] # (exclusive)
Get 'Name' and 'City' cols for all rows	df.loc[: , ['Name', 'City']]	df.iloc[: , [0, 2]]
Conditional selection	df.loc[df['Age'] > 25]	df.iloc[(df['Age'] > 25).values]

Pro Tips

- Use .loc[] when you **know the labels** or want to do **Boolean filtering**.
- Use .iloc[] when you **only care about positions** (like working with arrays).
- Both are very powerful — and you can even mix them smartly in functions!

Boolean Indexing in Pandas

- Boolean indexing is a powerful way to filter rows or columns in a DataFrame using conditional logic. It returns only the rows (or columns) that meet the condition(s).

Basic Concept

df[condition]

The condition is a **Boolean Series** (True/False values) that is used to filter the DataFrame.

Example DataFrame:

```
import pandas as pd
data = {
   'Name': ['Alice', 'Bob', 'Charlie', 'David'],
   'Age': [25, 30, 35, 40],
   'City': ['NYC', 'LA', 'Chicago', 'Houston']
}
df = pd.DataFrame(data)
print(df)
```

Common Boolean Indexing Examples

1. Filter rows where age > 30 : print(df[df['Age'] > 30])
2. Multiple conditions (AND) : print(df[(df['Age'] > 30) & (df['City'] == 'Chicago')])
3. Multiple conditions (OR) : print(df[(df['Age'] < 30) | (df['City'] == 'Houston')])
4. Negation (NOT) : print(df[~(df['City'] == 'LA')])
5. Using .loc[] with condition : print(df.loc[df['Age'] >= 35, ['Name', 'City']])

Behind the Scenes

The condition inside df[...] creates a Boolean Series: **df['Age'] > 30**
The output of above expression is :

```
0    False
1    False
2     True
3     True
Name: Age, dtype: bool
```

Why Use Boolean Indexing?

- It's **concise** and **intuitive**.
- Helps with **data cleaning**, **exploration**, and **custom selections**.
- You can chain or combine multiple conditions for **complex filtering**.

Importing and Exporting Data between CSV Files and Dataframes

CSV Files: CSV stands for Comma Separated Values. A **CSV file** is a **plain text file** that contains **tabular data** (like a spreadsheet). **Each line** in the file is a **row** of data. **Columns** in each row are **separated(delimited) by commas (,)by default. Delimiters can also be specified by the user. CSVs don't support formatting (colors, fonts), unlike Excel files** The extension of such files will be " **.csv " ,** and are used for exchange data between applications.

Example of a CSV File: person.csv

```
Name,Age,Gender
Alice,30,Female
Bob,25,Male
Charlie,35,Male
```

Importing Data from CSV to DataFrame

pd.read_csv()

Above function reads a CSV file and loads it into a pandas DataFrame.
Syntax :

```
import pandas as pd
df = pd.read_csv('<filename.csv>')
```

where 'pd' is just an **alias (shortcut name)** used to refer to the pandas module in the code.
Options:

- sep=',' : Set delimiter (default is comma).
- header=0 : Which row to use as header.
- index_col=0 : Use a column as the index.
- usecols=['Col1, 'Col2', . . .] : Load only specific columns.

Example: **df = pd.read_csv('data.csv', index_col=0)**

Exporting DataFrame to CSV

df.to_csv()

Above statement will **write (save the DataFrame)** to a CSV file.

Basic Syntax:

df.to_csv('new_file.csv')

Options:

- index=False : to skip the row indexes while writing a dataframe in a csv file
- columns=['Col1', 'Col2',. . . .]: Export only selected columns.
- sep='<delimiter>' : Change delimiter if needed.

Example: df.to_csv('filtered_data.csv', index=False)

Example Workflow

If the csv file named students.csv contains the following data:

```
RollNo,Name,Age
101,Ramu,16
102,Sonu,19
103,Rita,16
104,Amit,20
105,Neha,21
```

Then if we execute the following code :

```
import pandas as pd
df = pd.read_csv('students.csv')   # Read CSV
filtered = df[df['Age'] > 18]     # Filter data
# Save to new CSV
filtered.to_csv('adult_students.csv', index=False)
```

The new csv file data :

```
RollNo  Name  Age
1   102  Sonu   19
3   104  Amit   20
4   105  Neha   21
```

Tips:

Use **na_values** to define missing values while reading:

pd.read_csv('data.csv', na_values=['NA', '?'])

Note : We can also read/write **Excel**, **JSON**, **SQL**, etc. with pandas.

Examples:

1. Create a dataframe named Df by importing data from the CSV File name 'studnet.csv'

Answer:

```
import pandas as pd
Df = pd.read_csv('student.csv')
```

Note: here 'Df' will be created by using the data from the csv file named student.csv , first row will be used as column labels, and 0,1,2,3,…will be the index.

2. Save the data represented by the Dataframe, 'df' , as a CSV file named 'student.csv', without index.
   Answer: **df.to_csv('student.csv', index=False)**
3. Saving dataframe as CSV files without index and with a custom delimiter.
   Answer: **df.to_csv('student.csv', sep=';', index=False)**
4. Saving only selected columns
   Answer: **df.to_csv('student.csv', columns=['Name'], index=False)**

Exercises:

1.Consider the following csv file, student.csv and answer the questions that follow.

RollNo,Name,Age,Mark,Grade
1,Shravan,15,99,A
2,Ruchi,15,98,A
3,Siddharth,14,95,B

a)Create a DataFrame with header=0 and Roll as index

Answer:

```
import pandas as pd
df = pd.read_csv(“student.csv”, header=0, index_col=0)
```

OR

```
df = pd.read_csv('student.csv', index_col='Roll')
```

b) Creating the DataFrame by using the second row as header and second column as index

Answer: **df = pd.read_csv(“student.csv”, header=1, index_col=1)**

c)Give the output of

```
import pandas as pd
# Read the CSV file and use 'Roll' as index
df = pd.read_csv('student.csv', index_col='Roll')
# Display the DataFrame
print(df)
```

Answer:

	Name	Age	Mark	Grade
1	Shravan	15	99	A
2	Ruchi	15	98	A
3	Siddharth	14	95	B

d)Give the output

```
import pandas as pd
# Reads the CSV file into a DataFrame
df = pd.read_csv('student.csv')
# Display the DataFrame
print(df)
```

Answer:

	Roll	Name	Age	Mark	Grade
0	1	Shravan	15	99	A
1	2	Ruchi	15	98	A
2	3	Siddharth	14	95	B

Note:

CSV Files can be accessed using different applications including notepad, and spreadsheet.

Advantages of CSV:

- Easy to read and edit.
- Supported by almost all software.
- Smaller file size.

Limitations:

- No support for complex data types.
- Can't handle formulas, formatting, or multiple sheets (unlike Excel).
- Problems with commas when data itself has commas.

Multiple Choice Questions With Answers	
1	**What is the primary characteristic of a Pandas DataFrame?** A) A one-dimensional array containing a sequence of values B) A collection of built-in Python modules for various actions C) A two-dimensional labeled data structure, similar to a spreadsheet, with both row and column indices D) A package used for numerical data analysis that works with homogeneous multidimensional arrays **Answer: C**
2	**How do Pandas DataFrames handle data types compared to NumPy arrays?** A) Both NumPy arrays and Pandas DataFrames require homogeneous data types B) A NumPy array can have different data types, while a Pandas DataFrame requires homogeneous data C) A Pandas DataFrame can contain different data types (e.g., float, int, string, datetime) in its columns, whereas a NumPy array requires homogeneous data D) Pandas DataFrames only store numerical data, while NumPy arrays can store any data type. **Answer: C**
3	**When creating a DataFrame from a dictionary of lists (e.g., dictForest = {'State': ['Assam'], 'GArea': }), what typically becomes the column labels in the resulting DataFrame?** A) The list values become the column labels. B) Numeric indices are assigned as column labels by default. C) The dictionary keys ('State', 'GArea') become the column labels D) The dictionary values become the row labels. **Answer: C**
4	**If you assign values to a column label that does not currently exist in a DataFrame (e.g., ResultDF['NewColumn'] = [val1, val2, val3]), what happens?** A) A ValueError is raised because the column doesn't exist. B) The assignment statement will update the values of an already existing column C) A new column with that label is created at the end of the DataFrame D) The DataFrame is converted into a Series. **Answer: C**
5	**What is the behavior of DataFrame.loc[] when used to add a new row to a DataFrame with an index label that already exists?** A) A new row is added, creating a duplicate index label. B) A KeyError is raised because duplicate index values are not allowed for rows. C) The existing row with that index label will be updated with the new data D) The operation fails silently, and no changes are made. **Answer: C**

6	What will be the output of **pd.DataFrame([1, 2, 3])**? A) A DataFrame with one column and three rows B) A DataFrame with three columns and one row C) An error D) A Series **Answer: A) A DataFrame with one column and three rows**
7	**Which parameter is used to set custom row labels when creating a DataFrame?** A) columns B) index C) labels D) rows **Answer: B) index**
8	You have the following dictionary: data = {'A': [1, 2], 'B': [3, 4]}. How many rows will the resulting DataFrame have? A) 1 B) 2 C) 3 D) 4 **Answer: B) 2**
9	**What is the default value of the index parameter when creating a DataFrame?** A) None B) Range Index starting from 0 C) Empty list D) Depends on the data **Answer: B) Range Index starting from 0**
10	**What happens if the lists in a dictionary used to create a DataFrame are of different lengths?** A) It fills missing values with zeros B) It fills missing values with NaN C) It raises a ValueError D) It aligns the shorter list to the left **Answer: C) It raises a ValueError**

11	**Which of the following can NOT be used to create a DataFrame?** A) Dictionary of lists B) List of tuples C) Single scalar value D) NumPy array **Answer: C) Single scalar value**
12	**To set custom column names in a DataFrame created from a list of lists, which parameter is used?** A) headers B) columns C) colnames D) labels **Answer: B) columns**
13	**What will pd.DataFrame(np.array([[1, 2], [3, 4]]), columns=['X', 'Y']) create?** A) A DataFrame with 2 rows and 2 columns named 'X' and 'Y' B) A DataFrame with 2 columns and default index C) A Series D) An error due to shape mismatch **Answer: A) A DataFrame with 2 rows and 2 columns named 'X' and 'Y'**
14	**Give the output of the following code:** **import pandas as pd** **df = pd.DataFrame({'A': [1, 2], 'B': [3, 4]})** **print(df.shape)** A) (2, 2) B) (2, 1) C) (1, 2) D) (4,) **Answer: A) (2, 2)**
15	**What will be the output?** **import pandas as pd** **data = {'Name': ['John', 'Alice'], 'Age': [25, 30]}** **df = pd.DataFrame(data)** **print(df['Name'][1])** A) John B) Alice C) 25 D) Error **Answer: B) Alice**

16	What does this code do? **import pandas as pd** **df = pd.DataFrame([[1, 2], [3, 4]], columns=['X', 'Y'], index=['a', 'b'])** **print(df.loc['a', 'Y'])** A) 1 B) 2 C) 4 D) Error **Answer : B) 2**
17	**What is the type of df in the following code?** **import pandas as pd** **df = pd.DataFrame([{'a': 1, 'b': 2}, {'a': 3, 'b': 4}])** A) Series B) DataFrame C) Dictionary D) List **Answer: B) DataFrame**
18	**What will be printed by this code?** **import pandas as pd** **import numpy as np** **df = pd.DataFrame(np.zeros((2,3)))** **print(df)** A) DataFrame filled with NaNs B) DataFrame filled with 0.0 C) Error D) DataFrame filled with None **Answer: B) DataFrame filled with 0.0**
19	**Choose the correct output:** **import pandas as pd** **df = pd.DataFrame({'x': [1, 2], 'y': [3, 4]}, index=['a', 'b'])** **print(df.index.tolist( ))** A) ['x', 'y'] B) ['a', 'b'] C) [0, 1] D) ['1', '2'] **Answer: B) ['a', 'b']**
20	**What does this code return?** import pandas as pd df = pd.DataFrame({'A': [10], 'B': [20]}) print(df.values) A) [[10, 20]] B) [10, 20]

<table>
<tr><td></td><td>C) (10, 20)
D) [[10][20]]
Answer: A) [[10, 20]]</td></tr>
<tr><td>21</td><td>What will be the output of the following code?
import pandas as pd
df = pd.DataFrame({'A': [1, 2], 'B': [3]})
print(df)
A) A DataFrame with NaN in missing values
B) A DataFrame with zeros in missing values
C) An error due to unequal list lengths
D) A DataFrame with truncated data
Answer: C) An error due to unequal list lengths</td></tr>
<tr><td>22</td><td>What will be the output of this code?
import pandas as pd
df = pd.DataFrame({'A': [10, 20, 30, 40]})
print(df[1:3])

A)
A
1 20
2 30

B)
A
2 30
3 40

C)
A
1 20
2 30
3 40

D) Error

Answer: A</td></tr>
<tr><td>23</td><td>What does this slicing return?
import pandas as pd
df = pd.DataFrame({'x': [5, 10, 15, 20]})
print(df.iloc[::2])

A) Rows at even indices
B) Rows at odd indices
C) First two rows
D) Last two rows
Answer: A) Rows at even indices</td></tr>
<tr><td>24</td><td>What will be the output of the following code?
import pandas as pd
df = pd.DataFrame({'A': [1,2,3,4]})
print(df.loc[0:2])
A) Rows with index 0, 1
B) Rows with index 0, 1, 2
C) Error
D) Rows with index 1, 2, 3
Answer: B) Rows with index 0, 1,2</td></tr>
<tr><td>25</td><td>What will happen when we execute the below code ?</td></tr>
</table>

	import pandas as pd df = pd.DataFrame({'A': [100, 200, 300, 400]}) print(df.iloc[-2:]) A) Prints last two rows B) Prints first two rows C) Error D) Prints nothing **Answer: A) Prints last two rows**

Short Answer Questions	
1	Write code to create the following dataframe 'profit' regarding the profit made by four companies, A,B,C,D in 2021,2022,2023,2024. Data given is in millions. Use years as the index. Dataframe: profit

	A	B	C	D
2021	10	8	10	6
2022	12	9	10	12
2023	10	11	11	14
2024	14	12	12	16

Answer:

```
import pandas as pd
data = {     'A':{2021:10, 2022:12, 2023:10, 2024:14},  \
             'B':{2021:8, 2022:9, 2023:11, 2024:12},    \
             'C':{2021:10, 2022:10, 2023:11, 2024:12},   \
              'D':{2021:6, 2022:12, 2023:14, 2024:16}
        }

profit = pd.DataFrame(data)
print(profit)
```

2 Give the output of the following code:

```
import pandas as pd
data = { 2021:{'A':10, 'B':12, 'C':10, 'D':14},
           2022:{'A':8, 'B':9, 'C':11, 'D':12},
          2023:{'A':10, 'B':10, 'C':11, 'D':12},
          2024:{'A':6, 'B':12, 'C':14, 'D':16}
        }
```

	profit = pd.DataFrame(data) print(profit) Answer: **2021 2022 2023 2024** **A** 10 8 10 6 **B** 12 9 10 12 **C** 10 11 11 14 **D** 14 12 12 16

3	Give the output of the following code: import pandas as pd df=pd.DataFrame(['Apple','Banana','Orange','Grapes','Guava']) print(df[2:4:2]) **Answer:** 0 2 Orange
4	Consider the following code and answer the questions that follow import pandas as pd data = { 2021:{'A':10, 'B':12, 'C':10, 'D':14}, 2022:{'A':8, 'B':9, 'C':11, 'D':12}, 2023:{'A':10, 'B':10, 'C':11, 'D':12}, 2024:{'A':6, 'B':12, 'C':14, 'D':16} } profit = pd.DataFrame(data) i)print(**profit.head(2)**) ii)print(**profit.tail(2)**) iii)print(**profit['A']**) **Answers:** **i)** **2021 2022 2023 2024** **A 10 8 10 6** **B 12 9 10 12** **ii)** **2021 2022 2023 2024** **C 10 11 11 14** **D 14 12 12 16** **iii)**

	KeyError: 'A' **Note** : To access row 'A', use .loc[]: print(profit.loc['A']) Then the output will be: 2021 10 2022 8 2023 10 2024 6 Name: A, dtype: int64
5	Shobit needs to create a dataframe named 'mydata' from two series named 'Eng' and 'Math'(as given below).Help him to write the code: **Eng** Aditi 25 bhavuk 21 chirag 23 deepak 24 Gaurav 27 dtype: int64 **Math** Aditi 9 bhavuk 29 chirag 15 deepak 14 Gaurav 20 dtype: int64

	Answer: import pandas as pd Eng = pd.Series([25,21,23,24,27]) Math = pd.Series([9,29,15,14,20]) mydata = pd.DataFrame({'Eng': Eng, 'Math': Math}) print(mydata) output: Eng Math 0 60 70 1 75 85 2 88 90 3 92 88 4 70 78
6	**Carefully observe the following code :** import pandas as pd product={'prodid':pd.Series([1,2,3,4,5]), 'pname':pd.Series(['pen', 'pencil', 'eraser', 'color', 'sharpener']), 'qty':pd.Series([2,10,10,30,10]), 'price':pd.Series([300,20,50,40,15])}

stock=pd.DataFrame(product)
print(stock)

Answer:

	prodid	pname	qty	price
0	1	pen	2	300
1	2	pencil	10	20
2	3	eraser	10	50
3	4	color	30	40
4	5	sharpener	10	15

7 **Consider the following dataframe, product, answer the questions that follow**

	prodid	pname	qty	price
0	1	pen	2	300
1	2	pencil	10	20
2	3	eraser	10	50
3	4	color	30	40
4	5	sharpener	10	15

a)Display the names of products.
b)Rename the column 'price' as 'newprice'

Answer:

a)product['pname']
b)product.rename(columns={'price':'newprice'},inplace=True)

8 Consider the given DataFrame 'result' :

	Name	Percentile
0	Rohit	95
1	Mohit	76
2	Raman	98
3	Aditya	47

Write the suitable Python statements for the following :
i)Add new column , 'grade' having values 'A', 'B', 'A', 'B
ii)Add a new row with name 'Arpit', Percentile 92 and grade 'A'
iii)Display the Percentile of 'Rohit'

Answer:

i)result['Grade']=['A', 'B', 'A', 'B']
ii)result.loc[5] = ['Arpit', 92, 'A']
iii)result.loc[result['Name']=='Rohit', 'Percentile']

9

Consider the following DataFrame 'employee':

EID	EName	Department	Salary
1	John	IT	50000
2	Ria	MKT	45000
3	Shobhit	IT	55000
4	Aditya	MKT	60000
5	Rashi	ADMIN	52000

i)Remove the column 'Salary'
ii)Remove the row having index 4
iii)Save the dataframe to a CSV file, data.csv in D:\Data
iv)Increase the salary by 5000 for all employees

Answer:

i) employee.drop('Salary', axis=1, inplace=True)
ii)employee.drop(4, axis=0, inplace=True)
iii)employee.to_csv("D:\\Data\data.csv")
iv)employee['salary'] = employee['salary'] + 5000

Assertion and Reasoning based Question

Directions

In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as:

(A) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

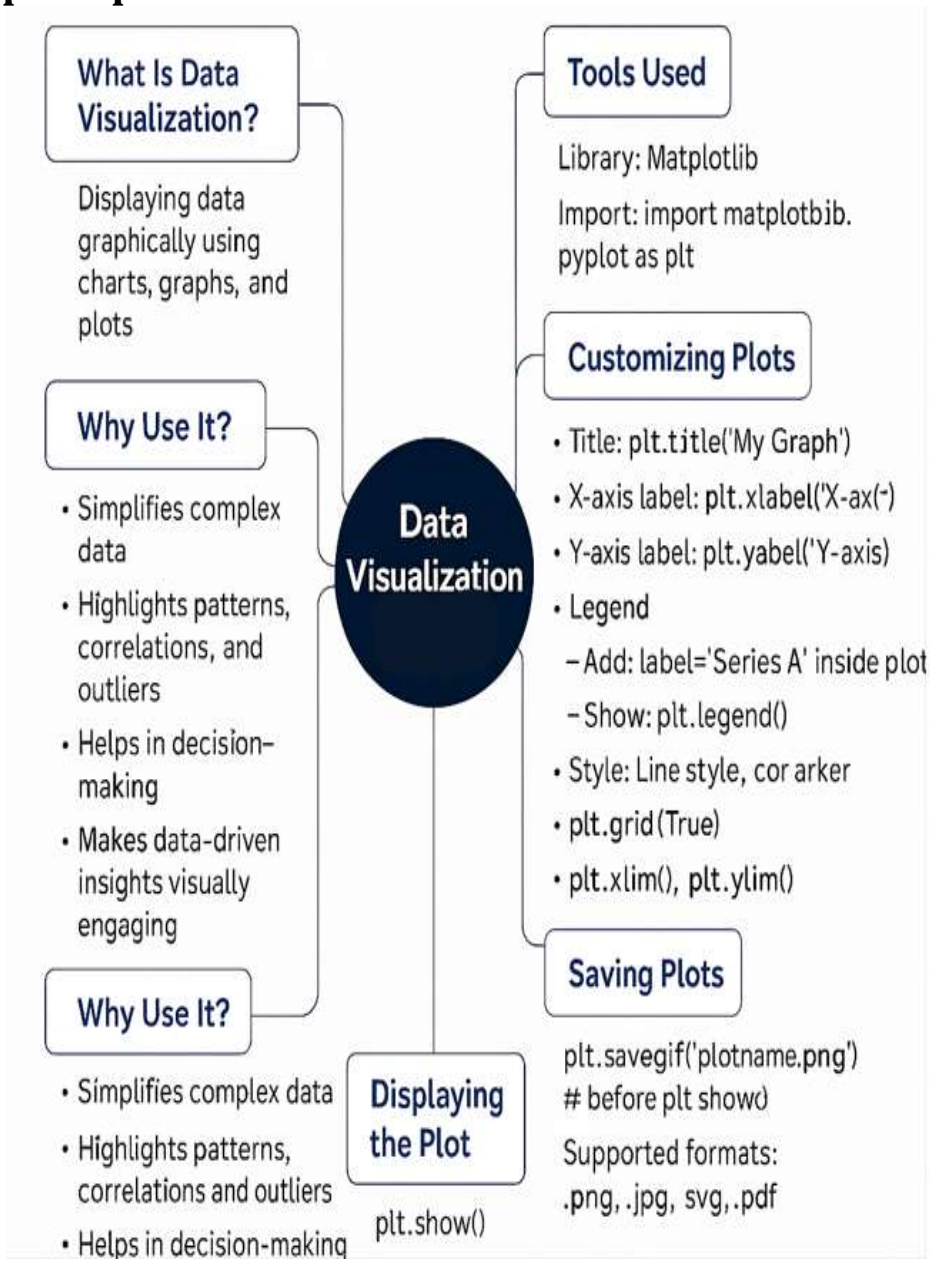
1	**Assertion (A):** A DataFrame is a two-dimensional labeled array. Its columns can have heterogeneous types, i.e., they can hold varying types of data. **Reason (R):** We need a DataFrame with a Boolean index to use Boolean indexing. **Answer**: (C) Assertion (A) is true, but Reason (R) is false. **Explanation**: **Assertion (A)**: True. A DataFrame is indeed a two-dimensional, labeled data structure in pandas. Its columns can have different data types, such as integers, strings, floats, etc. This makes DataFrames highly versatile for handling structured data. **Reason (R)**: False. Boolean indexing does not require the DataFrame to have a Boolean index. Instead, it is a technique for filtering data using Boolean conditions (i.e., True/False values) applied to the DataFrame's rows or columns.
2	**Assertion (A):** Iteration is a general term for taking each item of something one after another. **Reason (R):** iter tuples() returns the iterator yielding each index value along with a series containing the data in each row.

	Answer: (C) Assertion (A) is true, but Reason (R) is false
3	**Assertion (A):** Indexing can also be known as subselection. **Reason (R):** Pandas DataFrame .loc attribute accesses groups of rows and columns by label(s) or a Boolean array in the given DataFrame. **Answer: (A) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).**
4	**Assertion (A):** To delete a column from a pandas DataFrame, drop() method is used. **Reason (R):** Columns are deleted by dropping columns with index labels. **Answer:(C) Assertion (A) is true, but Reason (R) is false.** **Explanation:** **Assertion (A)**: True. The drop() method is indeed used to delete a column from a pandas DataFrame. It allows the removal of one or more columns by specifying their names. **Reason (R)**: False. Columns are not deleted by using **index labels**; instead, they are deleted by specifying **column labels** (i.e., the names of the columns). The drop() method with axis=1 is used to indicate that a column is being dropped.
5	**Assertion (A):** Rows can also be selected by passing integer location. **Reason (R):** Integer location can be passed to the .iloc[ ] method. **Answer: (A) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).** **Explanation** **Assertion (A)**: True. Rows can indeed be selected by passing integer locations, which refers to their positional index in the DataFrame. **Reason (R)**: True. The .iloc[] method is specifically designed for positional indexing, allowing you to select rows and columns using integer-based location indices.
6	**Assertion (A):** The head( ) function returns the first *n* rows from the object based on position. **Reason (R):** *n* is the selected number of rows whose default value is 3. **Answer: (C) Assertion (A) is true, but Reason (R) is false.** **Explanation**: **Assertion (A)**: True. The head() function in pandas does indeed return the first *n* rows of a DataFrame or Series based on their position. **Reason (R)**: False. The default value of *n* for the head() function is **5**, not 3.
7	**Assertion (A):** A list of dictionaries can be passed to form a DataFrame. **Reason (R):** Keys of the dictionary are taken as row names by default. **Answer: (C) Assertion (A) is true, but Reason (R) is false.** **Explanation**: **Assertion (A)**: True. A list of dictionaries can indeed be passed to pandas to form a DataFrame. Each dictionary in the list represents a row in the DataFrame, and the keys of the dictionary become column names. **Reason (R)**: False. Keys of the dictionary are not taken as row names by default. Instead, they are used as column names, while the row indices are assigned automatically (starting from 0) unless explicitly specified.

8	**Assertion (A):** Indexing can also be known as subselection. **Reason (R):** Pandas DataFrame .loc attribute accesses groups of rows and columns by label(s) or a Boolean array in the given DataFrame. **Answer:(A) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).**

DATA VISUALIZATION

Concept Map



Data Visualization is the graphical representation of information and data using visual elements like charts, graphs, and plots.

- Helps in understanding large data sets quickly
- Makes analysis easier by identifying trends and patterns

Popular Python Libraries for Visualization:

- matplotlib – Basic plotting library
- pylab – Combined interface of matplotlib + numpy (less common now)
- seaborn – Built on matplotlib (used for attractive statistical plots)

Types of Charts in matplotlib:

Chart Type	Description	Function
Line Chart	Shows trends over time or sequence	plt.plot()
Bar Chart	Displays data in rectangular bars	plt.bar()
Histogram	Shows distribution of continuous data	plt.hist()

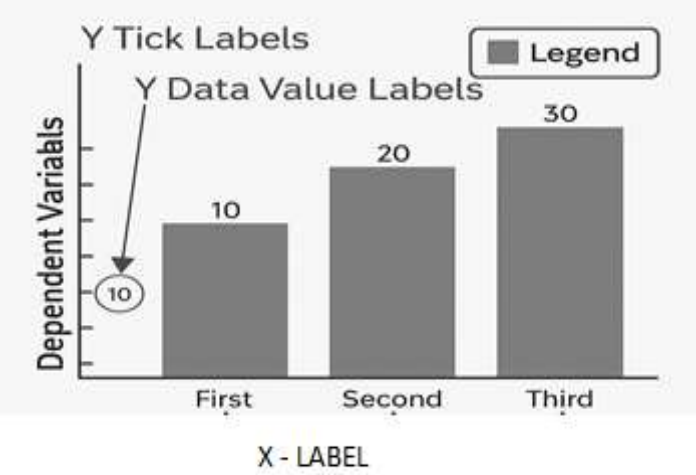
Basic Plotting Commands:

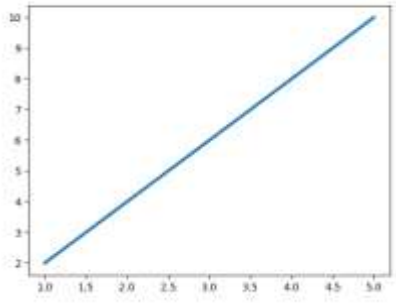
import matplotlib.pyplot as plt

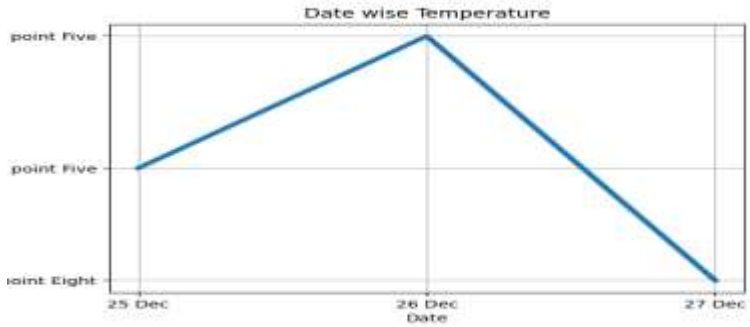
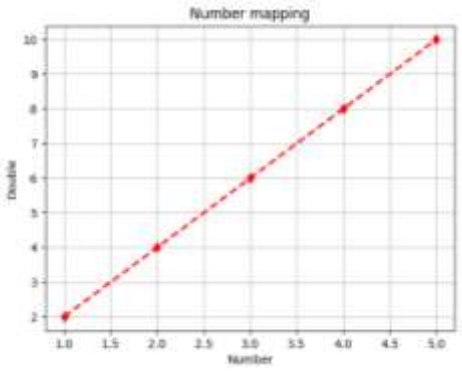
- plt.plot(x, y) – Line plot
- plt.bar(x, y) – Bar chart
- plt.hist(data) – Histogram
- plt.show() – Displays the plot
- plt.xlabel(), plt.ylabel(), plt.title() – Labeling the chart

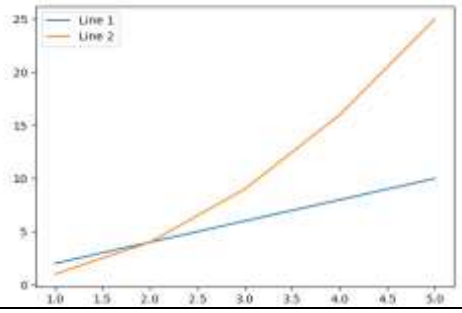
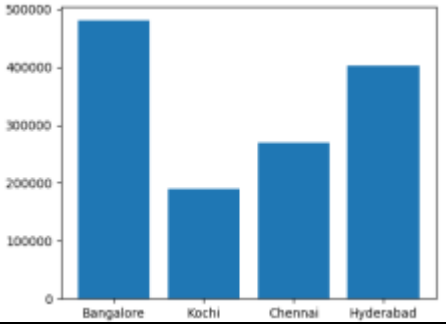
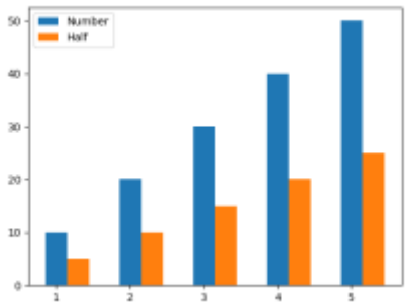
Customizing Graphs:

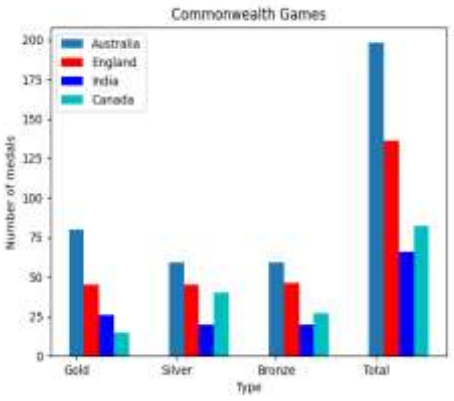
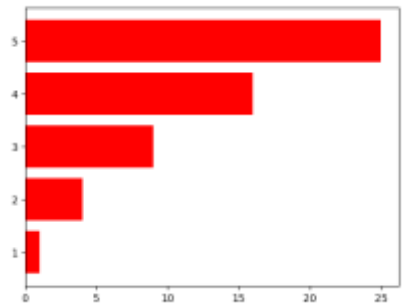
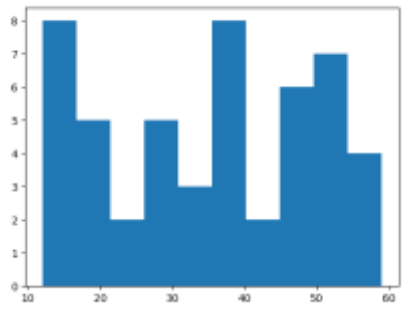
- Color: color='red'
- Line style: linestyle='--'
- Marker: marker='o'
- Legends: plt.legend(['Line1', 'Line2'])

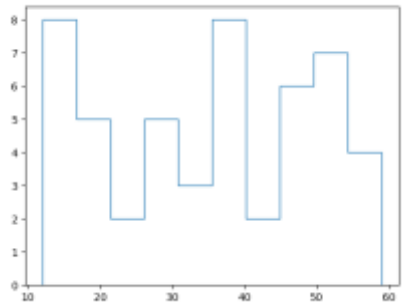
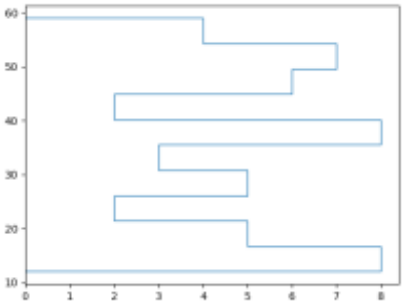


Topic	**Explanation**
The library used for creating static, animated, and interactive 2D- plots or figures in Python	matplotlib
import statement for including the matplotlib library in the Python program.	import matplotlib.pyplot as plt plt is an alias or an alternative name for matplotlib.pyplot
Function to create (plot) charts	plt.plot(x,y). where x and y are the coordinates
Function to show the chart	plt.show()
Line Chart : It displays the information as a series of points called 'markers'. All markers are connected by line segments.	
Sample program	**OUTPUT**
import matplotlib.pyplot as plt import numpy as np a=[1,2,3,4,5] b=np.array(a)*2 plt.plot(a,b) plt.show() **a and b are collection of values of list or tuple or array or series.**	
Customization of Plots Pyplot library gives us numerous functions, which can be used to customize charts such as adding titles or legends.	
import matplotlib.pyplot as plt date=["25/12","26/12","27/12"] temp=[8.5,10.5,6.8] plt.plot(date, temp) plt.xlabel("Date") plt.ylabel("Temp") plt.title("Date wise Temperature") plt.grid(True)	plt.xlabel() #add the Label on x-axis plt.ylabel( ) #add the Label on y-axis plt.title() #add the title to the chart plt.grid () #add gridlines to the background plt.xticks() # set the locations of the ticks on the x-axis

plt.xticks(date,["25 Dec","26 Dec","27 Dec"]) plt.yticks(temp,["Eight point Five","Ten point Five","Six point Eight"]) plt.show()	plt.yticks() # set the locations of the ticks on the y-axis
	
Arguments in the plot() function	
marker	A marker is any symbol that represents a data value in a line chart. Marker can be specified using the codes +, -, o, <, >, ^, x, d, *, etc.
colour	To change the colour of the plotted data. We can specify the colour using the codes b(blue), g(green), r(red), y(yellow), k(black), w(white), etc.
linewidth	Used to change the width of the line chart.
linestyle	It is used to change the type of line chart.It can be solid, dotted, dashed, dashdot
import matplotlib.pyplot as plt import numpy as np a=[1,2,3,4,5] b=np.array(a)*2 plt.plot(a,b,color='r',marker='d',linewidth=2,linestyle='dashed') plt.xlabel('Number') plt.ylabel("Double") plt.title("Number mapping") plt.grid(True) plt.show()	
label	It allows us to assign a name to the line, which we can later show in the legend.
loc attribute in legend() function	It is used to specify the location of the legend. Default value of loc is 'upper left')
Different values for loc attribute A **legend** is used to label elements of your plot, like lines or markers, so that viewers can understand what each element represents.	<table><tr><th>Location String</th><th>Location code</th></tr><tr><td>upper right</td><td>1</td></tr></table>

Example plt.legend(loc= 'upper right') or plt.legend(loc=1)	<table><tr><td>upper left</td><td>2</td></tr><tr><td>lower left</td><td>3</td></tr><tr><td>lower right</td><td>4</td></tr></table>
Plotting multiple line chart and using legend()	A legend in a graph is a small box or area that explains the meaning of symbols, colors, lines, or markers used in the graph. It helps the viewer understand what each visual element represents.
import matplotlib.pyplot as plt x=[1,2,3,4,5] y=[2,4,6,8,10] z=[1,4,9,16,25] plt.plot(x, y, label='Line 1') plt.plot(x, z, label='Line 2') plt.legend(loc= 'upper right') plt.show()	
plt.figure(figsize=(15,7))	To set the size of the graph
plt.savefig("squares.png")	To save the graph as a picture file.
Bar Graph: A bar graph is used to represents data in the form of vertical or horizontal bars. It is useful to compare the quantities.	
Function to create bar graph	bar() for horizontal bar graph barh() for vertical bar graph
import matplotlib.pyplot as plt cities=['Bangalore', 'Kochi', 'Chennai', 'Hyderabad'] population=[480400,190330,270300,402050] plt.bar(cities, population) plt.show()	
Plotting multiple bar chart	
import matplotlib.pyplot as plt import numpy as np x=np.array([1,2,3,4,5]) y=np.array([10,20,30,40,50]) z=np.array([5,10,15,20,25]) plt.bar(x,y,width=.3,label='Number') plt.bar(x+.3,z,width=.3,label='Half') plt.legend() plt.show()	
Customization of bar graph	
width	To set the width of the bar
color	To set the colour of the bar
edgecolor	To set the edge colour of bar

label	This allows us to assign a name to the bar, which we can later show in the legend
import matplotlib.pyplot as plt import numpy as np info=['Gold','Silver','Bronze','Total'] australia=[80,59,59,198] England=[45,45,46,136] India=[26,20,20,66] Canada=[15,40,27,82] x=np.arange(len(info)) plt.bar(info,australia,width=.15, label='Australia') plt.bar(x+.15,England,width=.15,color='r', label='England') plt.bar(x+.30,India,width=.15,color='b', label='India') plt.bar(x+.45,Canada,width=.15,color='c',la bel='Canada') plt.title("Commonwealth Games") plt.xlabel("Type") plt.ylabel("Number of medals") plt.legend() plt.show()	
Creating horizontal barchart import matplotlib.pyplot as plt import numpy as np a=np.array([1,2,3,4,5]) b=a**2 plt.barh(a,b,color='r') plt.show()	
Histogram Histogram shows distribution of values. Histogram is similar to bar graph but it is useful to show values grouped in bins or intervals.	
import matplotlib.pyplot as plt import numpy as np a=np.array([58, 54, 36, 48, 14, 29, 18, 37, 30, 36, 15, 21, 53, 14, 28, 24, 12, 16, 54, 59, 13, 54, 17, 58, 46, 35, 19, 59, 27, 32, 49, 12, 40, 49, 41, 24, 42, 37, 40, 54, 16, 45, 51, 38, 18, 31, 49, 28, 39, 52]) plt.hist(a,bins=10) plt.show()	
Attribute of hist function	
histtype	bar, barstacked, step, stepfilled default is bar

bins	bins is an integer, it defines the number of equal-width bins in the range.
import matplotlib.pyplot as plt import numpy as np a=np.array([58, 54, 36, 48, 14, 29, 18, 37, 30, 36, 15, 21, 53, 14, 28, 24, 12, 16, 54, 59, 13, 54, 17, 58, 46, 35, 19, 59, 27, 32, 49, 12, 40, 49, 41, 24, 42, 37, 40, 54, 16, 45, 51, 38, 18, 31, 49, 28, 39, 52]) plt.hist(a,bins=10,histtype='step') plt.show()	
For horizontal histogram use the attribute orientation with value 'horizontal'	
import matplotlib.pyplot as plt import numpy as np a=np.array([58, 54, 36, 48, 14, 29, 18, 37, 30, 36, 15, 21, 53, 14, 28, 24, 12, 16, 54, 59, 13, 54, 17, 58, 46, 35, 19, 59, 27, 32, 49, 12, 40, 49, 41, 24, 42, 37, 40, 54, 16, 45, 51, 38, 18, 31, 49, 28, 39, 52]) plt.hist(a,bins=10,histtype='step',orientation='horizontal') plt.show()	

Multiple Choice Questions

Q1. Which Python library is commonly used for data visualization?
a) NumPy
b) Pandas
c) matplotlib
d) SciPy
Answer: c) matplotlib

Q2. What does the plot() function in matplotlib do?
a) Reads a file
b) Draws a line chart
c) Displays data in a table
d) Opens a window
Answer: b) Draws a line chart

Q3. Which function is used to display the plot on screen?
a) show()
b) display()
c) render()
d) open()
Answer: a) show()

Q4. Which parameter is used to label a line in plot() for legends?
a) text
b) label

c) name
d) legend
Answer: b) label

Q5. What is the purpose of legend() function in matplotlib?
a) To save the plot
b) To show grid lines
c) To display the labels of plotted data
d) To format the plot
Answer: c) To display the labels of plotted data

Assertion and Reasoning Based Questions

Mark the correct choice as:
A. Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A)
B. Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A)
C. Assertion (A) is true, but Reason (R) is false
D. Assertion (A) is false, but Reason (R) is true
Q. 1 **Assertion (A):** Bar charts are suitable for comparing different categories of discrete data.
Reason (R): Bar charts display data using bins, and the bars touch each other without gaps.

Answer : C

Q. 2 **Assertion (A):** Line charts are best used to display data that changes over time.
Reason (R): Line charts help in observing trends and patterns in time-series data.
Answer : A
Q.3 **Assertion (A):** In a histogram, bars must have gaps between them.
Reason (R): Histogram is used for plotting frequency of discrete data.

Answer : D

Exercise

Q. 1 Write a Python code using matplotlib to:

1. Plot a bar chart for sales data ['Q1', 'Q2', 'Q3', 'Q4'] with corresponding values [150, 200, 180, 220].
2. Set bar colour to cyan.
3. Label axes as “Quarter” and “Sales (in ₹)”.
4. Include a title “Quarterly Sales” and display values on top of each bar.

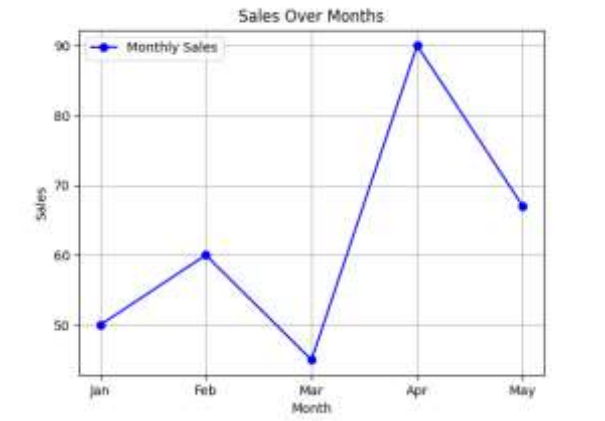
Answer :

```
import matplotlib.pyplot as plt
quarters = ['Q1', 'Q2', 'Q3', 'Q4']
sales = [150, 200, 180, 220]
plt.bar(quarters, sales, color='cyan')          # Custom bar color
plt.xlabel('Quarter')                           # X-axis label
plt.ylabel('Sales (in ₹)')                      # Y-axis label
```

plt.title('Quarterly Sales') # Plot title

Q. 2 Radhika has to fill in the blanks in the given Python program that generates a line plot as shown below. The given line plot represents the sales in lakhs over five months as given in the table

Month	Sales
Jan	50
Feb	60
Mar	45
Apr	90
May	67




```
import _____as plt                                  #statement 1
months = ['Jan', 'Feb', 'Mar', 'Apr', 'May']
sales = [50, 60, 45, 90, 67]
plt._____(months, sales, marker='o', color='blue', linestyle='-', label='Monthly Sales')
                                                    #statement 2
plt.xlabel('_____')                                 #statement 3
plt.ylabel('Sales')
plt.title('_____')                                  #statement 4
plt.grid(True)
plt.legend()
plt.show()
```

Write the missing statement according to given specification

1. write the suitable code to import the required module in the blank space in the line mark as statement 1
2. fill in the blank in statement 2 with a suitable python function name to create a line plot.
3. referred to the graph shown and fill in the blank in statement 3 to display the appropriate label for x axis.
4. refer to the graph shown and fill in the blank in statement 4 to display the suitable chart title.

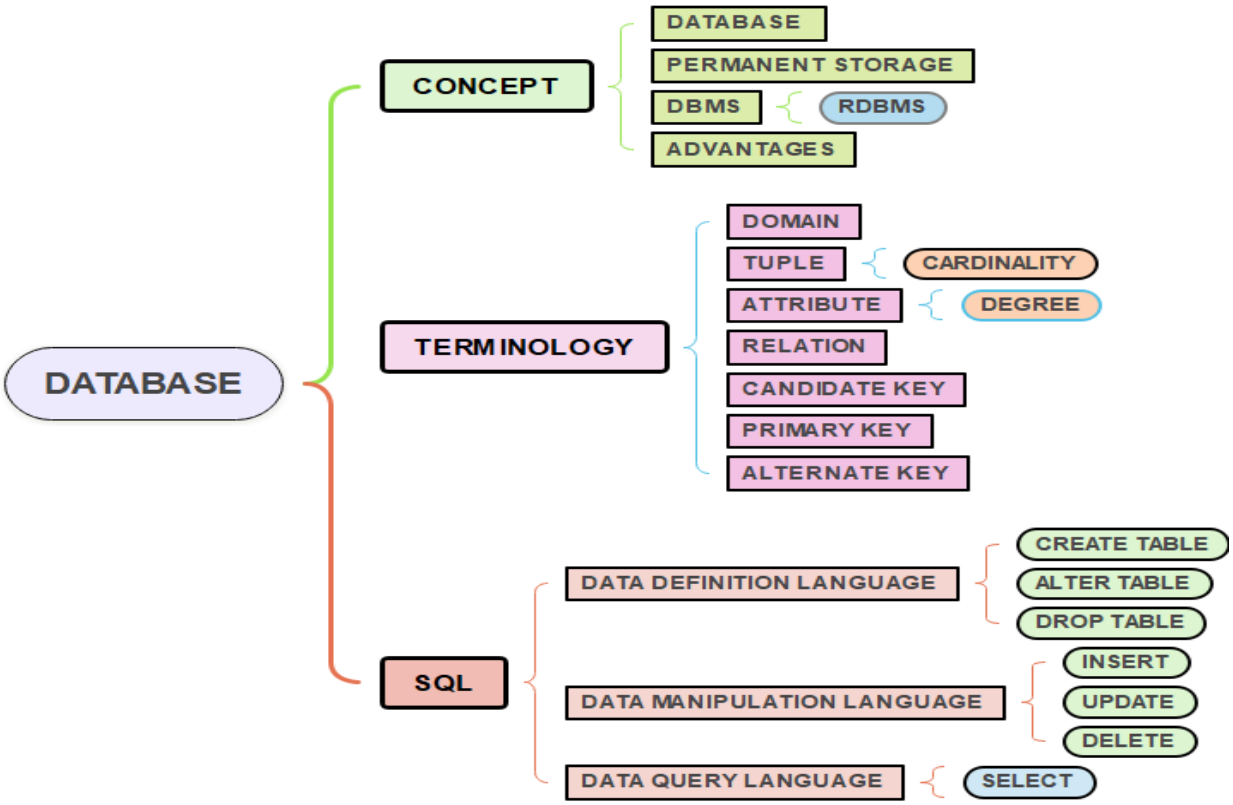
Answer :

```
import matplotlib.pyplot as plt                     #statement 1
months = ['Jan', 'Feb', 'Mar', 'Apr', 'May']
sales = [50, 60, 45, 90, 67]
plt.plot(months, sales, marker='o', color='blue', linestyle='-', label='Monthly Sales')
                                                    #statement 2
plt.xlabel('Month')                                 #statement 3
plt.ylabel('Sales')
plt.title('Sales Over Months')                      #statement 4
plt.grid(True)
plt.legend()
plt.show()
```

Unit 2: Database Query Using SQL

Revision of Database Concepts and SQL Commands covered in Class XI

Concept Map :



1. What is a Database?

A database is like a digital filing cabinet. It stores information in a structured way on a computer. It is a well-organized collection of data about a specific topic or business.

Need of a database

Databases help us manage information efficiently.

5. They reduce repeated data.
6. They keep data consistent.
7. They allow many people to use the same data.
8. They protect data.
9. They make sure data is correct.

Example: A school database might store student names, addresses, and grades.

2. Database Management System (DBMS)

10. A DBMS is a software that create, access, and manage databases. It helps to store and find data easily.
11. Examples: MySQL, Oracle, MongoDB, PostgreSQL etc

3. Relational Data Model

This model organizes data into tables. Each table contains rows and columns. Tables are related to each other. Each table has multiple columns, and each column has a unique name. Tables are also known as relations.

Example: A table of students and a table of courses can be linked(related) by a "student ID" column.

4. Key Concepts

SN	Name of Concept	Explanation with example
1	**Domain**	A domain is a set of values that can be stored in a column of a database table.They are the allowed values for a column. Example: A "gender" column might have a domain of "Male" or "Female." in attendance register
2	**Table (Relation)**	A collection of related data in rows and columns.
3	**Tuple/ Record**	A row in a table. Example: One student's information in a student table
4	**Attribute / Field**	A column in a table. Example: "Name," "grade," or "Roll Number" in a student table.
5	**Degree**	The number of columns in a table.
6	**Cardinality**	The number of rows in a table.
7	**Candidate Key**	A column (or set of columns) that can uniquely identify a row. Example: Student ID or Roll Number
8	**Primary Key**	A chosen candidate key or a column which will uniquely identify a row in a table. A table can only have one primary key. Example: Student Roll Number
9	**Alternate Key**	A candidate key that is not chosen as the primary key. Example If Student Roll Number is the primary key, then maybe Email Address could be an alternate key.
10	**Data Definition Language (DDL)**	DDL commands are used to define the database structure. They handle creating, altering, and deleting tables and databases.
11	**Data Manipulation Language (DML)**	DML commands are used to manage the data within the database. This includes inserting, selecting, updating, and deleting data. Examples: `INSERT`, `SELECT`, `UPDATE`, `DELETE`.
12	**Introduction to MySQL**	MySQL is a popular, free, and open-source database management system. It's used by many websites and applications. It is reliable, fast, and easy to use.
13	**Creating a Database**	The `CREATE DATABASE` command makes a new database. Syntax: CREATE DATABASE <database_name>; Example: CREATE DATABASE SchoolDB;
14	**Data types**	Data Types specify the kind of data a column can hold (e.g., text, numbers, dates). Examples: 12. `CHAR(size)`: Fixed-length text string. 13. `VARCHAR(size)`: Variable-length text string. 14. `INT(size)`: Integer number. 15. `DATE`: Date value (YYYY-MM-DD).
15	**Creating a Table**	The **`CREATE TABLE`** command makes a new table in a database. Syntax: CREATE TABLE <table_name> (column1 datatype,

		column2 datatype, ...); Example: CREATE TABLE Students (StudentID INT, Name VARCHAR(255), Address VARCHAR(255));
16	**Drop : Deleting a Table**	The `**DROP TABLE**` command removes a table from the database. Syntax: DROP TABLE <table_name>; Example:DROP TABLE Students;
17	**Alter Command**	The `ALTER` command modifies the structure of a table. ALTER TABLE command allows us to perform the following operations: ▪ **Adding new column in existing table** Syntax: ALTER TABLE <table-name> ADD COLUMN <column-name> datatype(length); Example: ALTER TABLE employee ADD COLUMN grade char(2); ▪ **Dropping existing column from table** Syntax: ALTER TABLE <table-name> DROP COLUMN <column–name>; Example: ALTER TABLE employee DROP COLUMN grade; ▪ **Modifying column definition in table** Syntax: ALTER TABLE <table-name> MODIFY column-name datatype(length); Example: ALTER TABLE employee MODIFY ename varchar(25); ▪ **Changing the name of column** Syntax: ALTER TABLE <table-name> CHANGE [<old column-name>] [<new column-name>] <datatype>; Example: ALTER TABLE students CHANGE grade score char(2); ▪ **Dropping constraint after table creation**. Syntax: ALTER TABLE [<table_name>] DROP CONSTRAINT [<constraint_name>]; Example: ALTER TABLE emp drop PRIMARY KEY ALTER TABLE emp ALTER TABLE <table_name> I. **Adding constraint after table creation.** Syntax: ALTER TABLE [<table_name>] ADD CONSTRAINT [<constraint_name>]; Example: ALTER TABLE emp ADD UNIQUE emp_name;
18	**Data Query**	Querying involves retrieving specific data from the database
19	**Select Query**	SELECT Command: With the SELECT command we can retrieve previously inserted rows. The general form of SELECT is: Syntax: SELECT column names FROM table_name; Example: SELECT * FROM Student; SELECT name, stream FROM Student;

20	**Where Clause**	The WHERE clause is used to retrieve data that satisfy the specified conditions. With WHERE clause the following operators can be used: • Comparison/ Relational Operators are: <, <=, =, !=, <>, >=, > • Logical Operators are: AND < <= OR NOT = • Comparison operator for special value – NULL, IS NULL
21	**Relational Operators**	Example: SELECT * FROM Student WHERE Age < 18 ; SELECT name FROM Student WHERE stream = ”S” SELECT name, age, stream FROM Student WHERE Stream=’C’;
22	**BETWEEN Operator**	The `BETWEEN` operator selects values within a given range. Example: `SELECT * FROM Products WHERE Price BETWEEN 10 AND 20;`
23	**Logical Operators**	Logical operators (`AND`, `OR`, `NOT`) combine conditions. **OR**: True if **either** condition is true Example: Age > 18 **or** City = 'Mumbai' Means either age >18 or city is Mumbai **NOT**: Reverses the condition Example: NOT City = 'Delhi' Means exclude Delhi **AND**: True if **both** conditions are true Example:SELECT * FROM Students WHERE Age >18 AND City = 'Delhi';
24	**NULL Value**	NULL` represents a missing or unknown value.
25	**NOT NULL Constraint**	The `NOT NULL` constraint ensures that a column cannot have a null value.
26	**IS NULL and IS NOT NULL**	`IS NULL` and `IS NOT NULL` are used to check for null values. Example: SELECT * FROM Students WHERE Phone IS NULL;
27	**Inserting Data**	The `INSERT INTO` command adds new rows to a table. Syntax: INSERT INTO table_name VALUES (value1, value2, ...); Example: INSERT INTO Students VALUES (1, 'John Doe', 'Delhi');
28	**Deleting Data**	The `DELETE` command removes rows from a table. Syntax: DELETE FROM table_name WHERE condition; Example: DELETE FROM Students WHERE StudentID = 1;
29	**Updating Data**	The `UPDATE` command modifies existing rows in a table. Syntax: UPDATE table_name SET column1 = value1, ... WHERE condition; Example: UPDATE Students SET City = 'Mumbai' WHERE StudentID = 1;

Consider following table Student

Students (RollNo, Name, Marks, Grade)

RollNo	Name	Marks	Grade
101	Alice	84.75	B
102	Bob	91.45	A

RollNo	Name	Marks	Grade
103	Charlie	76.20	B
104	David	68.99	C
105	Eva	88.33	B

Multiple Choice Questions (MCQ)

QN	Question	Answer
1	What is the primary purpose of a database? A) To store data in an unorganized manner B) To manage and organize data efficiently for retrieval and manipulation C) To create graphical user interfaces D) To perform hardware troubleshooting	B) To manage and organize data efficiently for retrieval and manipulation **Explanation**: A database is used to store, manage, and retrieve data in an organized manner to support efficient operations.
2	Which of the following is a function of a DBMS? A) Creating web applications B) Ensuring data integrity and security C) Managing computer hardware D) Writing operating system code	B) Ensuring data integrity and security **Explanation**: A DBMS ensures data integrity, security, and efficient data management.
3	In the relational model, a tuple is: A) A column in a table B) A row in a table C) A table in a database D) A database schema	B) A row in a table **Explanation**: A tuple represents a single row in a relation (table) in the relational model.
4	Which key uniquely identifies a tuple in a relation and is chosen by the database designer? A) Candidate Key B) Alternate Key C) Primary Key D) Foreign Key	C) Primary Key **Explanation**: The primary key is chosen by the designer to uniquely identify tuples in a table.
5	_____ is an example of a Data Manipulation Language (DML) command. A) CREATE B) DROP C) INSERT D) ALTER	C) INSERT **Explanation** : INSERT is a DML command which is used to add new record in a table.
6	_____ is used to create a new database in MySQL. A) NEW DATABASE B) CREATE DATABASE C) MAKE DATABASE D) ADD DATABASE	B) CREATE DATABASE **Explanation**: The `CREATE DATABASE` command is used to create a new database in MySQL.
7	The data type which is most suitable for storing the "Marks" column in the Students table (assuming whole numbers)? A) VARCHAR B) INT C) FLOAT D) DATE	B) INT **Explanation**: INT is used for whole numbers, suitable for storing marks.
8	Identify the query to add a new column "Phone" to the Students table? A) ALTER TABLE Students ADD Phone VARCHAR(10); B) MODIFY TABLE Students Phone VARCHAR(10); C) ADD COLUMN Students Phone VARCHAR(10);	A) ALTER TABLE Students ADD Phone VARCHAR(10); -: The `ALTER TABLE ... ADD` command is used to add a new column.

	D) UPDATE TABLE Students Phone VARCHAR(10);	
9	Identify the query to retrieve students with marks between 60 and 90 (inclusive)? A) SELECT * FROM Students WHERE Marks BETWEEN 60 AND 90; B) SELECT * FROM Students WHERE Marks > 60 AND Marks < 90; C) SELECT * FROM Students WHERE Marks IN (60, 90); D) SELECT * FROM Students WHERE Marks = 60 OR Marks = 90;	A) SELECT * FROM Students WHERE Marks BETWEEN 60 AND 90; **Explanation**: The `BETWEEN` operator includes the range 60 to 90 (inclusive).
10	Among the following find out the correct query to retrieve students from "Delhi" with marks greater than 75? A) SELECT * FROM Students WHERE City = 'Delhi' OR Marks > 75; B) SELECT * FROM Students WHERE City = 'Delhi' AND Marks > 75; C) SELECT * FROM Students WHERE City = 'Delhi' XOR Marks > 75; D) SELECT * FROM Students WHERE City != 'Delhi' AND Marks > 75;	B) SELECT * FROM Students WHERE City = 'Delhi' AND Marks > 75; **Explanation**: The `AND` operator ensures that both the conditions (City = 'Delhi' and Marks > 75) must be true.

Assertion and Reasoning-Based Questions

Mark the correct choice as

(a)Both A and R are true and R is the correct explanation for A
(b)Both A and R are true and R is not the correct explanation for A
(c) A is True but R is False
(d) A is false but R is True
(e) Both A and R are False

QN	Question	Answer
1	**Assertion (A):** A primary key can never have NULL values. **Reason (R):** A primary key uniquely identifies each record in a table.	(a) Both A and R are true and R is the correct explanation for A
2	**Assertion (A):** DROP TABLE command permanently removes the table and its data. **Reason (R):** DROP is used to delete selected rows from a table.	(c) A is True but R is False
3	**Assertion (A):** A tuple refers to a row in a relation. **Reason (R):** A domain refers to the number of rows in a table.	(c) A is True but R is False
4	**Assertion (A):** SQL is used to create, modify, and retrieve data from databases.	(c) A is True but R is False

	Reason (R): SQL is a programming language used to create operating systems.	
5	**Assertion (A):** The BETWEEN operator includes both boundary values. **Reason (R):** BETWEEN 10 AND 20 includes 10 and 20 in the result.	(a) Both A and R are true and R is the correct explanation for A
6	**Assertion (A):** A candidate key may have duplicate values. **Reason (R):** Candidate keys are used to establish relationships between tables.	(e) Both A and R are False
7	**Assertion (A):** IS NULL is used to find rows with undefined (missing) values in a column. **Reason (R):** NULL means a value of 0.	(c) A is True but R is False
8	**Assertion (A):** ALTER TABLE command can be used to add a new column to an existing table. **Reason (R):** ALTER is only used to remove columns from a table.	(c) A is True but R is False
9	**Assertion (A):** MySQL is an example of a relational database management system. **Reason (R):** MySQL allows storage of unstructured media files such as images	(b) Both A and R are true and R is not the correct explanation for A
10	**Assertion (A):** SELECT is used to retrieve data from one or more tables. **Reason (R):** SELECT statement modifies existing data in a table.	(c) A is True but R is False
11	**Assertion (A):** A relation in a relational database is also known as a table. **Reason (R):** Relations contain rows and columns to store data.	(a) Both A and R are true and R is the correct explanation for A
12	**Assertion (A):** INSERT command adds new records into a table. **Reason (R):** DELETE command is also used to insert records into a table.	(c) A is True but R is False

Very Short Questions

QN	Question	Answer
1	Differentiate between a database and a DBMS.	A database is a collection of organized data, while a DBMS is a software to manage that data. Example: Student records are a database; Oracle is a DBMS to handle them.
2	State two advantages of using a DBMS.	1. Data Consistency: Reduces redundancy by storing data centrally. 2. Security: Provides access control to protect data.
3	How does a DBMS reduce data redundancy?	Answer: A DBMS stores data in a centralized manner, eliminating duplicate copies using normalized tables, ensuring efficient storage.

		Example: Storing customer details once in a single table.
4	Differentiate between a candidate key and a primary key.	A candidate key is a set of attributes that uniquely identifies tuples, while a primary key is one chosen candidate key. Example: RollNo and Email can be candidate keys; RollNo is selected as the primary key.
5	Differentiate between DDL and DML.	DDL (Data Definition Language): Defines database structure, e.g., CREATE, DROP. DML (Data Manipulation Language): Manipulates data, e.g., INSERT, UPDATE.
6	How can you verify a database creation in MySQL?	Use the command `SHOW DATABASES;` to list all databases, checking if the created database (e.g., Library) appears.
7	Differentiate between CHAR and VARCHAR data types.	CHAR: Fixed-length string, e.g., CHAR(10) always uses 10 spaces. VARCHAR: Variable-length string, e.g., VARCHAR(10) uses only required spaces.
8	Write the command to create a table "Employee" where EmpID column as a primary key and Name column should not be left blank .	`CREATE TABLE Employee (EmpID INT primary key, Name VARCHAR(50) not null);`
9	Manoj wants to delete a record from "Employee" whose EmpID is 5. Help him to write a query in MySQL.	`DELETE FROM Employee WHERE EmpID = 5;`
10	Smita wants to modify the value in the marks column to 95 whose roll no is 101 in the student table.	`UPDATE Student SET Marks = 95 WHERE RollNo = 101;`
11	Write the query to add a column "Salary" to the "Employee" table.	`ALTER TABLE Employee ADD Salary DECIMAL(10,2);`
12	Categorize the following commands as DDL or DML: INSERT, UPDATE, ALTER, DROP	INSERT, UPDATE: DML ALTER, DROP: DDL

Case- Based Questions

QN	Question	Answer
1	Ritika, a computer science teacher, is guiding her students in maintaining a record of exam results using MySQL. She	i) SELECT Name FROM Student WHERE Marks > 85;

creates a table named Student to store the following details:

Help her to write query for:

i) Ritika wants to find out which students have scored **more than 85 marks**.

ii) One student's marks was entered incorrectly. Ritika wants to change David's marks to 72.65. Write the SQL command to do this.

iii) A new student named Frank with RollNo 106**,** Marks 80.5 and Grade B joins the class. Help Ritika to insert the record into the table.

ii) UPDATE Student SET Marks = 72.65 WHERE Name = 'David';

iii) INSERT INTO Student VALUES (106, 'Frank', 80.5, 'B');

2

RELATION : LIBRARY

Book_ID	Title	Author	Category	Price	Issued
101	Python Programming	Nitin Sinha	Computer	350.00	Yes
102	Wings of Fire	A.P.J. Abdul Kalam	Biography	275.50	No
103	Learning MySQL	Vikram Dutt	Computer	425.00	Yes
104	The Alchemist	Paulo Coelho	Fiction	200.00	No
105	Introduction to AI	Anjali Mehta	Computer	500.00	Yes

Rohit, a school librarian, wants to digitize the library's records to manage the availability and issue of books efficiently. He designs a table named Library in MySQL with the following fields:

i) Write an SQL query to display books with price greater than 300 and less than or equal to 450.

ii) Rohit mistakenly entered a wrong category for Book_ID 104. Write the command to change its category to 'Literature'.

iii) Rohit wants to delete the record of the book titled 'The Alchemist'. Write the SQL command.

Answers:

i) SELECT * FROM Library WHERE Price > 300 AND Price <= 450;

ii) UPDATE Library SET Category = 'Literature' WHERE Book_ID = 104;

iii) DELETE FROM Library WHERE Title = 'The Alchemist';

Dr. Mehta, the administrator of Sunrise Hospital, is developing a database to manage patient records. She designs a **table Patient** to store patient details. Help her to write the query. The structure and data of the table is as follows:

RELATION : PATIENT

Patient_ID	**Name**	**Age**	**Gender**	**Disease**	**Doctor**	**Admission_Date**	**Discharged**
P101	**Ananya Sharma**	**32**	**F**	**Pneumonia**	**Dr. Kapoor**	**2024-01-12**	**Yes**

3	**P102**	**Rahul Verma**	**45**	**M**	**Diabetes**	**Dr. Sinha**	**2024-02-15**	**No**
	P103	**Meena Iyer**	**28**	**F**	**Migraine**	**Dr. Kapoor**	**2024-01-20**	**Yes**
	P104	**Aman Joshi**	**55**	**M**	**Heart Disease**	**Dr. Bhalla**	**2024-03-02**	**No**
	P105	**Riya Malhotra**	**40**	**F**	**Arthritis**	**Dr. Sinha**	**2024-02-25**	**Yes**

i) Write the SQL query to display the name and disease of all patients who are still admitted.
ii) Write an SQL command to insert a new record:Patient_ID: P106,Name: Veer Singh,Age: 38,Gender: M,Disease: Asthma, Doctor: Dr. Kapoor,Admission_Date: '2024-03-10',Discharged: No
iii) Find the names of all patients who were admitted in February 2024.

Answers :
i) SELECT Name, Disease FROM Patient WHERE Discharged = 'No';
ii) INSERT INTO Patient VALUES ('P106', 'Veer Singh', 38, 'M', 'Asthma', 'Dr. Kapoor', '2024-03-10', 'No');
iii) SELECT Name FROM Patient WHERE Admission_Date BETWEEN '2024-02-01' AND '2024-02-29';

Long Answer Questions

Refer table Student

QN	Question	Answer
1	**i)** Identify the **Primary key** and any **Alternate key** in the **Student** table. ii) Write the command to create the database SchoolDB and use it. iii) Write the SQL command to create the Student table as per the structure above.	**i) Primary Key**: RollNo (unique for every student) **Alternate Key**: Name (assuming no two students have the same name) **ii)** CREATE DATABASE SchoolDB; USE SchoolDB; **iii)** CREATE TABLE Student (RollNo INT PRIMARY KEY, Name VARCHAR(50), Marks decimal(5,2), Grade CHAR(1));
2	i) Insert the following record into the Student table: RollNo: 106, Name: Farah, Marks: 79.45, Grade: B ii) Write a query to display names of students who scored marks between 80 and 90. iii) Write the SQL command to delete the record of the student David.	i) INSERT INTO Student VALUES (106, 'Farah', 79.45, 'B'); ii) SELECT Name FROM Student WHERE Marks BETWEEN 80 AND 90; iii) DELETE FROM Student WHERE Name = 'David';
3	i) Increase the marks of all students with grade 'B' by 5 marks. **ii)** What is the **degree and cardinality** of the Student table?	i) UPDATE Student SET Marks = Marks + 5 WHERE Grade = 'B'; ii) Degree (Number of columns): **4** Cardinality (Number of rows): **5**

4	i) Write the SQL query to display RollNo and Name of students whose Grade is NOT NULL. ii) Change the data type of column Marks to DECIMAL(5,2) using SQL. iii) Write the command to remove the entire table Student from the database.	i) SELECT RollNo, Name FROM Student WHERE Grade IS NOT NULL; ii) ALTER TABLE Student MODIFY Marks DECIMAL(5,2); iii) DROP TABLE Student;

Math Functions():

Mod (), Power () & Round()

Three commonly used numeric functions are POWER(), ROUND() and MOD().

Function	Description	Example
POWER(P,Q) or POW(P,Q)	Calculates P to the power Q.	SELECT POWER(2,3); Output: 8 (because 2 × 2 × 2 = 8)
ROUND(N,D)	Rounds off number N to D number of decimal places. Note: If D=0, then it rounds off the number to the nearest integer.	SELECT ROUND(3.14159, 2); Output:3.14 SELECT ROUND(165.2); Output:165
MOD(X, Y)	Returns the remainder after dividing number X by number Y.	mysql> SELECT MOD(10, 3); Output:1 (because 10 ÷ 3 = 3 remainder 1)

String/Text functions:

UCASE ()/UPPER (), LCASE ()/LOWER (), MID ()/SUBSTRING ()/SUBSTR (), LENGTH (), LEFT (), RIGHT (), INSTR(), LTRIM (), RTRIM(), TRIM ().

String functions in SQL are powerful tools for manipulating text data.
They allow us to modify, extract, and format strings in various ways.

Function Name	Description	Example	Output
UCASE(string) OR UPPER(string)	Converts a string to uppercase	SELECT UPPER('MySql');	MYSQL
LOWER(string) OR LCASE(string)	Converts a string to lowercase	SELECT LOWER(' MYSQL ');	mysql
SUBSTRING(string, pos, n) OR MID(string, pos, n) OR SUBSTR(string, pos, n)	Extracts a substring from a string. **Index starts at 1**	SELECT SUBSTRING('DataBaseSystems', 5, 5);	BaseS (Starts at 5th character, takes 5 characters)

LENGTH(string) OR LEN(string)	Returns the length of a string	SELECT LENGTH(' SQL Rocks! ');	12 (Counts all characters including spaces)
LEFT(string, N)	Returns the left part of a string with the specified number of characters	SELECT LEFT('Environment', 6);	Enviro
RIGHT(string, N)	Returns the right part of a string with the specified number of characters	SELECT RIGHT('Environment', 4);	ment
INSTR(string, substring)	Returns the position of the first occurrence of a substring	SELECT INSTR('I love learning SQL and Python', 'SQL');	17 (Starts at position 17)
LTRIM(string)	Removes leading spaces from a string	SELECT LTRIM(' Hello World');	Hello World
RTRIM(string)	Removes trailing spaces from a string	SELECT RTRIM('Hello World ');	Hello World
TRIM(string)	Removes leading and trailing spaces from a string	SELECT TRIM(' Hello World ');	Hello World

Multiple Choice Questions

QN	Question	Answer
1	**What does** TRIM(' AI Tools ') **return?** A) ' AI Tools ' B) 'AITools' C) 'AI Tools' D) ' AI Tools '	C) 'AI Tools' Explanation:TRIM() removes spaces from both ends.
2	**What is the output of** LTRIM(' Coding')**?** A) ' Coding' B) ' Coding ' C) 'Coding' D) 'Coding '	C) 'Coding' Explanation:LTRIM() removes spaces from left side only
3	**What is the position of "SQL" in** INSTR('Learn SQL Programming', 'SQL')**?**	C)7 Explanation:"SQL" starts at 7th position in the string.

	A) 7 B) 8 C) 7 D) 6	
4	**What does** RIGHT('EXAMINATION', 6) **return?** A) ATION B) TION C) NATION D) INATION	C)NATION Explanation:Last 6 letters "NATION"
5	**What is the result of** SUBSTRING('ComputerScience', 9, 7)**?** A) puterSc B) mputer C) Science D) terScie	C) Science Explanation:Starts at position 9 → "S", takes 7 letters → "Science"
6	**What does** LENGTH('Python 3') **return?** A) 6 B) 8 C) 7 D) 9	B) 8 Explanation: Characters including space: "P y t h o n _ 3" → 8 characters
7	**What is the output of** UCASE('cbse board')**?** A) cbse board B) CBSE BOARD C) Cbse board D) CBSe BOARD	B) CBSE BOARD Explanation: UCASE() converts text to uppercase → "CBSE BOARD"

Assertion and Reasoning-Based Questions

Mark the correct choice as

(a) Both A and R are true and R is the correct explanation for A
(b)Both A and R are true and R is not the correct explanation for A
(c) A is True but R is False
(d)A is false but R is True

QN	Question	Answer
1	**Assertion (A):** TRIM(' Hello ') returns'Hello'. **Reason (R):** The TRIM() function removes all internal spaces from a string.	(c) A is true but R is false Explanation: TRIM() removes only leading and trailing spaces, not the spaces between words.
2	**Assertion (A):** INSTR('Banana', 'n') returns 3. **Reason (R):** INSTR() returns the position of the first occurrence of a substring.	Answer: (a) Both A and R are true and R is the correct explanation for A Explanation: 'n' first appears at the 3rd position in 'Banana'.
3	**Assertion (A):** LEFT('Notebook', 4) returns 'Note'. **Reason (R):** The LEFT() function returns the last n characters of a string.	Answer: (c) A is true but R is false Explanation: LEFT() returns the first n characters, not the last

4	**Assertion (A):** The LENGTH('apple') function returns 6. **Reason (R):** The LENGTH() function returns the number of characters in a string.	Answer: (d) A is false but R is true Explanation: LENGTH('apple') returns 5, not 6.
5	**Assertion (A):** MID('Computer', 2, 3) returns 'omp'. **Reason (R):** The MID() or SUBSTRING() function extracts a portion of a string from a given position for a specified length.	Answer: (a) Both A and R are true and R is the correct explanation for A Explanation: Starting from position 2, extract 3 characters → "omp".
6	**Assertion (A):** The function UCASE('hello') returns HELLO. **Reason (R):** The UCASE() or UPPER() function is used to convert text to uppercase.	Answer: (a) Both A and R are true and R is the correct explanation for A Explanation: UCASE() or UPPER() converts lowercase to uppercase letters.
7	**Assertion (A):** The MOD(17, 5) function returns 2. **Reason (R):** The MOD() function returns the product of the two numbers.	Answer: (c) A is true but R is false Explanation: MOD() returns the remainder of division, not the product. 17 ÷ 5 = 3 remainder 2.
8	**Assertion (A):** The POWER(2, 3) function returns 8. **Reason (R):** The POWER() function is used to raise one number to the power of another.	Answer: (a) Both A and R are true and R is the correct explanation for A Explanation: $2^3 = 8$; POWER(2, 3) means 2 raised to the power of 3

Very Short Questions

Consider a following table and answer the following questions

Students (RollNo, Name, Marks, Grade)

RollNo	Name	Marks	Grade
101	Alice	84.75	B
102	Bob	91.45	A
103	Charlie	76.20	B
104	David	68.99	C
105	Eva	88.33	B

QN	Question	Answer
1	Write a query to display the names of all students in uppercase**.**	SELECT UPPER(Name) FROM STUDENT;
2	Write a query to show the first 3 characters of each student's name.	SELECT LEFT(Name, 3) FROM STUDENT;
3	Write a query to display each student's name and the result of Marks MOD 10 (i.e., the	SELECT Name, MOD(Marks, 10) AS Remainder FROM STUDENT;

	remainder when marks are divided by 10).	
4	Write a query to display Name and the position of letter 'a' in the name using the INSTR) function.	SELECT Name, INSTR(Name, 'a') AS Position FROM STUDENT;
5	Write a query to display the Name, Marks, and rounded marks (to nearest integer) of each student.	SELECT Name, Marks, ROUND(Marks) AS RoundedMarks FROM STUDENT;

Case- Based Questions

QN 1

The HR department of **TechNova Ltd.** maintains a table named Employee that stores information about employees' names, salaries, and departments. Here's a sample of the table:

Emp_ID	Name	Salary	Department
E101	rohit sharma	45200.75	Sales
E102	Ananya Das	37800.50	HR
E103	MEENA JOSHI	62000.00	Finance
E104	sushil mehra	50000.25	IT
E105	Divya Nair	47000.00	HR

Help her to write query for

i) Write an SQL query to display all employee names in uppercase.
ii) Display the last 4 characters of the employee names
iii) Write a query to round the salaries to the nearest 100**.**
iv) Display employee names without leading and trailing spaces.

Answers :

i) SELECT UPPER(Name) FROM Employee;
i) SELECT RIGHT(Name, 4) FROM Employee;
ii) SELECT Name, ROUND(Salary, -2) FROM Employee;
v) SELECT TRIM(Name) FROM Employee;

2

BookBazaar maintains a table named Books to store details of the books available in their store. Here's a sample of the table:

- Write a query to round off the prices to the nearest whole number.
- Show the square of the price of each book.
- Extract 3 characters starting from position 6 from each author's name.

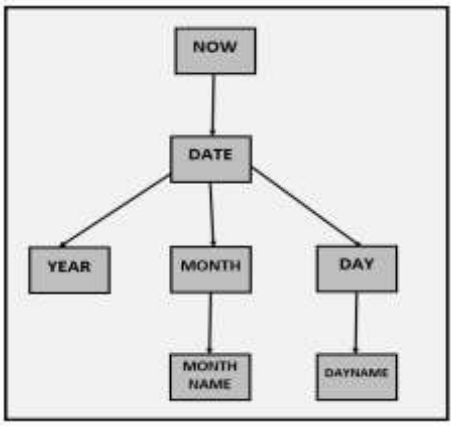
RELATION : **Book_ID**

Book_ID	Title	Author	Price
B101	the alchemist	paulo coelho	299.75
B102	Wings of Fire	A.P.J Abdul Kalam	350.40
B103	the theory of everything	Stephen Hawking	499.99
B104	deep work	Cal Newport	280.00
B105	zero to one	Peter Thiel	399.50

	Answer :
	i) SELECT Title, ROUND(Price) FROM Books;
	ii) SELECT Title, POWER(Price, 2) FROM Books;
	iii) SELECT SUBSTRING(Author, 6, 3) FROM Books;

DATE FUNCTIONS

CONCEPT MAP



1. **NOW( ) :** Returns the current date and time as a datetime value.
   Example:
   SELECT NOW();

```
+---------------------+
| NOW()               |
+---------------------+
| 2025-04-25 15:05:56 |
+---------------------+
```

2. **DATE( ) :** Extracts the date part from a datetime expression.
   Example:
   SELECT DATE(NOW());

```
+--------------+
| DATE(NOW()) |
+--------------+
| 2025-04-25  |
+--------------+
```

3. **MONTH( ) :** Returns the month number (1-12) from a date.
   Example:
   SELECT MONTH('2025-04-25');

```
+----------------------+
| MONTH('2025-04-25') |
+----------------------+
|                    4 |
+----------------------+
```

4. **MONTHNAME( ) :** Returns the full month name of a date.
   Example:
   SELECT MONTHNAME('2025-04-25');

```
+--------------------------+
| MONTHNAME('2025-04-25') |
+--------------------------+
| April                    |
+--------------------------+
```

5. **YEAR( ) :** Extracts the year from a date value.
   Example:
   SELECT YEAR('2025-04-25');

```
+--------------------+
| YEAR('2025-04-25') |
+--------------------+
|               2025 |
+--------------------+
```

6. **DAY( ) :** Returns the day of the month (1-31) from a date.
   Example:
   SELECT DAY ('2025-04-25');

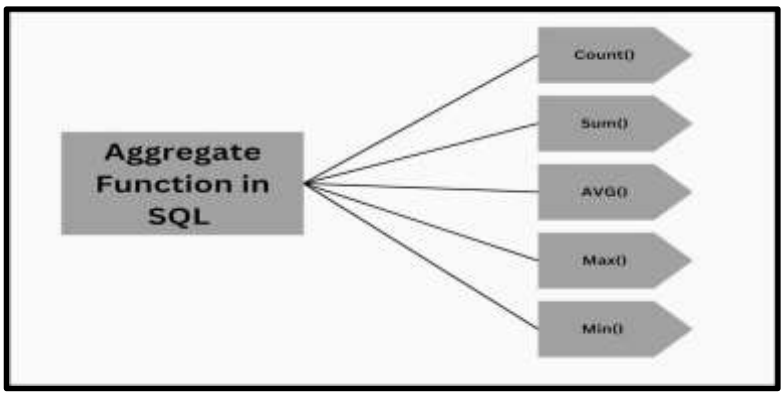
```
+-------------------+
| DAY('2025-04-25') |
+-------------------+
|                25 |
+-------------------+
```

7. **DAYNAME( ) :** Returns the name of the weekday for a date.
   Example:
   SELECT DAYNAME('2025-04-25');

```
+-----------------------+
| DAYNAME('2025-04-25') |
+-----------------------+
| Friday                |
+-----------------------+
```

AGGREGATE FUNCTIONS

CONCEPT MAP



Aggregate functions are special SQL functions that perform calculations on multiple rows and return a single value.
Table below shows the difference between Single row functions and multiple row functions.
Consider the below Table **Employees** in order to understand the concept of aggregate function with examples.

Employees Table

employee_id	first_name	last_name	department	salary	hire_date	birth_date
1	John	Smith	Engineering	75000.00	2020-05-15	1985-03-25
2	Sarah	Johnson	Marketing	68000.00	2019-10-10	1990-07-12
3	Michael	Davis	Engineering	82000.00	2018-02-28	1982-11-30
4	Emily	Wilson	HR	62000.00	2021-01-05	1992-04-18
5	David	Brown	Engineering	79000.00	2017-08-01	1988-09-03
6	Lisa	Miller	Marketing	70000.00	2019-03-15	1991-05-22
7	Robert	Taylor	Finance	90000.00	2016-11-12	1980-12-15
8	Jennifer	Anderson	HR	64000.00	2022-06-20	1994-02-28
9	William	Thomas	Engineering	85000.00	2018-07-09	1986-08-17
10	Jessica	Moore	Finance	88000.00	2017-04-25	1983-10-10

BASIC AGGREGATE FUNCTIONS

1. **COUNT ( ) :** The COUNT function counts rows or values. It's like asking "How many?"

Examples:

a. **Count all rows in the employees table**

SELECT COUNT(*) FROM employees;

COUNT(*)
10

b. **Count employees in the Engineering department**

SELECT COUNT(*) FROM employees WHERE department = 'Engineering';

COUNT(*)
4

c. **Count how many different departments exist**

SELECT COUNT(DISTINCT department) FROM employees;

COUNT(DISTINCT department)
4

The DISTINCT keyword makes COUNT only count unique values, ignoring duplicates.

2. **SUM () :** The SUM function adds up numeric values. It's like asking "What's the total?"

   Examples:

   a. **Calculate total salary budget**

SELECT SUM(salary) FROM employees;

```
+-------------+
| SUM(salary) |
+-------------+
|   763000.00 |
+-------------+
```

3. **AVG():** The AVG function calculates the average (mean) of numeric values. It's like asking "What's the typical value?"

   a. **Find average employee salary**

SELECT AVG(salary) FROM employees;

```
+--------------+
| AVG(salary)  |
+--------------+
| 76300.000000 |
+--------------+
```

4. **MIN() :** This function finds the smallest (MIN) value. They're like asking "What's the lowest?"

Examples:

   a. **Find lowest salary**

SELECT MIN(salary) FROM employees;

```
+-------------+
| MIN(salary) |
+-------------+
|    62000.00 |
+-------------+
```

5. **MAX() :** This function finds the smallest (MIN) or largest (MAX) value. They're like asking "What's the lowest/highest?"

Examples:

   a. **Find highest salary**

SELECT MAX(salary) FROM employees;

```
+-------------+
| MAX(salary) |
+-------------+
|    90000.00 |
+-------------+
```

COUNT() vs COUNT(*) in SQL

The main difference between COUNT() and COUNT(*) is what they count:

- COUNT(*) counts all rows in the result set, including those with NULL values
- COUNT(column) counts only non-NULL values in the specified column

id	name	department	manager_id
1	Alice	Sales	5
2	Bob	Marketing	NULL
3	Charlie	Sales	5
4	David	IT	NULL
5	Eve	Management	NULL

SELECT COUNT(*) FROM employees;

v/s

SELECT COUNT(manager_id) FROM employees;

The results would be:

- COUNT(*): 5 (counts all rows)
- COUNT(manager_id): 2 (counts only non-NULL values in manager_id column)

This distinction is important when working with data that might contain NULL values, as the two counting methods can give significantly different results.

QUERYING AND MANIPULATING DATA

GROUP BY and HAVING Clauses

GROUP BY Clause

The GROUP BY clause lets you group rows that have the same values into summary rows. It's like sorting information into piles or categories. When combined with aggregate functions, it helps you analyse data by groups.

Basic GROUP BY Syntax

SELECT column1, aggregate_function(column2)

FROM table

GROUP BY column1;

For example:

Count employees in each department

SELECT department, COUNT(*) AS employee_count

FROM employees

GROUP BY department;

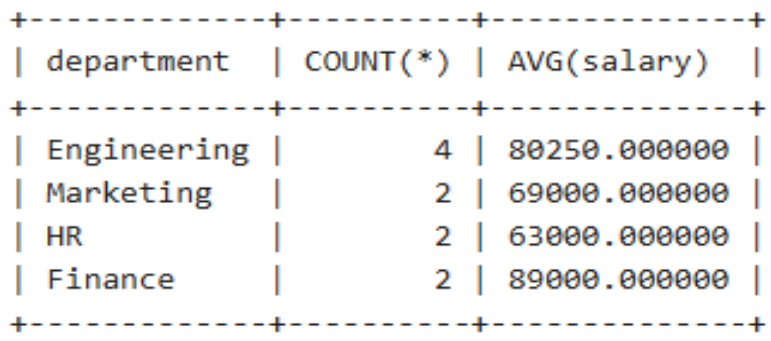
department	employee_count
Engineering	4
Marketing	2
HR	2
Finance	2

The SELECT List Rule in GROUP BY Clause

In standard SQL, if you use GROUP BY, each column in your SELECT list must either:

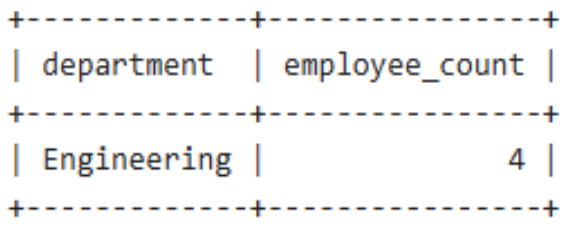
1. Be included in the GROUP BY clause, OR
2. Be used within an aggregate function

Example:
SELECT department, COUNT(*), AVG(salary)
FROM employees
GROUP BY department;



department	COUNT(*)	AVG(salary)
Engineering	4	80250.000000
Marketing	2	69000.000000
HR	2	63000.000000
Finance	2	89000.000000

What is the HAVING Clause?
The HAVING clause filters groups, similar to how the WHERE clause filters individual rows. It's like setting requirements for which groups should appear in your results.
Example:
SELECT department, COUNT(*) AS employee_count
FROM employees
GROUP BY department
HAVING COUNT(*) > 2;



department	employee_count
Engineering	4

This shows only departments that have more than 2 employees.

ORDER BY Clause

The ORDER BY clause sorts the result set of a query based on one or more columns. Think of it like organizing a list alphabetically or numerically to make it easier to find what you're looking for.
Order By Basic Syntax:
SELECT column1, column2, ... FROM table_name
ORDER BY column1 [ASC|DESC], column2 [ASC|DESC], ...;
Examples:

(a) Sort employees by last name alphabetically
SELECT employee_id, first_name, last_name
FROM employees ORDER BY last_name;

employee_id	first_name	last_name
8	Jennifer	Anderson
5	David	Brown
3	Michael	Davis
2	Sarah	Johnson
6	Lisa	Miller
10	Jessica	Moore
1	John	Smith
7	Robert	Taylor
9	William	Thomas
4	Emily	Wilson

(b) Sort employees by salary from highest to lowest

```
SELECT employee_id, first_name, last_name, salary
FROM employees
ORDER BY salary DESC;
```

employee_id	first_name	last_name	salary
7	Robert	Taylor	90000.00
10	Jessica	Moore	88000.00
9	William	Thomas	85000.00
3	Michael	Davis	82000.00
5	David	Brown	79000.00
1	John	Smith	75000.00
6	Lisa	Miller	70000.00
2	Sarah	Johnson	68000.00
8	Jennifer	Anderson	64000.00
4	Emily	Wilson	62000.00

Sorting by Multiple Columns - ORDER BY CLAUSE

We can sort by multiple columns, creating a hierarchy of sorting criteria:

a. Sort by department first, then by salary (highest to lowest) within each department

```
SELECT employee_id, first_name, last_name, department, salary
FROM employees
ORDER BY department ASC, salary DESC;
```

employee_id	first_name	last_name	department	salary
9	William	Thomas	Engineering	85000.00
3	Michael	Davis	Engineering	82000.00
5	David	Brown	Engineering	79000.00
1	John	Smith	Engineering	75000.00
7	Robert	Taylor	Finance	90000.00
10	Jessica	Moore	Finance	88000.00
8	Jennifer	Anderson	HR	64000.00
4	Emily	Wilson	HR	62000.00
6	Lisa	Miller	Marketing	70000.00
2	Sarah	Johnson	Marketing	68000.00

In this example, MySQL first groups all employees by department alphabetically. Then, within each department, it sorts employees by their salary in descending order.

Working with Two Tables Using Equi-Join

An equi-join is a type of join operation that combines rows from two tables based on a condition where the values in specified columns are equal. This is one of the most common ways to relate data across tables in a relational database.

Syntax:

SELECT * FROM <table1>, <table2>
WHERE table1.column = table2.column;

Consider below two tables for **Customers** and **Orders** for Join concept.

Customers Table

customer_id	name	email	city
1	Alice	alice@example.com	New York
2	Bob	bob@example.com	Los Angeles
3	Charlie	charlie@example.com	Chicago
4	Diana	diana@example.com	Miami

Orders Table

order_id	customer_id	product	amount	date
101	1	Laptop	1200.00	2023-01-15
102	3	Smartphone	800.00	2023-01-20
103	1	Headphones	150.00	2023-02-05
104	2	Monitor	300.00	2023-02-10
105	4	Keyboard	80.00	2023-02-15

Example 1. To see all orders with customer information

```
SELECT o.order_id, o.product, o.amount, c.name, c.email, c.city
FROM Orders o , Customers c  where o.customer_id = c.customer_id;
```

order_id	product	amount	name	email	city
101	Laptop	1200.00	Alice	alice@example.com	New York
103	Headphones	150.00	Alice	alice@example.com	New York
104	Monitor	300.00	Bob	bob@example.com	Los Angeles
102	Smartphone	800.00	Charlie	charlie@example.com	Chicago
105	Keyboard	80.00	Diana	diana@example.com	Miami

MULTIPLE CHOICE QUESTIONS

Q1. Which aggregate function returns the number of rows in a result set, including rows with NULL values?

A) COUNT(column) B) COUNT(*)
C) SUM(column) D) AVG(column)

Answer : B

Q2. Which statement is true about the AVG () function?

A) It includes NULL values in the calculation B) It ignores NULL values in the calculation
C) It treats NULL values as zero D) It returns NULL if any value in the column is NULL

Answer : B

Q3. Which of the following is NOT a valid aggregate function in MySQL?

A) MIN () B) SUM()
C) MAX () D) MEDIAN()

Answer : D

Q4. If a table has no rows, what will COUNT (*) return?

A) NULL B) Error
C) 0 D) -1

Answer : C

Q5. What is the difference between COUNT (DISTINCT column) and COUNT(column)?

A) COUNT (DISTINCT column) counts only unique values, while COUNT(column) counts all non-NULL values
B) COUNT (DISTINCT column) counts all values including NULL, while COUNT(column) counts only unique values
C) They are exactly the same
D) COUNT (DISTINCT column) always returns a lower count than COUNT(column)
Answer : A

Q6. In a GROUP BY query, which statement is correct?
A) You can select only columns that appear in the GROUP BY clause
B) You can select any column regardless of whether it appears in GROUP BY
C) You can select columns that appear in GROUP BY or are used in aggregate functions
D) You can only select aggregate functions
Answer : C

Q7. What is the correct order of clauses in a SQL query that includes GROUP BY?
A) SELECT, GROUP BY, FROM, WHERE
B) SELECT, FROM, WHERE, GROUP BY
C) SELECT, FROM, GROUP BY, WHERE
D) FROM, SELECT, WHERE, GROUP BY
Answer : B

Q8. What is the primary purpose of the HAVING clause?
A) To filter individual rows before grouping
B) To filter groups after the GROUP BY has been applied
C) To specify the columns to be grouped
D) To sort the final result set
Answer : B

Q9. What will the following query return?

```
SELECT department, COUNT(*) AS employee_count
FROM employees
GROUP BY department HAVING COUNT(*) > 5;
```

A) All departments
B) Departments with exactly 5 employees
C) Departments with more than 5 employees
D) Departments with fewer than 5 employees
Answer : C

Q10. What will happen if we use ORDER BY with a column that contains NULL values?
A) NULL values will be sorted first
B) NULL values will be sorted last
C) NULL values will cause an error
D) NULL values will be excluded from the result
Answer : A

Q11. How many columns can you specify in an ORDER BY clause?
A) Only one B) Maximum of three C) Maximum of five D) As many as needed
Answer : D

Q12. What is the result of this query?

```
SELECT name, department, salary
FROM employees
ORDER BY department ASC, salary DESC;
```

A) Results are sorted by salary in descending order, then by department
B) Results are sorted by department in ascending order, then by salary in descending order
C) Results are sorted by department in descending order, then by salary in ascending order
D) Results are sorted by salary in ascending order, then by department
Answer : B

Q13. What is the result of MONTH('2023-07-15')?
A) July B) 7 C) 07 D) 6
Answer : B

Assertion and Reasoning Based Questions

Each question consists of an assertion (A) and a reason (R). You need to determine whether each statement is true or false, and if the reason correctly explains the assertion. Options are as follows:

A. Assertion and Reason both are correct and Reason is correct explanation of assertion
B. Assertion and Reason both are correct and Reason is not correct explanation of assertion
C. Assertion is True and Reason is False
D. Assertion is False and Reason is True
E. Assertion and Reason both are False

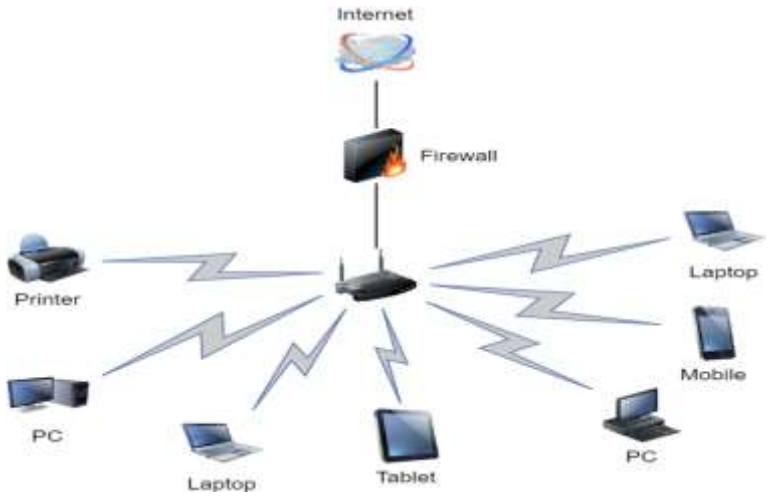
Question1. Assertion (A): COUNT(column_name) and COUNT() *always return the same value.*
Reason (R)*: Both COUNT(column_name) and COUNT()* count all rows in a table or result set.
Answer : E
Question 2 Assertion (A): The AVG() function returns NULL if all values in the column are NULL.
Reason (R): Aggregate functions in MySQL ignore NULL values in their calculations.
Answer : A
Question 3 Assertion (A): The SUM() function always returns a numeric value, even when applied to an empty result set.
Reason (R): MySQL aggregate functions return 0 or NULL when applied to empty sets.
Answer : D
Question 4 Assertion (A): The GROUP BY clause in MySQL must include all non-aggregated columns that appear in the SELECT clause.
Reason (R): MySQL requires that each column in the SELECT list that is not part of an aggregate function must be included in the GROUP BY clause to ensure deterministic results.
Answer : A
Question 5 Assertion (A): Using GROUP BY on a column with NULL values will place all NULL values into a single group.
Reason (R): MySQL treats all NULL values as identical when comparing them for equality.
Answer : C

Question 6 Assertion (A): The COUNT(column_name) and COUNT(*) functions can produce different results when used with GROUP BY.
Reason (R): COUNT(column_name) counts only non-NULL values in the specified column, while COUNT(*) counts all rows regardless of NULL values.
Answer : A
Question 7 Assertion (A): The WHERE and HAVING clauses can be used interchangeably when filtering rows that contain aggregate values.
Reason (R): Both WHERE and HAVING filter rows, but they are processed at different stages of query execution.
Answer : D
Question 8 Assertion (A): In MySQL, the default sort order is ascending (ASC) if neither ASC nor DESC is specified.
Reason (R): The ASC keyword is implicitly applied when no sort direction is specified to provide a consistent default behaviour.
Answer : A
Question 10 Assertion (A): In MySQL, you can sort by a column that is not included in the SELECT clause.
Reason (R): The ORDER BY clause operates independently of the columns listed in the SELECT clause.
Answer : A
Question 11 Assertion (A): When using ORDER BY with NULL values, MySQL sorts NULL values first when using ASC order.
Reason (R): MySQL treats NULL as the lowest possible value in the column's data type hierarchy.
Answer : A
Question 12 Assertion (A): The DATE() function extracts the date part from a datetime expression, removing any time component.
Reason (R): DATE() truncates the time portion of a datetime value to standardize date comparisons.
Answer : A
Question 13 Assertion (A): When joining tables with an Equi Join, the joined columns must have the same name.
Reason (R): Equi Joins compare columns that have identical values, which requires the columns to have matching names.
Answer : E
Question 14 Assertion (A): In an Equi Join, columns with NULL values will never match, even if both columns have NULL.
Reason (R): In SQL, NULL = NULL evaluates to NULL (unknown), not TRUE, so rows with NULL values in join columns are excluded.
Answer : A
Question 15 Assertion (A): The NOW() and CURRENT_TIMESTAMP() functions in MySQL return identical results.
Reason (R): Both functions retrieve the current date and time from the server's system clock at the moment the statement begins to execute.
Answer : A

Unit 3: Introduction to Computer Networks

Introduction to Networks:

A group of two or more autonomous interconnected computers or computing devices is called a computer network. Each computer or device can share data with other devices.



Advantages of Using Computer Networks:

- Resource sharing: Resources can be any hardware or information or storage space etc.
- More Storage space: Data can be stored on available hard disks in a network.
- Back up of data: Data can be saved on multiple devices in network. And this ensures the availability of data.
- Sharing of computing power and memory: Processes can be distributed across the network and can have more computing power.
- Communication: Can communicate with any one through E mail, chat etc., also can transfer files easily and economically.

Different types of Networks:

Based on geographical area covered and the data transfer rate, the following four types of networks are there.

1. **PAN**: Personal Area Network

   Size and Coverage: PAN connects devices such as smartphones, laptop, camera, tablets etc. They are designed for short-distance communication. Most common

communication technology is Bluetooth and hence can give a range up to 10 meters.

Speed and Cost: PANs are low-cost networks with moderate data speeds suitable for personal device connectivity.

Example: A person connecting smartphone, smartwatch, and wireless headphones using Bluetooth.

2. **LAN**: Local Area Network
   Size and Coverage: LANs are limited to a relatively small area, such as a single building, home, office, or school campus or one or two campuses. The term "local" refers to single management. LAN can be wired or wireless. The range can be from 10 meters to 1 KM.

   Speed and Cost: They offer high data transfer speeds and are cost-effective to set up and maintain. Wired LAN can operate at a speed of 100 Mbps to 1 Gbps. There are LANs which can operate at a speed of 10 Gbps.

   Usage: Commonly used to connect computers, printers, and other devices within small spaces for sharing resources like files and internet access.

   Example: A school using a LAN to connect all its computers and share a central server.

3. **MAN**: Metropolitan Area Network
   Size and Coverage: MANs are larger than LANs but smaller than WANs, spanning over a city or two cities. These networks link multiple LANs within the defined territory. They can be extended up to 30 - 40 Km.

   Speed and Cost: MANs offer faster speeds compared to LANs but are more complex and expensive than LANs.

   Usage: Often used by governments, universities, and large organizations to connect resources across a city or metropolitan region.

   Example: A cable TV Network covering a city, Cable based broadband internet service.

4. **WAN**: Wide Area Network

Size and Coverage: WANs operate over large geographic areas, such as cities, countries, or even continents. The internet is the most common example of a WAN. Different types of network using various technologies are connected together to form WAN.

Speed and Cost: These networks generally have slower data transfer speeds compared to LANs and are more expensive to implement and maintain.

Usage: Primarily used to connect multiple LANs and enable global communication.

Example: A multinational company connecting branch offices across different countries using a WAN.

Summary Table: Key Differences

Aspect	PAN	LAN	MAN	WAN
Coverage Area	Very small (personal)	Small (building or campus)	Medium (city or campus-wide)	Large (regional or global)
Speed	Moderate	High	Higher than WAN	Slower than LAN
Cost	Low	Low	Moderate to high	High
Purpose	Personal device links	Resource sharing	Connecting LANs across cities	Interconnect large networks

Network Devices:

To interconnect computers and other devices to create a computer network and to transfer data we need some devices and these devices are called network devices.

1.**Network Interface Card**(Ethernet Card/Terminal Access Point/ Network Interface Unit):

- This is a network adaptor used to set up a wired network.
- It acts as an interface between the device and the network.
- Network cable(Ethernet cable) connects to this card using the RJ-45 Connector.
- They support data transfer between 10 Mbps to 1 Gbps.
- Each NIC has a permanent hardware address called MAC(Media Access Control)

Address. MAC addresses are of 48 bits(6 Bytes) and are represented using hexadecimal numbers. MAC address is used to identify the device on the network. Example : D4:3D:7E:8A:12:34

2.**Modem**:

- A modem is a device that allows computers, smartphones, tablets, and other devices to connect to the internet. They connect a computer network with a telephone network.
- They convert digital signals from the computer network to analog signals for transmitting it over the telephone network and on receiving the analog signal from the telephone network, it converts it to digital signal.
- The term 'Modem' stands for 'MOdulator DEModulator'.

3.**Hub**(Ethernet Hub):

- This is a device that connects multiple devices (like computers or other network devices) within a local area network (LAN), through wires.
- Multiple ports where ethernet cables can be connected using RJ-45 connectors are available.
- Data received through one port will be broadcasted to all other devices connected.

4.**Switch**:

- A switch is a hardware device that connects multiple devices (like computers, printers, and servers) on a network, enabling them to communicate by exchanging data packets.
- Initially it works like a Hub but gradually It forwards data intelligently to the intended destination based on the destination's MAC address.
- It can forward multiple packets at the same time. Also it can transfer data to multiple hosts if required.

5.**Repeater**:

- Data is carried in the form of signals over the cable and can be transmitted up to 100 meters only.
- Repeaters are devices in computer networks used for amplifying or regenerating an incoming signal before retransmitting it so that it reaches the destination or next node.
- They operate at the physical layer of the OSI (Open Systems Interconnection) model

6.**Router**:

- Connects two or more networks and forwards data packets between them.
- They can receive the data, analyse it and transmit it to other networks.
- It uses IP address(Internet Protocol Address is used to identify a connection in a network)
- A router connects a local area network to the internet.
- It can connect different types of network(using different technologies/protocols).
- It can analyse the data packet received and can decide how to forward it. It can even repackage the received packet.
- If the destination is known then it will forward the data packet to the exact destination, otherwise it will be forwarded to the next router connected to it. Router uses a routing table to forward the packet.
- Wireless routers can provide Wi-Fi access.

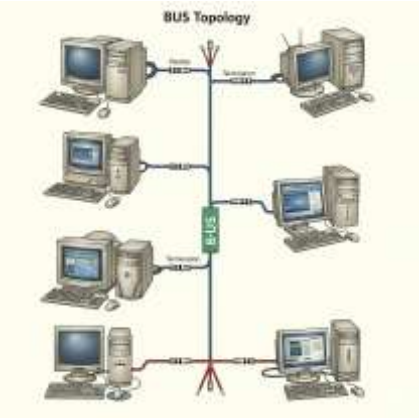
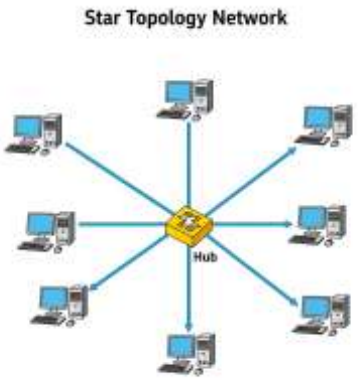
7.**Gateway**:

- In computer networks, a gateway is a device or software that acts as a bridge between different networks. They connect different types of networks together.
- It acts as an entry and exit point and all data passes through it.

Network Topologies:

Network topology describes the physical and logical arrangement of nodes(any computer or device connected to a network is called a node) and connections within a network(LAN).

It dictates how data flows and how devices communicate. There are several types of network topologies, including Star, Bus, Tree, Mesh, ring and hybrid. Understanding network topology is crucial for designing, managing, and troubleshooting networks.

Bus Topology Each communicating device connects to a transmission medium, known as bus. A single backbone wire called bus is shared among the nodes. Data can be received by any of the nodes connected to the bus. Signals will be absorbed by terminators on reaching the end of the bus. Bus topology is less secure and less reliable. Advantages: Simple to install, inexpensive to implement. Disadvantages: if the bus fails, the entire network is down , limited speed, and security concerns. Difficult to expand beyond a certain limit due to repeater configuration issues.	
Star Topology Each device connects to a central node(hub or switch) Advantages: Very effective, efficient and fast as each device is directly connected with the central device. Easy to troubleshoot and maintain, and scalable. Disadvantages: If the central node fails, the entire network will be affected. More expensive than other topologies as more cable is required.	

Tree topology:

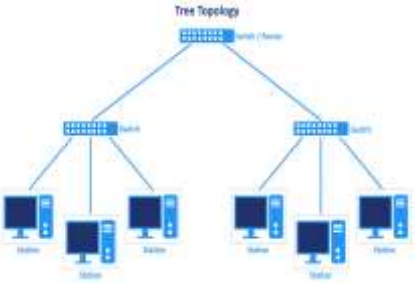
Tree topology is a combination of bus and star topologies. Devices are arranged in a hierarchical, tree-like structure, often using a central hub at the root.

This is a hybrid topology.

All the stars are connected together like a bus.

Advantages: Good for hierarchical structures, scalable, and can be used for different types of networks.

Disadvantages: More complex than simpler topologies, and can be slower than other options.

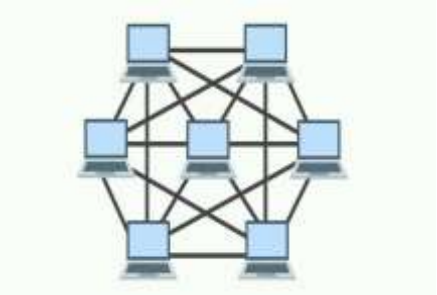


Mesh Topology:

Each device connects to multiple other devices, creating a mesh of connections.

Advantages: Highly reliable, fault-tolerant, and scalable.

Disadvantages: Complex to install and manage, and can be expensive due to the number of connections.

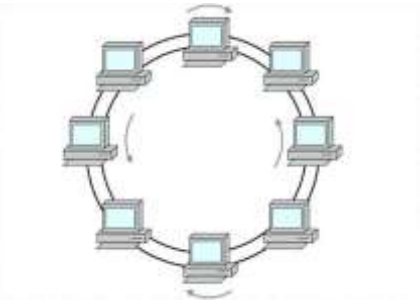


Ring Topology:

Each node(device) is connected to exactly two other adjacent nodes and forms a ring(closed loop)

Advantages: Simple architecture, data can be transmitted efficiently in one direction.

Disadvantages: Single point of failure, can be difficult to troubleshoot, and not as scalable as other topologies.



Communication Media

The medium through which the signals are transferred is called communication media. It can be Guided or Unguided.

1.Guided Media(Wired Media)

Twisted pair Cables: Twisted pair cables allow the user to connect their devices to a Local Area Network (LAN). There are 8 wires or 4 pairs of wires with each pair twisted together in the cable.

Coaxial Cables: A coaxial cable is used to carry high-frequency signals with low losses. Its maximum transmission speed is 10 Mbps. It is usually used in telephone systems, cable TV, etc.

Fiber Optic Cable(OFC): Fiber optic cables use optical fibers and transmit data in the form of light signals due to which there are no electromagnetic interference in fiber optics. Fiber optics can transmit signals over a very long distance as compared to twisted pairs or coaxial cables.

2.**Unguided Media**(Wireless Media): It includes electromagnetic waves of different frequencies. Different types of unguided media are : Radio Waves, Microwaves, Satellite mode of communication, Bluetooth and Infrared communication.

Introduction to Internet:

The Internet is the network of all the networks spread across the globe. Different types of networks are interlinked. Devices/networks are connected to the Internet Service Provider's(ISP) network. ISP's networks are connected to form regional networks and regional networks are connected to form national networks. Such country wise networks are connected to form the internet.

URL: URL is Uniform Resource Locator and provides the location and mechanism (protocol) to access the resource. It is also called a web address. It consists of the following:

1. Protocol - set of rules to access the resource and can be http, https, ftp, telnet etc
2. Domain name - the name given to the website. Example: ncert.nic.in
3. Path to the resource - based on the web server.
4. Name of the resource.

Examples for URL:

1. https://cbseacademic.nic.in/
2. https://ncert.nic.in/textbook.php

3. http://www.ncert.nic.in/textbook/textbook.htm

Applications of Internet:

Some of the applications of internet are:

1)**World wide web**(WWW):- www is the collection of interlinked web pages and web resources which can be accessed through the internet. Sir Tim Berneres Lee is considered as the father of www. Three fundamental technologies that lead to creation of web: HTML(HyperText Markup Language) used to design the web page and present the content, URI(Uniform Resource Identifier)to identify a resource located on the web, HTTP(HyperText Transfer Protocol) the set of rules used to retrieve linked web pages.

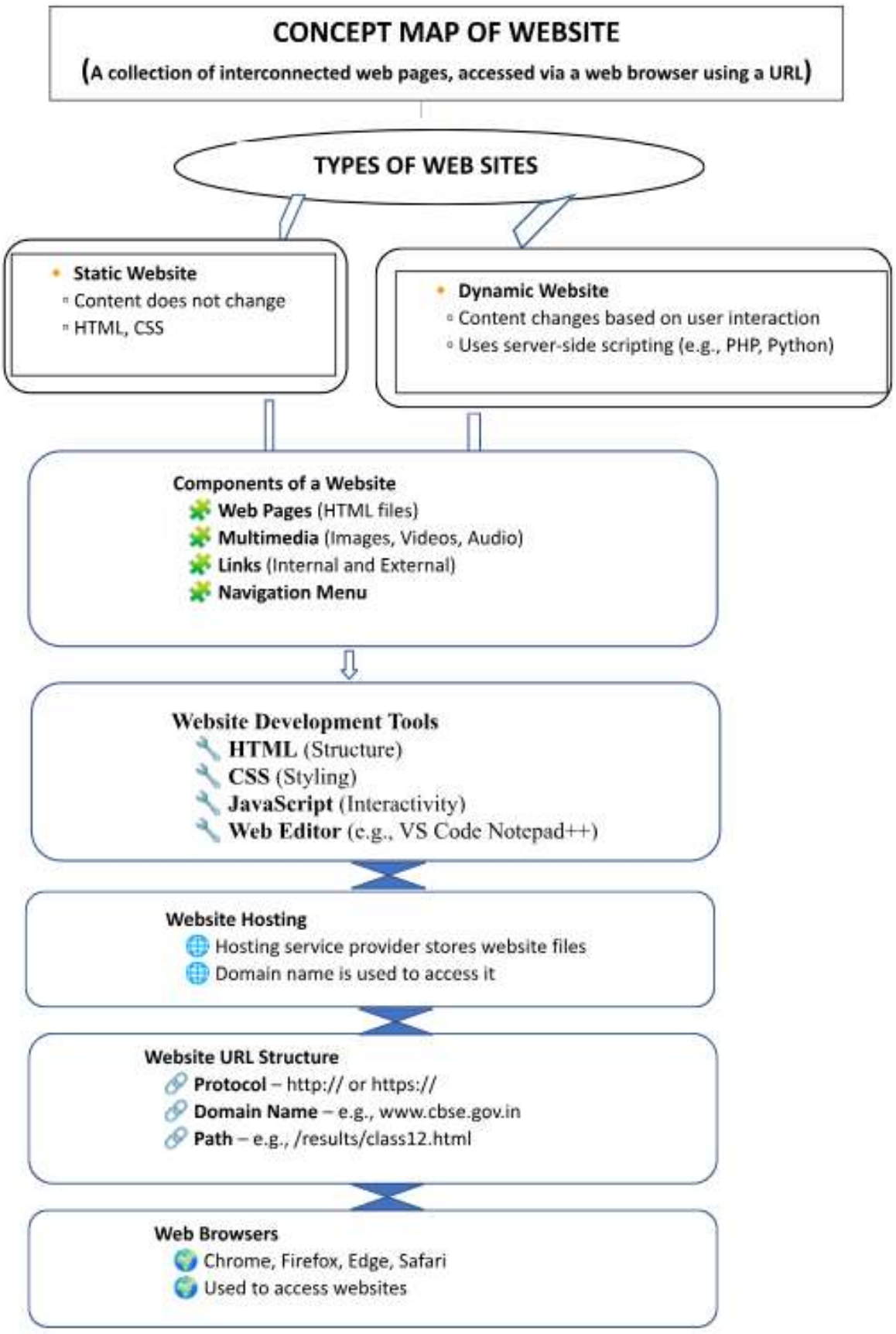
2)**Electronic mail**(E-mail): An email can be sent anytime to any number of recipients anywhere. Files can be attached with email. To use email service users must register with an email service provider. Gmail and Outlook are examples for email service providers.

3)**Chat**: It is for real time messages. Applications such as WhatsApp, Slack, Skype, YahooMessenger, Google Talk, Facebook Messenger, Google Hangout, etc., are examples of instant messengers.

4)**Voice over Internet Protocol**(VoIP) - VoIP allows us to have voice calls over the internet.It is also known as Internet Telephony or Broadband Telephony.

Website:

A website is a collection of web pages linked through hyperlinks, and saved on a web server. Hyperlinks connect the pages together. To access a website URL is required. A web page is usually a part of a website and may contain information in the forms of texts, images, audio and video etc. The first page of the website is called Home page.


CONCEPT MAP OF WEBSITE
(A collection of interconnected web pages, accessed via a web browser using a URL)
TYPES OF WEB SITES
Static Website
Content does not change
HTML, CSS
Dynamic Website
Content changes based on user interaction
Uses server-side scripting (e.g., PHP, Python)
Components of a Website
Web Pages (HTML files)
Multimedia (Images, Videos, Audio)
Links (Internal and External)
Navigation Menu
Website Development Tools
HTML (Structure)
CSS (Styling)
JavaScript (Interactivity)
Web Editor (e.g., VS Code Notepad++)
Website Hosting
Hosting service provider stores website files
Domain name is used to access it
Website URL Structure
Protocol – http:// or https://
Domain Name – e.g., www.cbse.gov.in
Path – e.g., /results/class12.html
Web Browsers
Chrome, Firefox, Edge, Safari
Used to access websites

The basic structure of a web page is created using HTML. To make web pages more attractive, CSS (Cascaded Style Sheets) sheet is used. To make the pages interactive scripts are used. A website's purpose is to make the information available to all at any time.

Depending on the functionality and features, a web page may be classified as-

Static Web Page:A static webpage is one whose content always remains the same(static), i.e., does not change based on person, location or device. Static web pages are generally created using HTML , CSS and have the extension .htm or .html. Content can be manually modified by the administrator of such a website.

Dynamic Web Page: A dynamic web page is one in which the content of the web page can be different for different users according to users' response, location or device. The dynamic websites are more complex in design and take more time to load than static web pages. Dynamic web pages can be created using scripting languages such as JavaScript, PHP, ASP.NET, Python etc. Web pages displaying the date, time, weather report, multilingual pages or auto resizing webpage as per screen size of the client device are Dynamic web pages.

Static V/s Dynamic Web Page

Static Webpage	Dynamic Web page
No Change in contents until someone changes it manually. HTML and CSS can be used to create such pages It takes less time to display on the browser at client end.	Web page changes its appearance or contents according to user, location or device. Needs scripts to create the pages. It takes more time to display on the browser at client end.

Web Server: A web server is used to store and deliver the contents of a website. Web server is implemented using software. The content of the website along with the required scripts are saved in the web server. Web server as a software, is a specialized program that understands URLs and receives requests from browsers, and responds to those requests.

Examples for Web server: Apache web server, Nginx, Microsoft IIS.

Web Hosting:

It is a service that enables us to publish websites on the Internet. After creating a web site, it needs to be placed on a web server for global access. Generally Web Server services (CPU, RAM, and storage etc.) are taken on rent basis from the service providers.

Web developers host websites on a server by uploading the files constituting the website (HTML, CSS, JavaScript, images, databases, etc.).

All web servers are identified by a unique numeric address called IP address, and this IP address needs to be mapped to domain name (Website name/URL) of the website using DNS (Domain Name System) Server. By this mechanism the IP address corresponding to a domain name can be identified.

Web Browser:

Browser is used to view/access the web page using URL. Browser sends a request to the server and receives the response from the server.

Commonly used Browsers : Google chrome, Mozilla Firefox and Microsoft Edge.

Browser Settings :

Browser settings are configuration options in a web browser (like Chrome, Firefox, Edge) that allow users to control how the browser behaves — from privacy and security to appearance and performance.

Add-ons and Plug-ins:

Add-ons and plug-ins are the tools that help to extend the functionality of the web browser. An add-on is also called extension in some browsers and is used to add a particular functionality to the browser. Mostly these Add-ons are provided as Extensions through a library provided by the Web Browser which can be installed from the browsers setting options. Google Translate and Grammarly are examples of Add-ons.

A plug-in is a complete program or third-party software which offers some extra functionality to users. For example, Flash players and Java are plug-ins etc. A Flash player is required to play a video in the browser. A plug-in is a software that is installed on the host computer and can be used by the browser for multiple functionalities and can even

be used by other applications as well.

Cookies: A cookie is a small text file, which is transferred by the webserver to the browser while surfing a website. The information stored in cookies are related to the user, pages visited, choices and menu(s) settings on a particular website. It helps in customizing the web pages like language, auto-login information, preferences and sometimes remembering the shopping preference and displaying advertisements of interest, etc.

Cookies are usually harmless and they can't access information from the hard disk or transmit virus or malware. However, cookies may be privacy threats. Sometimes viruses can also be tricked as cookies and cause harm to a computer system. Cookies can be disabled by changing the Privacy and Security settings of the browser.

MULTIPLE CHOICE QUESTIONS

1	1. Which of the following networks typically covers the smallest geographical area? A) WAN B) MAN C) LAN D) PAN Answer:D) PAN
2	A network that connects computers within a city using high-speed connections is known as: A) LAN B) PAN C) WAN D) MAN Answer: D) MAN
3	Which type of network would most likely be used in a school or college campus? A) PAN B) LAN C) MAN D) WAN Answer: B) LAN
4	What type of network is the internet an example of? A) PAN B) LAN C) WAN D) MAN Answer: C) WAN
5	Bluetooth devices such as wireless headsets typically form which type of network? A) PAN B) LAN C) WAN D) MAN Answer: A) PAN
6	What is the primary function of an Ethernet card in a computer? A) Display graphics B) Connect to the internet wirelessly C) Enable network communication D) Store data Answer: C) Enable network communication
7	Which device is used to connect multiple networks and route data between

	them? A) Switch B) Router C) Hub D) Repeater Answer: B) Router
8	Which network device only regenerates and amplifies the signal to extend network range? A) Switch B) Router C) Repeater D) Gateway Answer: C) Repeater
9	A device that connects networks using different protocols is known as: A) Bridge B) HUB C) Repeater D) Gateway Answer: D) Gateway
10	Which network device blindly broadcasts incoming signals to all its ports? A) Switch B) Hub C) Router D) Gateway Answer: B) Hub
11	Which device is best for reducing network traffic by sending data only to the destination device? A) Hub B) Router C) Repeater D) Switch Answer: D) Switch
12	What is the primary function of a modem? A) Store data permanently B) Convert digital signals to analog and vice versa C) Provide electricity to network devices D) Route data between networks Answer: B) Convert digital signals to analog and vice versa
13	The term "modem" is a combination of which two operations? A) Multiplexing and Demultiplexing B) Modulation and Demodulation C) Modeling and Demonstration D) Modifying and Demanding Answer: B) Modulation and Demodulation
Assertion and Reasoning Based Questions	
A: Assertion R: Reason Choose the correct option: A. Both A and R are true, and R is the correct explanation of A. B. Both A and R are true, but R is NOT the correct explanation of A. C. A is true, but R is false. D. A is false, but R is true.`	
1	Assertion (A): A website is a collection of related webpages linked together under a domain name. Reason (R): A webpage is the homepage of a website. Answer: C. A is true, but R is false.

2	Assertion (A): A static web page always displays the same content for every visitor. Reason (R): Static web pages are generated in real-time by server-side programs. Answer : C A is true, but R is false.
3	Assertion (A): Dynamic web pages change content based on user interaction or other factors. Reason (R): Dynamic web pages are usually connected to databases and use server-side scripting languages. Answer : A Both A and R are true, and R is the correct explanation of A.
4	Assertion (A): A web server delivers web content to users upon request via a web browser. Reason (R): A web server can only host a single website at a time. Answer :C A is true, but R is false.
5	Assertion (A): Hosting a website means storing its files on a server that is accessible via the internet. Reason (R): Hosting is necessary for a website to be available publicly. Answer : A Both A and R are true, and R is the correct explanation of A.
6	Assertion (A): A web browser is used to retrieve and display content from the World Wide Web. Reason (R): A web browser is only required for sending emails. Answer:C. A is true, but R is false.
7	Assertion (A): Add-ons and plug-ins are used to extend the functionality of a web browser. Reason (R): Add-ons and plug-ins help improve user experience by adding extra features like ad-blockers or video players. Answer: A. Both A and R are true, and R is the correct explanation of A.
8	Assertion (A): Cookies help websites remember users and their preferences. Reason (R): Cookies are files stored on the user's device by web browsers. Answer: A. Both A and R are true, and R is the correct explanation of A.
9	Assertion (A): Cookies can make browsing more convenient but also raise privacy concerns. Reason (R): Cookies automatically delete themselves immediately after a session ends. Answer: C. A is true, but R is false.
10	Assertion (A): Every website must have at least one webpage. Reason (R): A website is the digital address where you store photos only. Answer: C. A is true, but R is false.

Short Questions with Answers
1 How a homepage in a website beneficial for users? Answer: The homepage is the first page of a website that opens when the website is accessed. It usually contains links to other pages on the site.
2.Explain the behaviour of dynamic web page? Give one situation where it is used. Answer:A dynamic web page changes content based on user interaction or other factors.It is used in online shopping websites to display products based on user search.
3.List any two differences between static and dynamic web pages. Answer: Static pages display fixed content; dynamic pages display changing content. Static pages are faster to load; dynamic pages require server-side processing.
4.What is a web browser? Name any two commonly used browsers. Answer: A web browser is a software application used to access and display web pages. Examples: Google Chrome, Mozilla Firefox.
5.How can a user manage or delete cookies from a web browser? Answer:A user can manage or delete cookies through the browser's privacy settings, under the "Clear browsing data" or "Cookies and site data" section.
6.What is the primary function of a hub in a network? Answer: A hub connects multiple computers in a LAN and broadcasts data to all connected devices.
7.How does a switch differ from a hub? Answer: Unlike a hub, a switch sends data only to the specific device it is intended for, improving network efficiency.
8.What is a router used for in a network? Answer: A router connects different networks together and directs data between them, often linking a local network to the internet.
9.What is the main role of a gateway in a network? Answer: A gateway acts as a translator between two different network protocols, enabling communication between dissimilar networks.
10.What does a modem do? Answer: A modem converts digital signals to analog (and vice versa) to enable internet access over telephone or cable lines.
11.What is a network card? Answer: A network card (NIC - Network Interface Card) is hardware that connects a computer to a network.
12.What is a MAC address? Answer: A MAC (Media Access Control) address is a unique physical address assigned to a device's network. A MAC address is 48 bits long.
13.What is the difference between a MAC address and an IP address? Answer: A MAC address is a hardware identifier, while an IP address is a logical

identifier used for locating devices on a network.

14.Why is DNS important in the internet?
Answer: DNS allows users to access websites using easy-to-remember domain names instead of numerical IP addresses.

15.What is a network topology?
Answer: Network topology refers to the physical or logical layout of devices and cables in a computer

Long Answer Questions:

1.Explain the concept of a Website and a Webpage. Differentiate between the two with examples.
Answer:
A website is a collection of interlinked webpages hosted under a single domain name. It is stored on a web server and can be accessed over the Internet.
Example: www.cbse.gov.in
A webpage is a single page of a website. It is a document that can be viewed using a browser.
Example: The "Results" page of the CBSE website.

2. What is the difference between a static web page and a dynamic web page? Give suitable examples.
Answer:
Static Web Page:
A static webpage is a page that shows the same content to all users every time it is accessed. It is created using HTML and CSS only.
Example: A company's contact page.
Dynamic Web Page:
A dynamic webpage shows different content and allows user interaction based on inputs or preferences. It is created using server-side scripting languages like PHP, ASP.NET, or database systems.
Example: An online shopping website's product page.

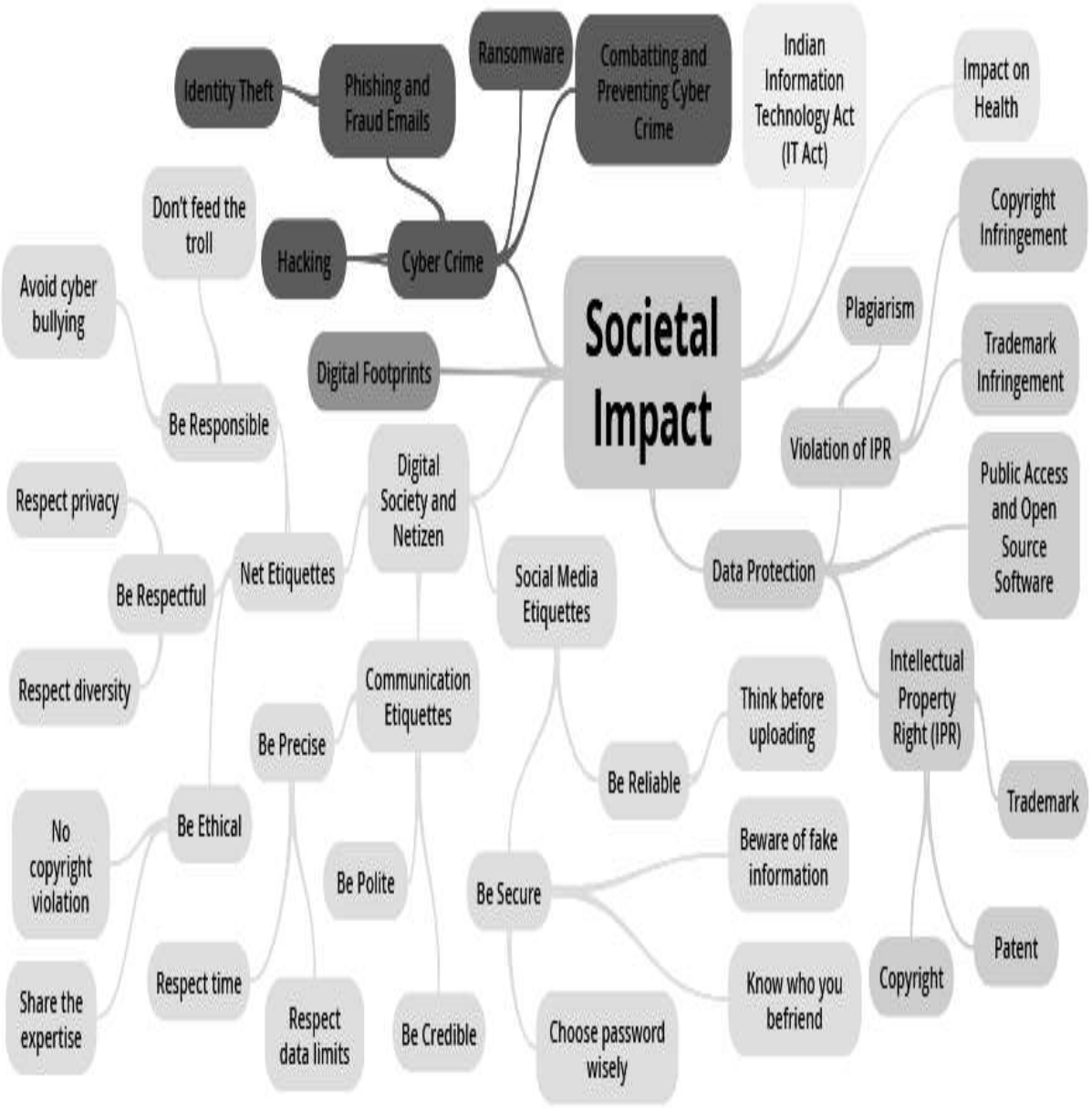
3. What is a web server? What is web hosting? Explain their importance in making a website available online.
Answer:
A web server is software that stores website files (HTML, CSS, images, scripts etc) and delivers them to users over the Internet when requested.
Web hosting refers to a service that provides storage space on a web server to make a website accessible through the Internet.
Importance:

A. Without web servers, users cannot access webpages.
B. Hosting makes sure the website is always available to users globally.
C. Hosting services also offer security, backups, and technical support for websites.

Example of web servers: Apache, Nginx
Example of hosting services: GoDaddy, Bluehost, HostGator

Unit 4: Societal Impact

Concept Map:



Digital Footprint
A digital footprint, is the data you leave behind when you use the internet. It includes the websites you visit, emails you send, and information you submit to online services and can be traced back by an individual.
It is of two types: i) Passive digital footprints ii) Active digital footprints

i) Passive digital footprints:
A passive digital footprint refers to the unknowing data trail an individual leave behind while online. Example: Your search history, which is saved by some search engines while you are logged in.

ii)Active digital footprints:
Active digital footprints: An "active digital footprint" includes data that you intentionally submit online.
Example: Publishing a blog and posting social media updates are another popular way to expand your digital footprint. Every tweet you post on Twitter, every status update you publish on Facebook, and every photo you share on Instagram contributes to your digital footprint.

How to reduce the footprint?
1.Double-check privacy settings
2.Logout after you're done surfing a website
3.Think before putting anything online/public platform
4. Don's post personal information online

Net and Communication Etiquettes
Net Etiquettes:
One should be ethical, respectful and responsible while surfing the Internet.
A) Be Ethical
• No copyright violation: we should not use copyrighted materials without the permission of the creator or owner. As an ethical digital citizen, we need to be careful while streaming audio or video or downloading images and files from the Internet.

• Share the expertise: it is good to share information and knowledge on Internet so that others can access it. However, prior to sharing information, we need to be sure that we have sufficient knowledge on that topic. The information shared should be true and unambiguous. Also, in order to avoid redundant information, we should verify that the information which we are going to post, is not available already on Internet.

B) Be Respectful

• Respect privacy: as good digital citizens we have the right to privacy and the freedom of personal expression. We should respect this privacy and should not share images, documents, files, etc., with any other digital citizen without each other's consent.
• Respect diversity: in a group or public forum, we should respect the diversity of the people in terms of knowledge, experience, culture and other aspects.

(C) Be Responsible
• Avoid cyber bullying: Cyberbullying means sending, posting, or sharing negative, harmful, false, or mean content about someone else. It implies repeatedly targeting someone with intentions to hurt or embarrass.

• Don't feed the troll: An Internet troll is a person who deliberately shows discord on the Internet by starting quarrels or upsetting people, by posting inflammatory or off topic messages in an online community, just for amusement. When encountering trolls we can ignore them block them and can report to the platform.

Communication Etiquettes
Digital communication includes email, texting, instant messaging, talking on the cell phone, audio or video conferencing, posting on forums, social networking sites, etc. All these are great ways to connect with people in order to exchange ideas, share data and knowledge. Good communication over email, chat room and other such forums require a digital citizen to abide by the communication etiquettes
(A) Be Precise
• Respect time: We should not waste precious time in responding to unnecessary emails or comments unless they have some relevance for us. Also, we should not always expect an instant response as the recipient may have other priorities.

• Respect data limits: For concerns related to data and bandwidth, very large attachments may be avoided. Rather send compressed files or link of the files through cloud shared storage like Google Drive, Microsoft OneDrive, Yahoo Dropbox, etc.

(B) Be Polite
Whether the communication is synchronous (happening in real time like chat, audio/video calls) or asynchronous (like email, forum post or comments), we should be polite and non-aggressive in our communication. We should avoid being abusive even if we don't agree with others' point of view.

(C) Be Credible
We should be cautious while making a comment, replying or writing an email or forum post such acts decide our credibility over a period of time.

Data Protection:
Data protection refers to the practices, safeguards, and binding rules put in place to protect your personal information and ensure that you remain in control of it.

In short, you should be able to decide whether you want to share some information or not, who has access to it, for how long, for what reason, and who be able to modify some of this information Personal data is any information relating to you, whether it relates to your private, professional, or public life.

Sensitive data:
Elements of data that can cause substantial harm, embarrassment, inconvenience and unfairness to an individual, if breached or compromised, is called sensitive data.
Examples of sensitive data include biometric information, health information, financial information, or other personal documents, images or audios or videos.

Privacy of sensitive data can be implemented by encryption, authentication, and other secure methods to ensure that such data is accessible only to the authorised user and is for a legitimate purpose.

Intellectuals Property Rights (IPR)

Intellectual property refers to intangible property that has been created by individuals and corporations for their benefit or usage such as copyright, trademark, patent and digital data.
It is therefore unethical to copy or steal the creativity and efforts of someone else.
Intellectual property is divided into categories which are-

1. Industrial property which majorly speaks about protecting inventions on the other hand.
2. Copyright majorly protects literary and artistic works.

Violation of IPR

Violation of intellectual property right may happen in one of the following ways:
(A) **Plagiarism**
Presenting someone else's idea or work as one's own idea or work is called plagiarism.
Plagiarism means not giving authors credit after copying that author's work. It involves lying, cheating, theft and dishonesty.
For example, copying papers written by other people and professionals and claiming it as written by you can be an example of plagiarism.
If we copy some contents from the Internet, but do not mention the source or the original creator, then it is considered as an act of plagiarism. Further, if someone derives an idea or a product from an already existing idea or product, but instead presents it as a new idea, then also it is plagiarism
It can be classified as:

i) Accidental/unintentional
ii) Deliberate/intentional

Accidental/unintentional Plagiarism: . Involves careless paraphrasing (changing the words or sentence construction of a copied document), quoting text excessively along with poor documentation. Accidental Plagiarism cases are less serious whereas
Deliberate/intentional Plagiarism: Includes copying someone else's work, cutting and passing blocks of text or any kind of information from electronic sources without the

permission of the original author. Deliberate plagiarism that may result in serious implications.

HOW TO AVOID PLAGIARISM?
Plagiarism should be avoided by the following simple measures:

i) Use your own ideas and words.
ii) Always provide a reference or give credit to the source from where you have received information.
iii) Cite the name of the website, a URL or the name of authors, and acknowledge them if you have used their work after rearranging the order of a sentence and changing some of the work.
iv) Take the information in the form of bulleted notes in your words.
v) Use online tools to check for plagiarism.
vi) Develop your writing skills.

(B) Copyright Infringement
Copyright infringement is when we use another person's work without obtaining their permission to use it or we have not paid for it, if it is being sold.

Suppose we download an image from the Internet and use it in our project. But if the owner of the copyright of the image does not permit its free usage, then using such an image even after giving reference to the image in our project is a violation of copyright.

(C) Trademark Infringement
Trademark Infringement means unauthorised use of other's trademark on products and services

Licensing of intellectual property:
Copyright, Patent and Trademark,

i) Code of the software will be protected by a copyright
ii) Functional expression of the idea will be protected by a patent
iii) The name and logo of the software will come under a registered trademark

(A) **Copyright**
Copyright grants legal rights to creators for their original works like writing, photograph, audio recordings, video, sculptures, architectural works, computer software, and other creative works like literary and artistic work. Copyrights are automatically granted to creators and authors.

(B) **Patent**
A patent is usually granted for inventions. Unlike copyright, the inventor needs to apply (file) for patenting the invention. When a patent is granted, the owner gets an exclusive right to prevent others from using, selling, or distributing the protected invention. Patent gives full control to the patentee to decide whether or how the invention can be used by

others. Thus, it encourages inventors to share their scientific or technological findings with others. A patent protects an invention for 20 years, after which it can be freely used.

(C) **Trademark**
Trademark includes any visual symbol, word, name, design, slogan, label, etc., that distinguishes the brand or commercial enterprise, from other brands or commercial enterprises. For example, no company other than Nike can use the Nike brand to sell shoes or clothes.

Licensing and copyright
A Software license is a legal permission or right to use or redistribution of that software. The software can run on a certain number of computers as per license agreement.

PROPRIETARY LICENSES
Exclusive rights in the software are retained with the owner /developer /publisher. They reserve all the freedom and rights to use and distribute this proprietary software.

PERMISSIVE LICENSES
Permissive licenses provide a royalty-free license to do virtually anything with the source code.
They permit using, copying, modifying, merging, publishing, distributing, sublicense and/or selling, but distribution can only be made without the source code as source code modifications can lead to permissive license violation. Distribution and modification of source code is permitted.
Example:
General Public License (GPL),
Creative Commons License (CC),
Lesser General Public License (LGPL),
Mozilla public License (MPL) etc.

COPYRIGHT
It is a form of protection given to the authors of "original works of authorship". This is given in the field of literature, dramatics, music, software, art etc. This protection applies to published as well as unpublished work.
Software copyright is used by software developers and proprietary software companies to prevent the unauthorized copying of their software. Free and open source licenses also rely on copyright law to enforce their terms. Copyright protects your software from someone else copying it and using it without your permission. When you hold the copyright to software, you can-

i) Make copies of it.
ii) Distribute it.
iii) Modify it

Public Access and Free and Open Source Software (FOSS)

Public License: The GNU General Public License (GPL) and the Creative Commons (CC) are two popular categories of public licenses.

Freeware: Freeware is software that is free to use and doesn't require a paid license. It also doesn't have expiration dates on how many times it can be downloaded.
Example: skype, Adobe Acrobat reader, VLC etc.

Proprietary software: Proprietary software that we use are sold commercially and their program code (source code) are not shared or distributed.
Example: Microsoft Windows, iTunes, Adobe Photoshop, Skype, Microsoft Excel, Adobe Acrobat, AutoCAD, and SOLIDWORKS.

Free and Open Source Software (FOSS): It is available freely for anyone and their source code is also open for anyone to access, modify, correct and improve.
For example, Linux kernel-based operating systems like Ubuntu and Fedora come under FOSS. Some of the popular FOSS tools are office packages, like LibreOffice, browsers like Mozilla Firefox, etc.

Software Piracy: Software piracy is the unauthorised use or distribution of software. Those who purchase a license for a copy of the software do not have the rights to make additional copies without the permission of the copyright owner. It amounts to copyright infringement regardless of whether it is done for sale, for free distribution or for copier's own use.
Adverse Effects of using pirated software:
1) Use of pirated software not only degrades the performance of a computer system, but also affects the software industry which in turn affects the economy of a country.

Creative Commons:
CC is used for all kind of creative works like websites, music, film, literature, etc. CC enables the free distribution of an otherwise copyrighted work. It is used when an author wants to give people the right to share, use and build upon a work that they have created. GPL is primarily designed for providing public licence to a software. GNU GPL is another free software license, which provides end users the freedom to run, study, share and modify the software, besides getting regular updates.

Cyber Crime:

Cybercrime is any criminal offence involving the use of electronic communication, computer or internet. The term "Cybercrime" covers phishing, Identity theft, credit card frauds, illegal downloading, child pornography, cyber bullying, cyber trolls, cyber stalking, cyber terrorism, distribution of viruses, spam, and industrial intelligence and so on.
(A) Hacking: Hacking is the act of unauthorised access to a computer, computer network or any digital system. Hackers usually have technical expertise in hardware and software. They look for bugs to exploit and break into the system.

Ethical Hacking: Hacking, when done with a positive intent, is called ethical hacking. Such ethical hackers are known as white hat hackers. They are specialists in exploring any loophole during testing of the software. Thus, they help in improving the security of a software and preparing the owner against any cyber-attack.
Non-ethical hacker: A non-ethical hacker is the one who tries to gain unauthorized access to computers or networks in order to steal sensitive data with the intent to damage or bring down systems. They are called black hat hackers or crackers. Their primary focus is on security cracking and data stealing. They use their skill for illegal or malicious purposes. Such hackers try to break through system securities for identity theft, monetary gain, to bring a competitor or rival site down, to leak sensitive information, etc.
(B) Online Fraud:
Fraud committed using the internet is called online fraud and may occur in many ways
Example: Non-delivery goods, Non-existent companies, Stealing information,
Fraudulent payments etc.
(C) Cyber Trolls:
Posting insulted messages online targeting people is called cyber trolls. It is closely related to cyberbullying.
(D) Cyber Bullying:
Harassing people or acting like someone or posting negative comments to someone or acting like someone using modern technologies such as internet, email, cell phone, instant massagers', social networks etc is called Cyber Bullying.
(E) Cyber Stalking:
Cyber stalking is a crime in which the attacker harasses a specific victim using electronic communication such as email or online message. Stalkers know their victims and they attack online instead resolving issues off line.
(F)Child pornography:
Child Pornography is defined as any visual or written representation including images or video that depicts sexual activity of anyone under the age of 18. Child pornography is sometimes called "child sexual abuse images".
(G) Digital Forensics:
It refers to methods used for interpretation of computer media for digital evidence.

(H) Phishing & Fraud Emails:
Phishing is a cyber-attack that uses email or a website as a weapon to trick the email recipient into believing that the message is something they want or need — a request from their bank, to click a link or download an attachment. They try to gather personal information or debit/credit card information.
The most common phishing method is through email spoofing where a fake or forged email address is used and the user presumes it to be from an authentic source. So, you might get an email from an address that looks similar to your bank or educational institution, asking for your information, but if you look carefully you will see their URL address is fake. Phishing attempts through phone calls or text messages are also common these days.

(I) Identity theft:
Identity theft is the unauthorized use of someone else's personal information to commit fraud, typically for financial gain.
Example: Using names, social security numbers, credit card details, or other identifying data without permission to open accounts, make purchases,

(J) Ransomware:
This is another kind of cybercrime where the attacker gains access to the computer and blocks the user from accessing, usually by encrypting the data. The attacker blackmails the victim to pay for getting access to the data, or sometimes threatens to publish personal and sensitive information or photographs unless a ransom is paid.
Preventing Cyber Crime
Following points can be considered as safety measures to reduce the risk of cybercrime:

i) Take regular backup of important data.
ii) Use an antivirus software and keep it updated always.
iii) Avoid installing pirated software. Always download software from known and secure (HTTPS) sites.
iv) Always update the system software which include the Internet browser and other application software
v) Do not visit or download anything from untrusted websites.
vi) Use a strong password for web login, and change it periodically. Do not use the same password for all the websites. Use different combinations of alphanumeric characters including special characters. Ignore common words or names in passwords.
vii) While using someone else's computer, don't allow browsers to save password or auto fill data, and try to browse in your private browser window.
viii) For an unknown site, do not agree to use cookies when asked for through a Yes/No option.
ix) Perform online transactions like shopping, ticketing, and other such services only through well-known and secure sites.
x) Always secure wireless networks at home with a strong password and regularly change it.

Cyber Law and IT Act:
Cyber law refers to all the legal and regulatory aspects of the internet. In India cyber law was enforced through IT Act, 2000. Its purpose is to provide legal recognition to electronic commerce. Electronic Governance i.e. E-documents get legal recognition. The maximum penalty for any damage to computers is fine up to 1 crore.

E-Waste: Hazards and Management
Electronic waste describes discarded electronic devices. "Electronic waste" may also be defined as discarded computers, office electronic equipment, entertainment device

electronics, mobile phones, television sets and refrigerators. This includes used electronics which are destined for reuse, resale, salvage, recycling or disposal.
Electrical and Electronic equipment contains metallic and non-metallic elements such as Copper, Aluminium, Gold, Silver, Palladium Platinum, Nickel, Tin, Lead, Iron, Sulphur, Phosphorous, Arsenic etc.

Impact of e-waste on environment:
To some extent, e-waste is responsible for the degradation of our environment. Whether it is emission of gases and fumes into the atmosphere, discharge of liquid waste into drains or disposal of solid e-waste materials, all of this contributes to environmental pollution in some way or the other.

A) Impact of e-waste on humans:

The electronic devices are manufactured using certain metals and elements like lead, beryllium, cadmium, plastics, etc. Most of these materials are difficult to recycle and are considered to be toxic and carcinogenic. If e-waste is not disposed of in proper manner, it can be extremely harmful to humans, plants, animals and the environment as discussed below:

- One of the most widely used metals in electronic devices (such as monitors and batteries) is lead.

When lead enters the human body through contaminated food, water, air or soil, it causes lead poisoning which affects the kidneys, brain and central nervous system. Children are particularly vulnerable to lead poisoning.

B) Management of E-waste

Some of the feasible methods of e-waste management are reduce, reuse and recycle.
• Reduce: We should try to reduce the generation of e-waste by purchasing the electronic or electrical devices only according to our need. Also, they should be used to their maximum capacity and discarded only after their useful life has ended. Good maintenance of electronics devices also increases the life of the devices.
• Reuse: It is the process of re-using the electric waste after slight modification. The electronic equipment that is still functioning should be donated or sold to someone who is still willing to use it. The process of re-selling old electronic goods at lower prices is called refurbishing.
• Recycle: Recycling is the process of conversion of electronic devices into something that can be used again, and again in some or the other manner. Only those products should be recycled that cannot be repaired, refurbished or re-used.

Awareness about health concerns related to the usage of technology

IMPACT ON HEALTH: Excessive usage of digital devices has a negative impact on our physical as well as psychological well-being. Ergonomic positioning of devices as well as our posture are important. When we continuously look at the screen for watching,

typing, chatting or playing games, our eyes are continuously exposed to the glare coming from the screens. Looking at small handheld devices makes it worse. Eye strain is a symptom commonly complained by users of digital devices. Stress, physical fatigue and obesity are the other related impacts the body may face if one spends too much time using digital devices.

Device Safety: Ensures Good Health of a Computer System

i) Regularly clean it to keep the dust off. Use a liquid solution specifically formulated for the cleaning of electronic screens.
ii) Wipe monitor's screen often using the regular microfibre soft cloth (the one used for spectacles).
iii) Keep it away from direct heat, sunlight and put it in a room with enough ventilation for air circulation.
iv) Do not eat food or drink over the keyboard. Food crumbs that fall into the gaps between the keys or spilled over liquid can cause issues to the devices.

Multiple Choice Questions

Q. No	Question
1.	Which of the following is not a type of a Cybercrime? A. Data theft B. Forgery C. Damage to data D. Installing Antivirus for Protection Answer : D
2.	What is the name of the IT Law that India is having in the Indian Legislature? A. India's Technology (IT) Act 2000 B. India's Digital information Technology (DIT) Act ,2000 C. The Information Technology Act ,2000 D. The Technology Act ,2008 Answer : C
3.	What is an example of e- waste? A. A ripened banana B. An old computer C. Old clothes D. Empty soda cans Answer : B

4.	An organization purchases new computers every year and dumps the old ones into the local dumping yard. Write the name of the most appropriate category of waste that the organization is creating every year, out of the following options: A. Solid waste B. Commercial waste C. E waste D. Business waste Answer : C
5.	Which electronic device can be used for cyber bullying? A. Television B. Cell Phones C. Typewriter D. CD Player Answer : B
6.	What is an example of cyberbullying? A. Telling someone their shirt is ugly B. Hitting someone C. Mean text messages D. Ignoring someone that is talking to you. Answer : C
7.	When can cyber bullying not happen? A. When you are at school B. When you talk with your friends C. When you are at home D. When you talk to someone face to face Answer : D
8.	What do you do if you or someone you know is being cyber bullied? A. Get into a fight with that person B. Keep it to yourself C. Let someone know D. Delete the text messages Answer : C
9.	_____is an internet scam done by cyber-criminals where the user is convinced digitally to provide confidential information? A. Phishing attack B. DoS attack C. Website attack D. MiTM attack Answer : A

10.	Which of the following types of data, phishers cannot steal from its target victims? A. email B. phone number C. passwords D. apps installed in the mobile Answer : D
11.	Which toxic compound is not found in e-waste? A. Mercury B. Cadmium C. Neon D. Lead Answer : C
12.	After using his email id, Anubhav forgot to sign off from his email account. Later, his servant saw his computer open and started using it. His servant's activity is an example of which of the following cybercrime? A. Hacking B. Identity theft C. Cyber bullying D. Plagiarism Answer : B
13.	After a fight with your friend, you did the following activities. Which of these activities is not an example of cyberbullying? A. You sent an email to your friend with a message saying that "I am sorry". B. You sent a threatening message to your friend saying "Do not try to call or talk to me. C. You created an embarrassing picture of your friend and uploaded it to your account on a social networking site. D. All of these Answer : A
14.	Rita is receiving threatening emails from some unknown sender repeatedly. What should she do? A. Inform parents, teacher and go to Police station with parents. B. Ignore them C. Keep silent and not tell anybody about it D. Follow the instructions of the sender Answer : A
15.	True name and Account Takeover are categories of? A Identity theft B Plagiarism C Phishing D None of these

	Answer : A
16.	What is meant by the term 'cyber-crime'? A. Any crime that uses computers to jeopardise or attempt to jeopardise national security B. The use of computer networks to commit financial or identity theft C. The theft of digital information D. Any crime that involves computers and networks Answer : D
17.	Which of the following is a responsible method for disposing of e-waste? A. Burning electronic devices in an open field B. Throwing electronic devices in regular garbage C. Recycling or donating old electronic devices D. Storing unused electronic devices indefinitely Answer : C
18.	Which of the following actions is considered a form of plagiarism? A. Quoting someone's work with proper citation B. Paraphrasing text without attribution C. Creating original content based on research D. Citing sources correctly in a bibliography Answer : B
19.	Identify the type of cybercrime where attackers impersonate a legitimate entity to deceive individuals into providing sensitive information like usernames, passwords, credit card numbers, or other personal data. A. Phishing B. hacking C. Identity Theft D. Cyberstalking Answer : A
20.	Using someone else's credentials to send inflammatory email messages is an act of A. Plagiarism B. Hacking C. Identity theft D. Cyber bullying Answer : C
21.	Which of the following is not a cyber-crime? A. phishing B. cyberstalking C. identity theft D. online chatting Answer : D

22.	What does e-waste stand for A. Environmental waste B. Electronic waste C. Electrical waste D. Equipment waste Answer : B
23.	E-waste contains heavy metals such as _____ and ____ which are highly toxic when ingested. A. Hydrogen and Mercury B. Lead and Argon C. Lead and Mercury D. Hydrogen and Argon Answer : C
24.	Ridhima purchased a license for a copy of a software and made additional copies without the permission of the copyright owner. This act of hers is known as_____. A. Trademark Infringement B. Identity Theft C. Copyright Infringement D. Patent Answer : C
25.	Rama was unable to understand how the recruiters were able to know about her digital activity when she had not shared anything with them. The recruiters might have checked. A. Carbon Footprint B. Water Footprint C. Online print of Rama. D. Digital Footprint Answer : D
26.	_____ help in data protection through copyrights, patents and trademarks: A. Data Privacy Right B. Right to Innovation C. Intellectual Property Rights (IPR) D. Right to Data Protection Answer : C

Assertion And Reasoning Based Questions

Mark the correct choice as

A) Both A & R are true and R explains A
B) Both A & R are true but R does not explain A

C) A is true but R is false
D) A is false but R is true

Q1 Assertion: The trail of online activity is called Digital Footprint.
Reason: Digital footprints are the records of online activities of an individual.

Answer: A

Q2 Assertion: Copyright, Patents and Trademarks are Intellectual Property Rights.
Reason: Intellectual Property Rights allow creators to decide how their creations are used.

Answer: A

Q3 Assertion: Social media cannot create or share content—they only allow networking.
Reason: We shouldn't respond to unnecessary emails or comments.

Answer: D

Q4 Assertion: Hacking is compromising security on digital devices.
Reason: Hacking involves stealing passwords and other digital information.

Answer: A

Q5 Assertion: Phishing is a method used to trick people into revealing personal information online.
Reason: Phishing websites look like legitimate websites to deceive users.

Answer: A

Q6 Assertion: Writing messages in all capital letters is considered rude in online communication.
Reason: All capital letters represent strong emotions or shouting in digital conversations.

Answer: A

Q7 Assertion: Improper disposal of e-waste can lead to environmental pollution.
Reason: E-waste contains hazardous materials like lead, mercury, and cadmium.

Answer: A

Q8 Assertion: The digital divide is the gap between people with access to digital technologies and those without.
Reason: High-speed internet is equally available in rural and urban areas.

Answer: C

Q9 Assertion: Creative Commons licenses allow creators to give others permission to use their work.
Reason: Under Creative Commons, all works automatically become public domain.

Answer: C

Q10 Assertion: Downloading copyrighted software without a license is illegal.
Reason: It violates the software's intellectual property rights.

Answer: A

Short Answer Questions

Q.1) Amit got good marks in all the subjects. His father gifted him a smartphone. He would like to make Amit aware of health hazards associated with inappropriate and excessive use of smartphones. Help his father to list the points which he should discuss with Amit.
Ans: Eye Strain, Poor Posture, Sleep Disruption, Mental Health Issues, Addiction and Dependency, Reduced Physical Activity, Social Isolation

Q.2) What are the digital footprint, and why are they important in the digital world?
Ans: A digital footprint refers to the trail of data and online activities left behind by individuals, organizations or devices on the internet and digital platforms. It encompasses various digital traces. Digital footprints are important because:

i) Personal Branding: online presence affects reputation and career opportunities.
ii) Privacy and security: Digital footprints can compromise sensitive information
iii) Targeted Advertising: online activities influence personalized ads.

Long Answer Questions

Q.1) Rahul wants to throw away his old mobile phone, but he's not sure how to do it properly.
I. What are the environmental risks of disposing of mobile phones improperly?
II. What is one eco-friendly way Rahul can dispose of his old phone?
III. How does proper disposal of mobile phones benefit the environment?
Answer: I. Improper disposal of mobile phones can lead to the release of harmful chemicals, such as lithium and arsenic, which can leach into the soil and water, causing pollution and damaging ecosystems.
II. Rahul can take his old mobile phone to a certified recycling program or donate it to an organization that refurbishes old phones for reuse.
III. Proper disposal of mobile phones prevents harmful chemicals from contaminating the environment, saves energy by recovering valuable materials like gold and silver, and reduces the need for mining new raw materials, helping to protect natural resources.

Q.2) Police officials arrested four members of an interstate gang for allegedly duping many people from different states on the pretext of providing them with holiday packages after creating fake websites of Tours and Travels. The cyber criminals sent fraudulent emails containing links to fraudulent websites created by them. 3 The victim in his complaint told police that he was offered a holiday package to Dubai a total of 10 times in the next 10 years and was charged ` 1.45 lakh through his credit card. Answer the following questions pertaining to the given news byte:
(i) Identify the type of cybercrime mentioned in the above case.
(ii) Which Act deals with such crimes in India?
(iii)Suggest any one precaution that can be taken to avoid falling prey to such criminals.

Answer: (a) (i) Phishing
(ii) IT Act 2000
(iii) To avoid phishing attacks, consider implementing the following precautions:
• Do not click on links or download attachments in unsolicited emails, messages, or pop-up windows.
• Avoid sharing sensitive information, such as passwords, account numbers, or Social Security numbers, in response to unsolicited requests.
• Check the URL of websites you visit to ensure they are legitimate.
• Ensure that your operating system, antivirus software, and web browsers are up to date with the latest security patches. [Write any one]

SAMPLE QUESTION PAPER 1 – 2025-26

Time : 03 Hrs. INFORMATICS PRACTICES (065) Marks: 70

General Instructions:

Read the following instructions very carefully and strictly follow them:

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

Q No.	**Section-A (21 x 1 = 21 Marks)**	Marks
1	State whether the following statement is True or False: Pandas Series is two dimensional object similar to an array.	1
2	Krishna wants to display the unique departments from table emp. Which of the following is correct statement for him? i. Select unique department from emp; ii. Select distinct department from emp; iii. Select department from emp; iv. Select department(unique) from emp;	1
3	The device used to connect two networks using different protocols is: i. Router ii. Repeater iii. Gateway iv. Hub	1

4	In MySQL, which function used to display current date and time? i. Date( ) ii. Time( ) iii. Current( ) iv. Now( )	1
5	E-waste refers to: i. Software that has become obsolete ii. Data that has been deleted from a storage device iii. Viruses that infect computers iv. Electronic devices that are no longer in use	1
6	DataFrame.index is used to display_____. i. row labels ii. column labels iii. Both a and b iv. None of the above	1
7	Pyplot is a collection of methods within _____library. i. Matplotlib ii. Pandas iii. Numpy iv. pyGame	1
8	_____Clause in SQL is used to specify conditions on the rows with GROUP BY clause. i. WHERE ii. HAVING iii. ORDER BY iv. DISTINCT	1
9	Data in a DataFrame can be written to a text file on disk by using the pandas _____function.	1

	i. DataFrame.to_ csv() ii. DataFrame.from_csv() iii. DataFrame.to-csv() iv. DataFrame.csv_from()	
10	After practicals, Patharv left the computer laboratory but forgot to sign off from his email account. Later, his classmate Parvan started using the same computer. He is now logged in as Patharv. He sends inflammatory email messages to few of his classmates using Patharv's email account. Parvan's activity is an example of which of the following cyber crime? i.Hacking ii.Identity theft iii.Cyber bullying iv.Plagiarism	
11	_____ returns the number of values in the specified column ignoring the NULL values. i. MAX() ii. SUM(column) iii. COUNT(column) iv. COUNT(*)	1
12	What is network topology?	1
13	_____returns the number of non-NaN values in the Series i. head() ii. tail() iii. tail(n) iv. count()	1

<table>
<tr><td>14</td><td>It helps in data protection through copyrights, patents and trademarks.
i. FOSS
ii. IPR
iii. DIGITAL FOOTPRINT
iv. COPYRIGHT INFRINGEMENT</td><td>1</td></tr>
<tr><td>15</td><td>Dictionary keys can be used to construct an _____ for a Series.
i. values
ii. index
iii. both the above
iv. none of the above</td><td>1</td></tr>
<tr><td>16</td><td>Match the following SQL functions/clauses with their descriptions:
<table>
<tr><th colspan="2">Functions/clauses</th><th colspan="2">Description</th></tr>
<tr><td>A</td><td>NOW()</td><td>I</td><td>Is used after group by clause</td></tr>
<tr><td>B</td><td>DAY()</td><td>II</td><td>Is used before group by clause</td></tr>
<tr><td>C</td><td>WHERE</td><td>III</td><td>To retrieve day from date</td></tr>
<tr><td>D</td><td>HAVING</td><td>IV</td><td>To retrieve current date and time</td></tr>
</table>
i. A-III, B-IV, C-I,D-II
ii. A-IV, B-III, C-II, D-I
iii. A-III, B-IV, C-I,D-II
iv. A-III, B-IV, C-II, D-I</td><td>1</td></tr>
<tr><td>17</td><td>How to select the rows where age is missing?
i. df[df['age']==numpy.NaN]
ii. df[df['age']==NaN]
iii. df[df['age']==0]
iv. None of the above</td><td>1</td></tr>
<tr><td>18</td><td>Consider the following series object Named 'Ser':</td><td>1</td></tr>
</table>

	0 578 1 235 2 560 3 897 4 118 What will be the output of following statements?: print(ser.index) i. RangeIndex(start=0, stop=5, step=1) ii. [578 235 560 897 118] iii. 0,1,2,3,4 iv. None of Above	
19	The generally recognized term for the government protection afforded to intellectual property written and electronic is called _____ i. Computer security law. ii. Aggregate information. iii. Copyright law iv. Data security standards.	
Q-20 and Q-21 are Assertion (A) and Reason (R) Type questions. Choose the correct option as: i. Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A) ii. Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A) iii. Assertion (A) is True, but Reason (R) is False iv. Assertion (A) is False, but Reason (R) is True		
20	ASSERTION(A):drop() function removes data from a Dataframe temporarily. REASONING(R): Axis parameter is compulsory with drop() function.	

<table>
<tr><td>21</td><td colspan="2">Assertion (A):-The key word DISTINCT is used with SELECT statement.
Reason (R): - DISTINCT keyword eliminates duplicate rows.</td><td></td></tr>
<tr><td colspan="4">Section-B (7 x 2 = 14 Marks)</td></tr>
<tr><td>22</td><td>A</td><td>Write a program in to create a series ‘Emp’ using a dictionary having Employee name as key and salary as value with following data –

<table><tr><td>Employee Name</td><td>Salary</td></tr><tr><td>Ashok</td><td>10000</td></tr><tr><td>Ravi</td><td>7500</td></tr><tr><td>Dinesh</td><td>12500</td></tr><tr><td>Akram</td><td>8000</td></tr></table>
OR
Carefully observe the following code:
import pandas as pd
Y1={'Qtr1':500,'Qtr2':600,'Qtr3':120,'Qtr4': 1800}
Y2={'A' :130,'B':160,'C':150}
totSales={1:Y1,2:Y2}
df=pd.DataFrame(totSales)
print(df)

Answer the following:
i) List the index of the DataFrame df
ii) List the column names of DataFrame df.</td><td>2</td></tr>
<tr><td>23</td><td colspan="2">Write the differences between Plagiarism and Copyright infringement.</td><td>2</td></tr>
<tr><td>24</td><td colspan="2">Write suitable queries for the following:</td><td>2</td></tr>
</table>

		i) To display the day like “Monday”, “Tuesday”, from the date when India got independence. ii) Display the position of the first occurrence of “BASE” from “RELATIONAL DATABASE MANAGEMENT SYSTEM”.	
25		Mital, an IP student, is a bit confused between the terms “INTERNET” and “WWW”. Help her in understanding both the terms with the help of suitable examples.	2
26		Explain the following keys in RDBMS: A. PRIMARY KEY B. FOREIGN KEY	2
27		State 2 benefits of e-waste recycling?	2
28	A	Younoose trys to create a dataframe using arrays. While executing the code it shows some error messages. Identify the errors, rewrite the correct code and underline the corrections made. import numberpy as np import pandas as pd A = pd.array([35, 40, 71, 25]) B = np.arrays([27, 34, 56, 73]) C = [11, 22, 33, 44] DF = np.DataFrame([A, B, C]) print(DF)	2
		OR	
	B	Complete the given Python code to get the required output: 0 10.0 1 20.0	

2 30.0

3 NaN

4 50.0

Code:

import pandas as _____

import _____ as _____

s=pd._____([10,20,30,np.NaN,50])

_____(s)

Section-C (4 X 3 = 12 Marks)

29 Explain Net Etiquettes and provide information on two such etiquettes. 3

30 A Write a Python program to create the following DataFrame using a list of dictionaries. 3

	Capital	Currency
India	New Delhi	Rupee
Russia	Moscow	Ruble
Japan	Tokyo	Yen

B

OR

Write a program to print the values of 0,2,4 positions from the following Series using .iloc.

a 10

b 20

c 30

0 40

E. 50

31 A. Write an SQL statement to create a table named employee with the following structure: (2+1 =3)

```
+------------+--------------+------+-----+---------+-------+
| Field      | Type         | Null | Key | Default | Extra |
+------------+--------------+------+-----+---------+-------+
| JOB_ID     | varchar(10)  | NO   | PRI |         |       |
| JOB_TITLE  | varchar(35)  | NO   |     | NULL    |       |
| MIN_SALARY | decimal(6,0) | YES  |     | NULL    |       |
| MAX_SALARY | decimal(6,0) | YES  |     | NULL    |       |
+------------+--------------+------+-----+---------+-------+
```

B. Write an SQL statement to insert the following record in the table empl.

EMP01, CLERK, 14000, 90000

32 A Consider the following tables GAMES and PLAYER. Write SQL commands for the statements i to iii. (3)

Table: GAMES

GCode	GameName	Number	PrizeMoney	ScheduleDate
101	Carom Board	2	5000	2024-01-23
102	Badminton	2	12000	2023-12-12
103	Table Tennis	4	8000	2024-02-14
105	Chess	2	9000	2024-01-01
108	Lawn Tennis	4	25000	2024-03-19

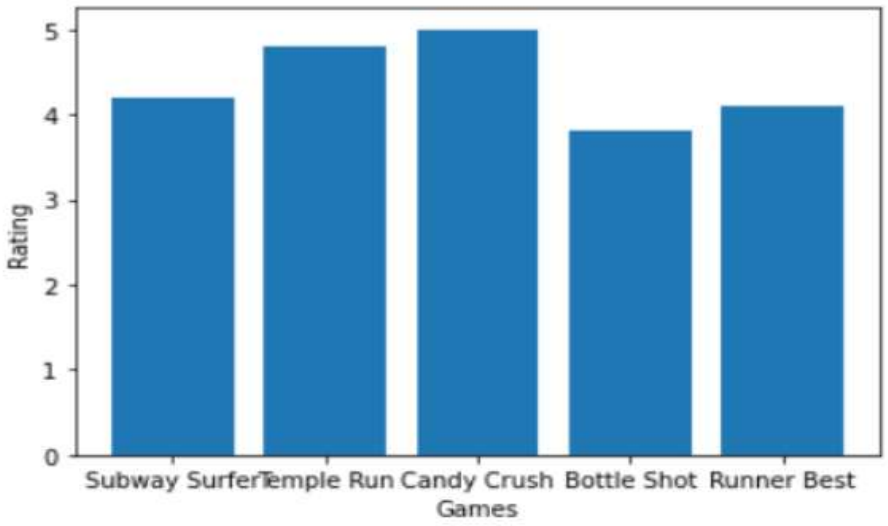
Table: PLAYER

PCode	Name	GCode
1	Nabi Ahamad	101
2	Ravi Sahai	108
3	Jatin	101
4	Nazneen	103

A. To display the content of the GAMES table in ascending order of ScheduleDate.

B. To display NUMBER wise average PrizeMoney.

	B	c. To display player names along with their corresponding GameName. OR Consider the tables Faculty and Batch given below and then write the output of the following queries from i to iii. Table: Faculty F_id | Fname | Qualification | Salary Emp01 | Neeta Khanna | MCA | 85000 Emp02 | Sonia Chawla | MA | 35000 Emp03 | Sheetal | MSc | 90000 Emp04 | Bindu | M.Com | 80000 Emp05 | Sunidhi | BA | 100000 Emp06 | Ashish | B.Com | 120000 Table: Batch B_id | F_id | Subjects B01 | Emp01 | English B02 | Emp05 | Chemistry B03 | Emp02 | Physics B04 | Emp03 | Mathematics B05 | Emp04 | Economics B06 | Emp01 | Accountancy 1. SELECT MAX(SALARY) ,MIN(SALARY) FROM FACULTY; 2. SELECT F.FNAME, F.QUALIFICATION, B.SUBJECTS FROM FACULTY F, BATCH B WHERE F.DOJ>'2020-01-01'; 3. SELECT LEFT(SUBJECTS,3) FROM BATCH;	
		Section-D (2 X 4 = 8 Marks)	
33		Mr. Sharma is working in a game development industry and he was comparing the given chart on the basis of the rating of the various games available on the play store. Please help him to fill up the following code according to the given chart.	4



import _____ as plt #statement 1

Games=["SubwaySurfer","TempleRun","CandyCrush","BottleShot","RunnerBest"]

Rating=[4.2,4.8,5.0,3.8,4.1]

plt. _____(Games,Rating) #statement 2

plt._____("Games") #statement 3

plt._____("Rating") #statement 4

plt. show()

34 I. Consider the following table named TEACHER. 4

TID	TNAME	SUBJECT	EXPERIENCE
1	GANESH	PHYSICS	2
2	NEELESH	HISTORY	4
3	JOHNY	CHEMISTRY	2
4	DEVAKUMAR	CHEMISTRY	4
5	TONY	PHYSICS	2

i) Write SQL statement to Display details of teacher whose tid more than 3

ii) Write a SQL statement to display the number of teachers teaching each subject.

iii) Write a SQL statement to display the teacher's name and experience sorted by experience in descending order.

iv) Write a SQL statement to display the first 3 characters of subjects.

OR

iv) Consider the following table named FAN.

FAN_ID	FAN_NAME	FAN_CITY	FAN_DOB	FAN_MODE
F001	SUSHANT	MUMBAI	1998-10-02	MAIL
F002	RIYA	MUMBAI	1997-12-12	LETTER
F003	ANIKA	DELHI	2001-06-30	BLOG
F004	RUDRA	AJMER	2005-08-22	MAIL
F006	MIARA	KOLKATTA	1998-11-01	BLOG

2. Write the output of the following SQL queries.

i) SELECT MAX(FAN_DOB) FROM FAN;

ii) SELECT FAN_MODE FROM FAN WHERE MONTH(FAN_DOB)<10;

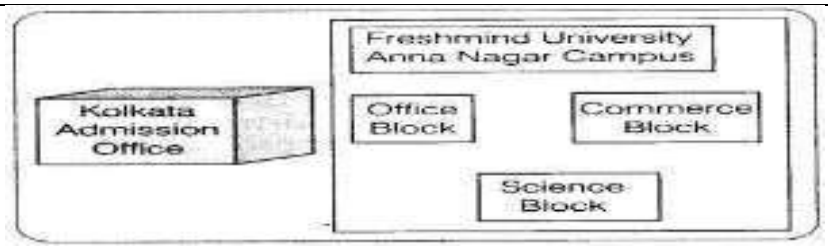
iii) . SELECT LENGTH(GFAN_NAME),FAN_ID FROM FAN Where Fan_City="Delhi";

iv) . SELECT RIGHT(FAN_ID,2) AS "NUMBER" FROM FAN;

Section-E (3 X 5 = 15 Marks)

35 Fresh mind University of India is starting its first campus Anna Nagar of South India with its centre admission office in Kolkata. The university has three major blocks comprising of office block, science block and commerce block in the 5 km are campus. 5

As a network expert, you need to suggest the network plan as per (i) to (v) to the authorities keeping in mind the distance and other parameters.



Number of computers to installed at various locations in the university are as follows:

Office Block	10
Science Block	140
Commerce Block	30
Kolkata Admission Office	8

Distance between various locations:

Office Block to Science Block	90 m
Office Block to Commerce Block	80 m
Science Block to Commerce Block	15 m
Kolkata Admission Office to Ana Nagar Campus	450 km

I. Suggest the authorities, the cable layout amongst various blocks inside university campus for connecting the blocks.

II. Suggest the most suitable place(block) to house the server of this university with a suitable reason.

III. Suggest an efficient device from the following to be installed in each of the blocks to connect all the computers.

xi) SWITCH b. MODEM c. GATEWAY

IV. Suggest the most suitable communication media for getting very high speed service.

V. Suggest the placement of Repeater in your layout and give justification.

36 Mr. Ankit is working in an organization as data analyst. He uses Python Pandas and Matplotlib for the same. He got a dataset of the passengers for the year 2010 to 2012 for January, March and December. His manager wants certain information from him, but he is facing some problems. Help him by answering few questions given below: 5

Year Month Passengers

		0 2010 Jan 25 1 2010 Mar 50 2 2012 Jan 35 3 2010 Dec 55 4 2012 Dec 65 I. Write Python statement to display the data of year column of indexes I to 3 ii. Write the Python code to rename the column name 'mon_name'in place of "Month" in the above Dataframe. Iii Write Python statement to display the number of passengers only ivWrite a Python statement to remove the column Month from the dataframe. V Write a Python statement to display the first two rows from the dataframe.	
37	A	Write suitable SQL query for the following: 1. Display 7 characters extracted from the 7th left character onwards from the string 'INFORMATICS PRACTICES'. 2. Display the position of occurrence of string 'COME' in the string 'WELCOME WORLD'. 3. Round off the value 2334.78 to one decimal place. 4. Display the remainder of 200 divided by 7. 5. Remove all the expected leading and trailing spaces from a column userid of the table 'USERS'. OR	5
	B	Explain the following SQL functions using suitable examples. • UCASE() • TRIM() • MID() • DAYNAME() • POWER()	

CBSE Question paper 2024-25

General Instructions :

(i) *Please check this question paper contains **37** questions.*

(ii) ***All** questions are compulsory. However, internal choices have been provided in some questions. Attempt only one of the choices in such questions.*

(iii) *The paper is divided into 5 sections – A, B, C, D and E.*

(iv) ***Section A** consists of **21** questions **(1 to 21)**. Each question carries **1** mark.*

(v) ***Section B** consists of **7** questions **(22 to 28)**. Each question carries **2** marks.*

(vi) ***Section C** consists of **4** questions **(29 to 32)**. Each question carries **3** marks.*

(vii) ***Section D** consists of **2** case study type questions **(33 & 34)**. Each question carries **4** marks.*

(viii) ***Section E** consists of **3** questions **(35 to 37)**. Each question carries **5** marks.*

(ix) ***All** programming questions are to be answered using Python language only.*

(x) *In case of MCQs, text of the correct answer should also be written.*

SECTION – A

1. State whether the following statement is True or False : **1**
In Python, we cannot create an empty DataFrame.

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

```
SELECT MONTHNAME('2024-08-02');
```

(A) 08 (B) 02

(C) February (D) August

3. Temporary data files stored by websites in our computer can be used to track our online activities and also to personalize browsing experience. These files are known as : **1**

(A) Plug-ins (B) Add-ons

(C) Cookies (D) Bookmarks

4. Which of the following is not an aggregate function in SQL ? 1

(A) `COUNT(*)` (B) `MIN()`

(C) `LEFT()` (D) `AVG()`

5. Raheem created a unique computer software and wants to protect his creation from being copied or used without his permission. He is considering to apply for legal protection. Which type of intellectual property protection should Raheem apply for, to safeguard his software ? 1

(A) Copyright (B) Plagiarism

(C) Trademark (D) Lease

6. What is the default index type for a Pandas Series if not explicitly specified ? 1

(A) String (B) List

(C) Numeric (D) Boolean

7. In Python which function of **`matplotlib`** library is used to save a plot ? 1

(A) `save()` (B) `saveplot()`

(C) `export()` (D) `savefig()`

8. State whether the following statement is True or False :

The `MOD()` function in SQL returns the quotient of division operation between two numbers. 1

9. Which of the following data structure is used for storing one-dimensional labelled data in Python Pandas ? 1

(A) Integer (B) Dictionary

(C) Series (D) DataFrame

10. Priya received an email that appeared to be from her bank, asking her to update her account information by clicking on a link. She clicked the link to enter her details, but immediately after, some amount was debited from her account. What type of cybercrime did Priya fall victim to ? 1

(A) Cyber stalking
(B) Phishing
(C) Fishing
(D) Cyber bullying

11. Which SQL function calculates a^b ? 1

(A) `MOD()`
(B) `POWER()`
(C) `RAISE()`
(D) `ROUND()`

12. Which protocol is used while communicating through video calls on the Internet ? 1

(A) Video Over Internet Protocol
(B) Voice Over Internet Protocol
(C) Internet Protocol
(D) Video Audio Over Internet Protocol

13. Which of the following Python statements will be used to select a specific element having index as **points**, from a Pandas Series named **ser** ? 1

(A) `ser.element(points)`
(B) `ser.select (points)`
(C) `ser[points]`
(D) `ser.show[points]`

14. Excessive screen time and poor posture can lead to : 1

(A) Faster Internet Speeds
(B) Eye strain and other health issues
(C) Better vision and bone density
(D) Improved physical health

15. Which of the following libraries defines an ndarray in Python ? 1

(A) `pandas` (B) `numpy`

(C) `matplotlib` (D) `scipy`

16. With respect to SQL, match the function given in column-II with categories given in column-I : 1

	I		II
(i)	Math function	(a)	`COUNT()`
(ii)	Aggregate function	(b)	`ROUND()`
(iii)	Date function	(c)	`RIGHT()`
(iv)	Text function	(d)	`YEAR()`

Options :

(A) (i)-(c), (ii)-(d), (iii)-(a), (iv)-(b)

(B) (i)-(b), (ii)-(a), (iii)-(d), (iv)-(c)

(C) (i)-(d), (ii)-(b), (iii)-(a), (iv)-(c)

(D) (i)-(b), (ii)-(c), (iii)-(d), (iv)-(a)

17. Which of the following Python statements is used to change a column label in a DataFrame, `df` ? 1

(A) `df = df.rename({old_name : new_name}, axis='columns')`

(B) `df = df.rename(old_name, new_name), axis='columns'`

(C) `df = df.change_name(old_name, new_name, axis='bar')`

(D) `df = df.update({old_name : new_name}, axis='bar')`

18. In Python Pandas, `DataFrame._____[]` is used for label indexing with DataFrames. 1

(A) `label` (B) `index`

(C) `labindex` (D) `loc`

19. Every web page on the Internet has a unique address. This address is known as : 1

(A) Domain Name (B) Protocol

(C) Uniform Resource Locater (D) Network Topology

Q. **20** and Q. **21** are Assertion (A) and Reason (R) type questions. Choose the correct option as :

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

(B) Both Assertion (A) and Reason (R) are True and Reason (R) is not the correct explanation for Assertion (A).

(C) Assertion (A) is True and Reason (R) is False.

(D) Assertion (A) is False, but Reason (R) is True.

20. **Assertion (A) :** The `drop()` method in Pandas can be used to delete rows and columns from a DataFrame. 1

Reason (R) : The axis parameter in the `drop()` method specifies whether to delete rows (`axis=0`) or columns (`axis=1`).

21. **Assertion (A) :** The `ROUND()` function in SQL can be used to round off a number to a specified number of decimal places. 1

Reason (R) : The `ROUND()` function is a string function that accepts character values as input and returns numerical values as output.

22. (a) Mention any two main points of difference between Series and DataFrame of Python Pandas. **2**

OR

(b) Explain how we can access elements of a series using slicing. Give an example to support your answer.

23. A small tech startup, is considering using open source software to develop their new project management tool. They are evaluating the benefits and potential challenges of adopting open source solutions. **2**

(i) Identify one key benefit of using open source software for the development of project management tool.

(ii) Give any two examples of open source software.

24. Consider the string, **"Informatics Practices"**. Write suitable SQL queries for the following : **2**

(i) To convert the entire string to uppercase.

(ii) To display the total number of characters in the given string.

25. (a) Give any two points of difference between Static web page and Dynamic web page. **2**

OR

(b) Describe the role of a router in a network.

26. What is a Database Management System (DBMS) ? Mention any two examples of DBMS. **2**

27. Give any two impacts on environment that are caused when e-waste is carelessly thrown or dumped in landfills or dumping grounds. **2**

28. (a) Rohit is trying to create a Pandas Series from scalar values. His code has some mistakes. Rewrite the correct code and underline the corrections made. **2**

```
import pandas
data = [50, 15, 40]
series = pd.series(data, Index=['x', 'y', 'z'])
Print(series)
```

OR

(b) Complete the given Python code to generate the following output :

```
   COLOUR   NAME   QTY
0    Red     Apple   10
1    Blue    Berry   15
2    Green   Guava   20
import _________ as pd
data=[{'COLOUR':'Red','NAME':'Apple', 'QTY':10},
{'COLOUR':'Blue','NAME':'Berry', 'QTY':15},
{_________,'NAME' :'Guava','QTY':20}]
df=pd.DataFrame(_________)
print(_________)
```

SECTION – C

29. Ravi is a student studying in grade 12. He frequently uses the internet for various activities such as social networking, online shopping, and to research for school projects. Recently, he noticed that he receives targeted advertisements based on his browsing history and is concerned about his digital footprint. Additionally, Ravi has encountered instances of cyberbullying and is unsure how to handle them. Help Ravi by answering the following questions : **3**

(i) What are digital footprints, and how are they created ?

(ii) Write any two net etiquettes that Ravi should follow to ensure respectful and responsible online behavior.

(iii) How can Ravi protect himself from cyberbullying ? Mention any one protective measure.

30. (a) Write a Python program to create the following DataFrame using a Dictionary of Series : **3**

	City	State
0	Mumbai	Maharashtra
1	Dehradun	Uttarakhand
2	Bengaluru	Karnataka
3	Hyderabad	Telangana

OR

(b) Write a Python program to create a Pandas Series as shown below from an ndarray containing the numbers `10, 20, 30, 40, 50` with corresponding indices `'A', 'B', 'C', 'D', 'E'`.

A	10
B	20
C	30
D	40
E	50

31. (i) Write the SQL statement to create a table, **Customer** with the following specifications : **(2+1) 3**

Table:Customer

Column Name	Data Type	Key
CID	Int	Primary Key
FName	Varchar(20)	
LName	Varchar(20)	
Age	Int	

(ii) Write the SQL query to display all records in descending order of **LName** from the Table **Customer**.

32. (a) Given the following tables : **3**

Table: STUDENTS

S_ID	NAME	AGE	CITY
1	Rahul	20	Delhi
2	Priya	22	Mumbai
3	David	21	Delhi
4	Neha	23	Bengaluru
5	Khurshid	22	Delhi

Table: GRADES

S_ID	SUBJECT	GRADE
1	Math	A
2	English	B
3	Math	C
4	English	A
5	Math	B

Write SQL queries for the following :

(i) To display the number of students from each city.

(ii) To find the average age of all students.

(iii) To list the names of students and their grades.

OR

(b) Consider the following tables : **3**

Table 1: PRODUCTS

This table stores the basic details of the products available in a shop.

PID	**PName**	**Category**
201	Laptop	Electronics
202	Chair	Furniture
203	Desk	Furniture
204	Smartphone	NULL
205	Tablet	Electronics

Table 2: SALES

This table records the number of units sold for each product.

SaleID	**PID**	**UnitsSold**
301	201	50
302	202	100
303	203	60
304	204	80
305	205	70

Write SQL queries for the following :

(i) To delete those records from table **`SALES`** whose **`UnitsSold`** is less than 80.

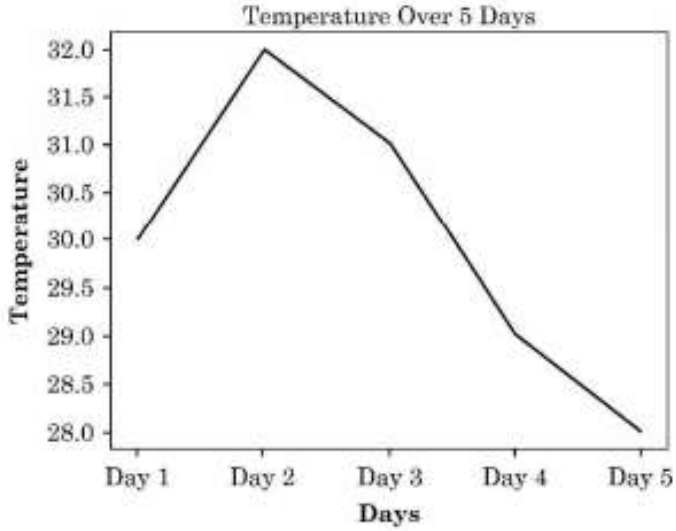
(ii) To display names of all products whose category is not known.

(iii) To display the product names along with their corresponding units sold.

SECTION – D

33. Gurkirat has to fill in the blanks in the given Python program that generates a line plot as shown below. The given line plot represents the temperature (in degree Celcius) over five days as given in the table : 4

Days	Temperature
Day 1	30
Day 2	32
Day 3	31
Day 4	29
Day 5	28




```
import ______ as plt # Statement-1
days = ['Day 1', 'Day 2', 'Day 3', 'Day 4', 'Day 5']
temp = [30, 32, 31, 29, 28]
plt.__(days, temp) # Statement-2
plt.xlabel('______') # Statement-3
plt.ylabel('Temperature')
plt.title('_____') # Statement-4
plt.show()
```

Write the missing statements according to the given specifications :

(i) Write the suitable code to import the required module in the blank space in the line marked as Statement-1.

(ii) Fill in the blank in Statement-2 with a suitable Python function name to create a line plot.

(iii) Refer to the graph shown and fill in the blank in Statement-3 to display the appropriate label for x-axis.

(iv) Refer to the graph shown and fill in the blank in Statement-4 to display the suitable chart title.

34. (a) An educational institution is maintaining a database for storing the details of courses being offered. The database includes a table COURSE with the following attributes : 4

C_ID : Stores the unique ID for each course.

C_NAME : Stores the course's name.

INSTRUCTOR : Stores the name of the course instructor.

DURATION : Stores the duration of the course in hours.

Table : **COURSE**

C_ID	C_NAME	INSTRUCTOR	DURATION
C101	Data Structures	Dr. Alok	40
C102	Machine Learning	Prof. Sunita	60
C103	Web Development	Ms. Sakshi	45
C104	Database Management	Mr. Suresh	50
C105	Python Programming	Dr. Pawan	35

Write SQL queries for the following :

(i) To add a new record with following specifications :

```
C_ID       : C106
C_NAME     : Introduction to AI
INSTRUCTOR : Ms. Preeti
DURATION   : 55
```

(ii) To display the longest duration among all courses.

(iii) To count total number of courses run by the institution.

(iv) To display the instructors' name in lower case.

OR

(b) Ashutosh, who is a manager, has created a database to manage employee records. The database includes a table named EMPLOYEE whose attribute names are mentioned below : 4

EID : Stores the unique ID for each employee.

EMP_NAME : Stores the name of the employee.

DEPT : Stores the department of the employee.

SALARY : Stores the salary of the employee.

JOIN_DATE : Stores the employee's joining date.

Table : **EMPLOYEE**

EID	EMP_NAME	DEPT	SALARY	JOIN_DATE
E01	ARJUN SINGH	SALES	75000	2019-11-01
E02	PRIYA JAIN	ENGINEERING	85000	2020-05-20
E03	RAVI SHARMA	MARKETING	60000	2018-08-14
E04	AYESHA	NULL	50000	2021-01-10
E05	RAHUL VERMA	FINANCE	40000	2017-06-25

Write the output of the following SQL Queries :

(i) `Select SUBSTRING(EMP_NAME, 1, 5) from EMPLOYEE where DEPT = 'ENGINEERING';`

(ii) `Select EMP_NAME from EMPLOYEE where month(JOIN_DATE) = 8;`

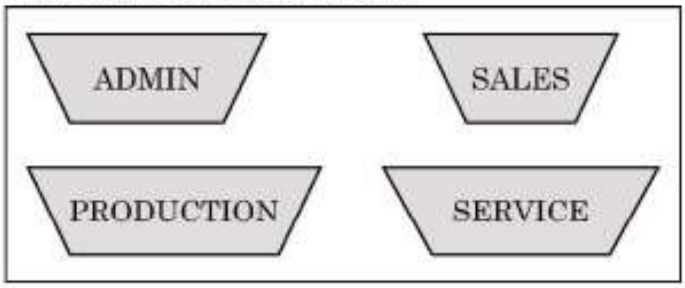
(iii) `Select EMP_NAME from EMPLOYEE where SALARY > 60000;`

(iv) `Select count(DEPT) from EMPLOYEE;`

SECTION – E

35. XYZ Technologies, Hyderabad is a company that deals with data science and AI projects. They have different divisions ADMIN, SALES, PRODUCTION and SERVICE.

The layout of the Hyderabad branch is : 5



The management wants to connect all the divisions as well as the computers of each division (ADMIN, SALES, PRODUCTION and SERVICE).

Distance between the divisions are as follows :

ADMIN to SALES	**69m**
ADMIN to PRODUCTION	**84m**
ADMIN to SERVICE	**60m**
SALES to PRODUCTION	**110m**
SALES to SERVICE	**135m**
PRODUCTION to SERVICE	**90m**

Number of computers in each division :

Division	**Number of Computers**
ADMIN	40
SALES	75
PRODUCTION	120
SERVICE	20

Based on the above specifications, answer the following questions :

(i) Suggest the topology and draw the most suitable cable layout for connecting all the divisions in the Hyderabad office.

(ii) XYZ Technologies is having its head office in USA. Out of LAN, MAN and WAN, which kind of network will be created to connect Hyderabad office with USA Office ? Justify your answer.

(iii) Suggest the division for the placement of server. Explain the reason for your selection.

(iv) Suggest the placement of Switch/Hub with justification.

(v) Where will a repeater be placed in the suggested network layout ? Justify your answer.

36. Consider the DataFrame **Doctor** shown below : **5**

	DID	Name	Department	Fee
0	101	Dr. Joe	ENT	1500
1	102	Dr. Salma	UROLOGY	1600
2	103	Dr. Jeet	ORTHO	1550
3	104	Dr. Neha	ENT	1200
4	105	Dr. Vikram	ORTHO	1700

Write suitable Python statements for the following :

(i) To print the last three rows of the DataFrame **Doctor**.

(ii) To display the names of all doctors.

(iii) To add a new column **'Discount'** with value of **200** for all doctors.

(iv) To display rows with index **2** and **3**.

(v) To delete the column **'Department'**.

37. (a) Write SQL query for the following : **5**

(i) To display sum total of all the values of the **Score** column, from **STUDENTS** table.

(ii) To display the first five characters of the **Name** column from **STUDENTS** table.

(iii) To display the values of **Name** column from the **STUDENTS** table, after removing the trailing spaces.

(iv) To retrieve the lowest score from the **Score** column of **GRADES** table.

(v) To increase the fee of all students by **100**, in the **STUDENTS** table. (The name of the column is **FEE**)

OR

(b) Write SQL queries for the following :

(i) To calculate the square of **15**.

(ii) To round the number **456.789** to the nearest integer.

(iii) To display the position of first occurrence of **'com'** in the string **'mycommercial.com'**.

(iv) To display the name of the day for the date **'2024-11-07'**.

(v) To display the current date and time.

Web links:

1. Syllabus for Higher Secondary Stage prescribed by NCERT:
https://ncert.nic.in/pdf/syllabus/IPHSS.pdf

2. CBSE Syllabus Class XII – IP (065) Session 2025-2026
https://cbseacademic.nic.in/web_material/CurriculumMain26/SrSec/Informatics_Practices_SrSec_2025-26.pdf
3. NCERT Publication Book for IP (Class XII)
https://ncert.nic.in/textbook.php?keip1=0-8

4. Digital Text Book Class XII- IP on Diksha Portal
https://diksha.gov.in/resources/play/collection/do_31303353249855078417 85?contentType=TextBook