LAST MINUTES REVISION MATERIAL

Session: 2020-21

Class-XII

INFORMATICS PRACTICES

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CHIEF PATRON

Sh. B L Morodia, Deputy Commissioner, KVS (RO), Jaipur

PATRON(S)

Shri D R Meena, Assistant Commissioner, KVS(RO), Jaipur

Sh. Mukesh Kumar, Assistant Commissioner, KVS(RO), Jaipur

CONTENT COORDINATOR/LEADER

Sh. Manoj Kumar Pandey, Principal K V Itarana Alwar

CONTENT TEAM

Sh. Sandeep Arora, PGT(CS) KV 1 Udaipur
Sh. Prem Prakash Meena, PGT(CS) KV Alwar
Sh. Navneet Sadh, PGT(CS) KV Churu

Python Revision

Intro:

- Python is a high level (close to English) and interpreted (read and executed line by line) programming language developed by **Guido Van Rossum** in the 90s.
- It can be operated via shell (interactive) or script mode.

Identifier: A variable/name of the function can be any combination of letters, digits and underscore characters. The first character cannot be a digit. Variables in Python are case sensitive.

valid	**abc** (all chars) **_val1** (underscore, char and digits) **first_name** (underscore as a connector)	**1abc** (starts with a digit) **for** (it is a reserved keyword) **first&name** (use of special character)	**invalid**

Keywords: Reserved for special use. Can't be used as variable names. Ex. if, any, in while, else etc

Operators: Just like regular mathematics has operators so does the python, most are borrowed from math

a, b=15,4

✓ **Arithmetic**: +, -,*,/,//,%,** **Ex.** print(a+b,a%b,a//b,a*b) **O/P** 19 3 3 60

✓ **Comparison**: <,==,>=; Ex. print(a>b, a<b, a==15) **O/P** True False True

✓ **Logical**: and, or, not; **Ex.** print(a>b and b<a-b) **O/P** True

✓ **Membership**: in, not in Ex. print (a in [3,41,50]) **O/P** False

Data Types:

✓ **Number** (Immutable)

✓ **Integer**- 52, -9

✓ **Float**- 23,7,-0.0003,

✓ **Boolean**- True, False, 2>3, 5%2==1

✓ **Collection**

❖ **String**- Ordered and immutable collection of characters, digits and special symbols. Methods: count (), find (), isupper (), isdigit (), tolower (), etc. Ex. *s1,s2 = 'अजगर', ''Sita sings the blues''*

❖ **List** - Ordered, Heterogenous and mutable collection. Methods: count (), insert (), append (), remove (), pop (), sort () etc. Ex. *l1,l2= [1,2,3], [1109,'R Rajkumar','XII','89.25%']*

❖ **Tuple** - Ordered, Heterogenous and immutable collection. Methods: count(), index() etc.
Ex.*t1,t2= (1,2,3), (1109,'R Rajkumar','XII','89.25%')*

- Common Operations:
  - * and + operator will behave same on all three.
    Ex. *print(s1*3)* # O/P: अजगरअजगरअजगर
    Ex. print(l1+l2) # O/P: [1,2,3,1,2,3]
  - Iteration works exactly the same.
    Ex. for i in t1:
    print(i,end=' ') # O/P: 1 2 3
  - Slicing and element access is also the same.
    Ex. print(s2[0:10]) # O/P: ''Sita sings''
- Uncommon: t1[2]=4 or s2[3]='e' will result in error(as they are immutable).

- **Mapping** Dictionary- Unordered, Heterogenous and has custom names for index called key.

Methods: get(), keys(), items(), update() etc.

d1= {'rno':1109,'name':'R Rajkumar','class':'XII','marks':'89.25%'}

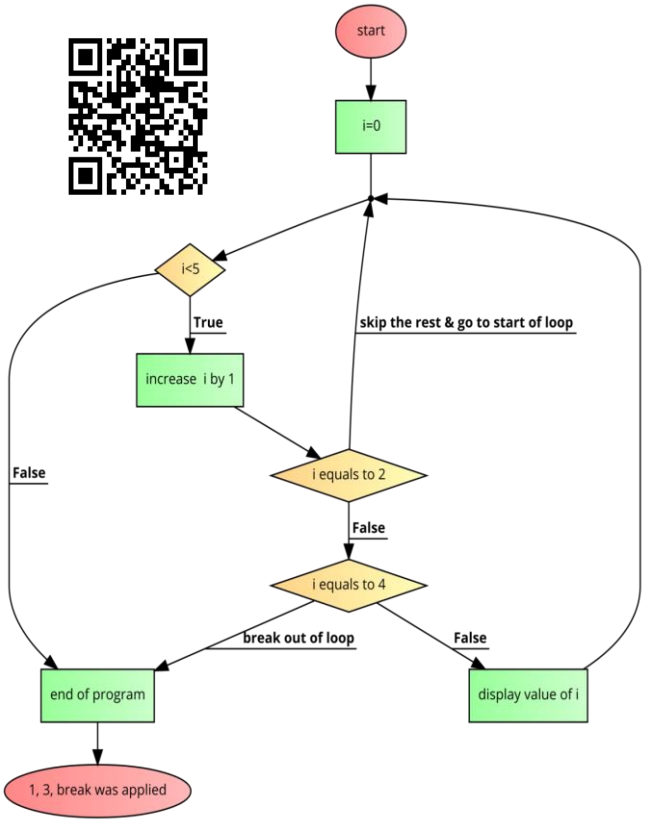
FLOW OF CONTROL: _____ High resolution version of flowchart image:

```
i=0   #initialisation
while(i<=5):  # execute statement inside, until i<=5
   i=i+1
   if(i==2):    # skip rest of the code and go to back to loop
      continue
   elif(i==4):
      break   # come out of the loop
   else:
      print(i,end=',')
else:
   print('came out successfully')
print('break was applied') # will print it if break is executed
```

```
for i in range(1,6): # i will have values from 1 to 5
   if(i==2):
      continue
   elif(i==4):
      break
   else:
      print(i,end=',')
else:
   print('came out successfully')
print('break was applied')

# increment was done with help of range function
```

Flow chart



output: 1, 3, break was applied

Some Common Functions/properties: use with example
- Inbuilt**:** len(), type(),id(), print(), input(), int(), float(),eval()
- math: log(),sqrt(),pow() etc

Numpy Library: Ordered, Homogenous collection of numbers (generally).
Import via=> *import numpy as np*

Comparison Question from list, NumPy, and pandas series **(3 Marks)**

List vs numpy array vs series
- **Size** - Numpy data structures take up less space than list and series
- **Performance** - they are faster than lists and series
- **Indexing** - Both list and NumPy have a numeric index (0,1,2…) whereas Series supports custom index.
- List does not support **vectorised** operation ex. print(np.array([2,4])*2) ⇒ [4,8]

```
import numpy as np
import pandas as pd
lst=[2,1,1,2]
arr=np.array(lst)
sr=pd.Series(lst)
print(lst+lst)
print(arr+arr)
print(lst*3)
print(sr*3)
```

O/P

```
[2, 1, 1, 2, 2, 1, 1, 2]
[4 2 2 4]
[2, 1, 1, 2, 2, 1, 1, 2, 2, 1, 1, 2]
0   6
1   3
2   3
3   6
dtype: int64
```

Note: Even though lst (list object), arr (array object) and sr (series object) have the same data. I.e. 2, 1, 1 and 2.

When + or * operators are applied to them list behaves differently from both NumPy and series.

lst*3 prints the list elements three times, whereas sr*3 multiplies 3 to the individual elements 2,1,1 and 2.

Data Handling using Pandas-Python Unit-1(25 Marks)

Python Library – Pandas • Python package for data science. • Builds on packages like NumPy and matplotlib • data analysis and visualization work.	**Basic Features of Pandas** • Keep track of our data. • Use of different data types (float, int, string, date time, etc.) • Easy grouping and joins of data • Good IO capabilities • Python MYSQL Connectivity • Label-based slicing, indexing and subsetting of large data sets.	**1 or 2 Marks**
Data Structures in Pandas	Two important data structures of pandas are– **Series,DataFrame**.	**1 Mark**
Series: It is like a one-dimensional array like structure with homogeneous data. For example, the following series is a collection of integers.	**Basic feature of series are:** • Homogeneous data • Size Immutable • Values of Data Mutable **Syntax: - pandas.Series (data, index, dtype, copy)** Creation of Series is possible from **–darray, dictionary & scalar value**	**1 Mark**
Create a Series from ndarray	import pandas as p1 import numpy as np1 data = np1.array(['P','R','E','M']) s=p1.Series(data,index= [10,11,12,13]) print(s) **Output:** 10 P 11 R 12 E 13 M	**2 Marks**
Create a Series from lictionary	import pandas as pd1 import numpy as np1 data = {'P': 0., 'R': 1., 'E': 2.,'M': 2.} s=pd1.Series(data,index=['b','c','d','a']) print(s) **Output** b NaN c NaN d NaN a NaN	**2 Marks**
Create a Series from Scalar	import pandas as pd1 import numpy as np1 s = pd1.Series(5, index= [0, 1, 2, 3]) print(s) **Output** 0 5 1 5 2 5 3 5 **Note**: - here 5 is repeated for 4 times	**2 Marks**

Maths operations with Series	import pandas as pd1
	s = pd1.Series([1, 2, 3])
	t = pd1.Series ([1, 2, 4])
	u=s+t #addition operation print (u)
	u=s*t # multiplication operation
	print (u)
	Output
	0 2
	1 4
	2 7
	
	0 1
	1 4
	2 12
		2 Marks

head and tail function: head () returns the first n rows (observe the index values) and tail() returns the last n rows (observe the index values). The default number of elements to display is five.	import pandas as pd1 s = pd1.Series ([1, 2, 3, 4, 5], index = ['a','b','c','d','e']) print (s.head (3)) print (s.tail (3)) **Output** a 1 b. 2 c. 3 Return first 3 elements ---------- c 3 d. 4 e. 5 Return last 3 elements	**2 Marks**
Accessing Data from Series with indexing and slicing	import pandas as pd1 s = pd1.Series ([1, 2, 3, 4, 5], index = ['p','r','e','m','e']) print (s[0]) print (s[:3]) print (s[-3:]) **Output:** 1 # for 0 index position 1 #for first 3 index values 2 3 3 # slicing for last 3 index values 4 5	**2 Marks**

Retrieve Data from selection	s = pd.Series (np.nan, index= [49, 48,47,46,45, 1, 2, 3, 4, 5]) **s.iloc[:3] # slice the first three rows** 49 NaN 48 NaN 47 NaN	**2 Marks**
DataFrame: It is like a two-dimensional array with heterogeneous data. features of DataFrame are: • Heterogeneous data • Size Mutable • Data Mutable	**Create DataFrame** It can be created with following: • Lists • Dict • Series • Numpy ndarrays • Another DataFrame	**1 or 2 Marks**
Create a DataFrame from Lists	import pandas as pd1 data1 = [['Freya',10],['Mohak',12], ['Dwivedi',13]] df1 = pd1.DataFrame(data1,columns= ['Name','Age']) print (df1) **Output** Name Age 1 Freya 10 2 Mohak 12 3 Dwivedi 13	**2 Marks**
Create a DataFrame from Dict of ndarrays / Lists	import pandas as pd1 data1 = {'Name': ['Freya', 'Mohak'],'Age':[9,10]} df1 = pd1.DataFrame(data1) print (df1) **Output** Name Age 1 Freya 9 2 Mohak 10	**2 Marks**
Create a DataFrame from List of Dicts	import pandas as pd1 data1 = [{'x': 1, 'y': 2}, {'x': 5, 'y': 4, 'z': 5}] df1 = pd1.DataFrame(data1) print (df1) **Output** x y z 0 1 2 NaN 1 5 4 5.0	**2 Marks**
Create a DataFrame from Dict of Series	import pandas as pd d1 = {'one': pd1.Series([1, 2, 3], index= ['a', 'b', 'c']), 'two': pd1.Series([1, 2, 3, 4], index= ['a', 'b', 'c', 'd'])} df1 = pd1.DataFrame(d1) print (df1) **Output** one two a 1.0 1 b 2.0 2 c 3.0 3 d NaN 4	**2 Marks**
Column Selection	print (df ['one'])	**1 Marks**
Column addition	df = pd.DataFrame({"A": [1, 2, 3], "B": [4, 5, 6]}) c = [7,8,9] df['C'] = c	**1 Marks**
Adding a new column using the existing columns values	df['four'] =df1['one'] +df1['three']	**1 Marks**
Column Deletion	del df1['one'] # Deleting the first column using DEL function df.pop('two') #Deleting another column using pop function	**1 Marks**
Rename columns	df = pd.DataFrame({"A": [1, 2, 3], "B": [4, 5, 6]}) >>> df.rename(columns= {"A": "a", "B": "c"}) **Output** a c 0 1 4 1 2 5 2 3 6	**2 Marks**
Row Selection	**#Selection by Label** import pandas as pd1 d1 = {'one': pd1.Series([1, 2, 3], index= ['a', 'b', 'c']), 'two': pd1.Series([1, 2, 3, 4], index= ['a', 'b', 'c', 'd'])} df1= pd1.DataFrame(d1) print (df1.loc['b']) **Output** one 2.0 two 2.0 Name: b, dtype: float64	**2 Marks**
	#Selection by integer location import pandas as pd1 d1 = {'one': pd1.Series([1, 2, 3], index= ['a', 'b', 'c']), **Output** one 3.0 two 3.0	**2 Marks**

	'two': pd1.Series([1, 2, 3, 4], index= ['a', 'b', 'c', 'd'])} df1 = pd1.DataFrame(d1) print (df1.iloc[2])	
Addition of Rows	import pandas as pd1 df1 = pd1.DataFrame([[1, 2], [3, 4]], columns = ['a', 'b']) df2 = pd1.DataFrame([[5, 6], [7, 8]], columns = ['a', 'b']) df1 = df1.append(df2) print (df1) **Output** a b 0 1 2 1 3 4 0 5 6 1 7 8	**2 Marks**

Deletion of Rows	# Drop rows with label 0
	df1 = df1.drop(0)
		1 Marks

Iterate over rows in a DataFrame	import pandas as pd1 import numpy as np1 raw_data1 = {'name': ['freya', 'mohak'],'age': [10, 1], 'favorite_color': ['pink', 'blue'], 'grade': [88, 92]} df1 = pd1.DataFrame(raw_data1, columns = ['name', 'age', 'favorite_color', 'grade']) for index, row in df1.iterrows(): print (row["name"], row["age"]) **Output** freya 10 mohak 1	**2 Marks**
Indexing a DataFrame using .loc[ ]: This function selects data by the label of the rows and columns.	import pandas as pd import numpy as np df = pd.DataFrame(np.random.randn(8, 4), index = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h'], columns = ['A', 'B', 'C', 'D']) #select all rows for a specific column print df.loc[: ,'A'] **Output** a -1.340477 b 0.669544 c -0.185628 d -0.658744 e 0.596576 f -1.167927 g 0.404994 h -0.576133	**2 Marks**

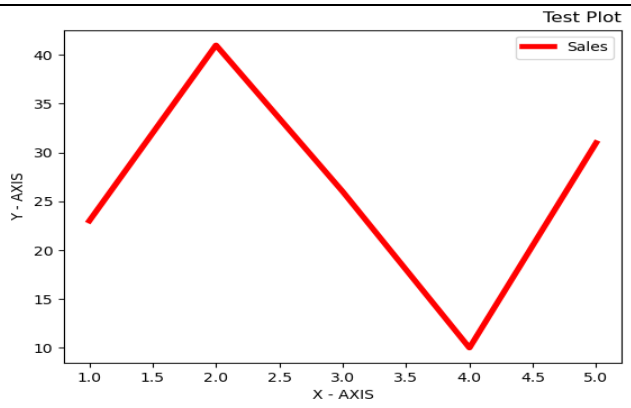
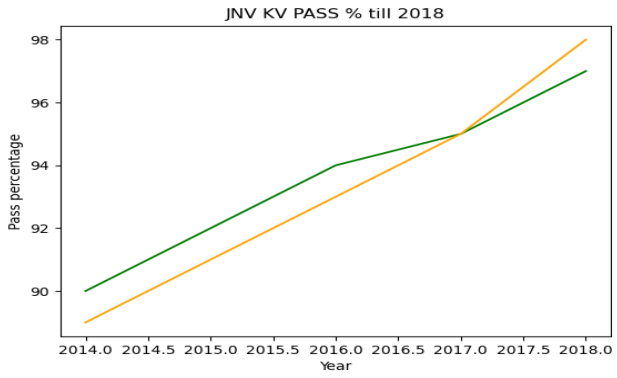
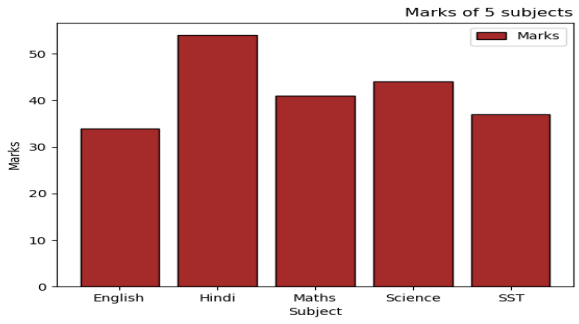
Accessing a DataFrame with a Boolean index: In order to access a dataframe with a boolean index, we have to create a dataframe in which index of dataframe contains a boolean value that is "True" or "False".	# importing pandas as pd
	import pandas as pd
	# dictionary of lists
	dict = {'name': ["Mohak", "Freya", "Roshni"],
	'degree': ["MBA", "BCA", "M.Tech"],
	'score': [90, 40, 80]}
	# creating a dataframe with boolean index
	df = pd.DataFrame(dict, index = [True, False, True])
	# accessing a dataframe using .loc[] function
	print(df.loc [True])
	Output:
	#it will return rows of Mohak and Roshni only (matching true only)
		2 Marks

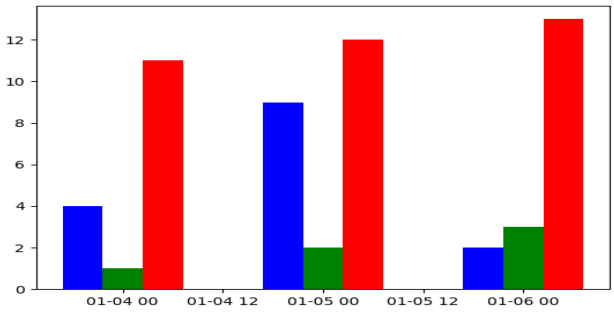
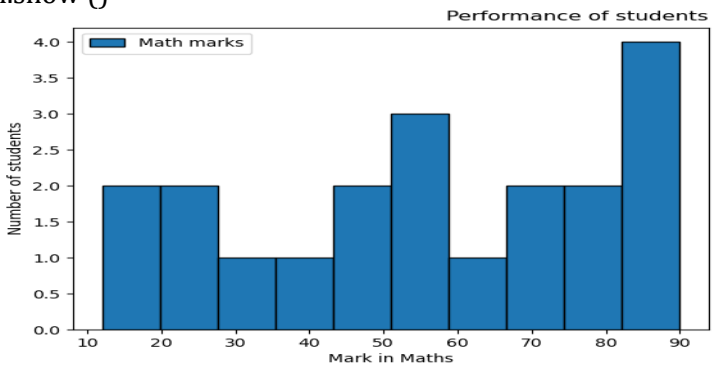
Binary operation over dataframe with series	x = pd.DataFrame({0: [1,2,3], 1: [4,5,6], 2: [7,8,9] }) y = pd.Series([1, 2, 3]) new_x = x.add(y, axis=0) print(new_x) **Output** 0 1 2 0 2 5 8 1 4 7 10 2 6 9 12	**2 Marks**
Export Pandas DataFrame to a CSV File: **to_csv function**	import pandas as pd cars = {'Brand': ['Honda Civic','Toyota Corolla', 'Ford Focus', 'AudiA4'], 'Price': [22000,25000,27000,35000]} df = pd.DataFrame(cars, columns= ['Brand', 'Price']) df.to_csv (r'D:\export_dataframe.csv', index = False, header=True) print (df) #csv file will be created in specified file location with specified name.	**1 or 2 Marks**

read_csv function:	import pandas as pd data = pd.read_csv("D:\export_dataframe.csv") print(data) **Output**: Brand Price 0 Honda Civic 22000 1 Toyota Corolla 25000 2 Ford Focus 27000 3 Audi A4 35000	**1 or 2 Marks**

Aggregation/Descriptive statistics – dataframe:
Aggregation is the process of turning the values of a dataset (or a subset of it) into one single value.
	import pandas as pd
	import numpy as np
	#Create a Dictionary of series
	d= {'Name':pd.Series(['Sachin','Dhoni','Virat','Rohit','Shikhar']),
	'Age':pd.Series([26,25,25,24,31]),
	'Score':pd.Series([87,67,89,55,47])}
	df = pd.DataFrame(d)
	print("Dataframe contents")
	print (df)
	print(df.count())
	print("count age",df[['Age']].count())
	print ("sum of score",df[['Score']].sum())
	print("minimum age",df[['Age']].min())
	print("maximum score",df[['Score']].max())
	print("mean age",df[['Age']].mean())
	print("mode of age",df[['Age']].mode())
	print("median of score", df[['Score']].median())
	
	Output:
	Dataframe contents
	Name Age Score
	0 Sachin 26 87
	1 Dhoni 25 67
	2 Virat 25 89
	3 Rohit 24 55
	4 Shikhar 31 47
	Name 5
	Age 5
	Score 5
	dtype: int64
	count age 5
	dtype: int64
	sum of score 345
	dtype: int64
	minimum age 24
	dtype: int64
	maximum score 89
	dtype: int64
	mean age 26.2
	dtype: float64
	mode of age 0 25
	median of score: 67.0
		2, 3 or 4 Marks

Data Visualization- Python		
Introduction to matplotlib	matplotlib.pyplot is a collection of functions for 2D plotting. Some of the types of plots: Line, Bar, Histogram, Pie and Boxplot.	**1 Marks**
To import the library for plotting	- import matplotlib.pyplot as pl **Basic steps to follow while plotting:** ➢ Choose appropriate plot type and then the function • Line plot: plot () • Bar plot: bar () and barh() • Histogram: hist () ➢ Understand the data and assign the legend values ➢ assign the axis labels ➢ assign plot title	**1 Marks**
Line Plot: A line plot/chart is a graph that shows the frequency of data occurring along a number line	import matplotlib.pyplot as pl x = [1, 2, 3, 4, 5] y = [23, 41, 26, 10, 31] pl.plot(x, y,'r', label = "Sales", linewidth = 4) pl.title ("'Test Plot", loc="right") pl.xlabel ("X - AXIS") pl.ylabel ("Y - AXIS") pl.legend () pl.show ()	**3 Marks**

		
Multiple line plots	import numpy as np import matplotlib.pyplot as plt year = [2014, 2015, 2016, 2017, 2018] Jnvpasspercentage = [90, 92, 94, 95, 97] Kvpasspercentage = [89, 91, 93, 95, 98] plt.plot (year, jnvpasspercentage, color='g') plt.plot (year, kvpasspercentage, color='orange') plt.xlabel ('Year') plt.ylabel ('Pass percentage') plt.title ('JNV KV PASS % till 2018') plt.show () 	**3 Marks**
Bar Plot: A graph drawn using rectangular bars to show how large each value is. The bars can be horizontal or vertical	import matplotlib.pyplot as pl x = ['English','Hindi','Maths','Science','SST'] y = [34, 54, 41, 44, 37] pl.bar (x, y, width =0.8, label= "Marks", color="brown", edgecolor="black") pl.title ("Marks of 5 subjects", loc="right") pl.xlabel ("Subject") pl.ylabel ("Marks") pl.legend () pl.show () 	**3 Marks**

Multiple Bar Plots	import matplotlib.pyplot as plt from matplotlib.dates import date2num import datetime x = [datetime.datetime (2011, 1, 4, 0, 0), datetime.datetime (2011, 1, 5, 0, 0), datetime.datetime (2011, 1, 6, 0, 0)] x = date2num(x) y = [4, 9, 2] z = [1, 2, 3] k = [11, 12, 13] ax = plt.subplot (111) ax.bar(x-0.2, y, width=0.2, color='b', align='center') ax.bar(x, z, width=0.2, color='g', align='center') ax.bar(x+0.2, k, width=0.2, color='r', align='center') ax.xaxis_date() plt.show() 	**3 Marks**
Histogram: A histogram is a graphical representation which organizes a group of data points into user-specified ranges.	import matplotlib.pyplot as pl import numpy as np math= [12,23,45,56,57,67,72,83,65,22,87,53,12,90,78, 83,45,75,37,28] x = np.arange (len(math)) freq, bin, patches = pl.hist(math, bins=10, edgecolor = "black", label = "Math marks") # frequency give the list of number of events in each bin # bin is the bin size taken for making 10 bins. # Check the number of bins given in the exam and accordingly give the bin size. # patches are the individual rectangle object pl.title ("Performance of students", loc="right") pl.xlabel ("Mark in Maths") pl.ylabel ("Number of students") pl.legend () pl.show () 	**3 Marks**
Save Plot: To save any plot use function pl.savefig("plot.png") Here plot.png is the name of the file where plot is saved.	plt.savefig ('line_plot.pdf') plt.savefig ('line_plot.svg') plt.savefig ('line_plot.png') # Parameter for saving plots .e.g. plt.savefig ('line_plot.jpg', dpi=300, quality=80, optimize=True, progressive=True)	**1 Marks**

DBMS: **Data Base Management System** **[Unit II Total 25 Marks]**

Data Models : is an abstract model that organizes elements of data and standardizes how they relate to one another

- Relational Data Model
- Network Data Model
- Hierarchical Data Model
- Object Oriented Model

RDBMS : Relational Database Management System: e.g. MySQL, Oracle, Ms-Access, FoxPro

SQL: Structured Query Language : is a universal language to interact with a wide variety of RDBMS

Keys: **[1 or 2 Marks Ques.]**

Table 1

RollNo	Name	Class	LibNo.	CourseID
1001	Amit	X	L12	AS124
1002	Booby	X	L13	AS135
1003	Anita	XI	**L15**	AJ147
1007	Ankit	XII	L18	AS124
1009	Bipin	XI	L25	AS135

Table 2

CourseID	CName	Duration
AS124	Streaming	2
AS135	Advance	3
AJ146	AI	3
AJ147	Programing	1

- **Primary Key:** A column or Group of Column, which uniquely identify a Tuple in a Table is called Primary Key. A Primary key cannot have null or duplicate values. A table can have only **ONE** primary key but a Combination of columns can also act as primary key. example Roll No., PNR Number , Aadhaar etc.
- **Candidate Key:** All Columns or group of Column, that **can act as a primary key** are called Candidate key. In Table 1 Roll No, LibNo, are possible candidate key.
- **Alternate Key:** All candidate key **other than Primary key**. In table 1 if we take RollNo as Primary key, LibNo will become Alternate key.
- **Foreign Key:** is a non-key attribute, which helps to establish a **relation with another table**. It is generally Primary Key of another table. In Table 1 CourseID if Foreign Key.

- **Degree**: **Total No. of Columns** in a table is called its Degree. In the above table degree is 4.
- **Cardinality**: **Total No of Rows** in a Table is Called its Cardinality. In the above table cardinality is 5. (Note, while calculating cardinality we do not count the header row.)

TIP: Degree →Column (DC : Direct Current) ; Cardinality → Row (CR : Credit Ratio) Both C not together

Q . A table has 4 rows and 6 column find its degree and cardinality. **[1 or 2 Marks]**

Ans. Degree 6 ; Cardinality 4

Q. A table has 6 rows and 5 columns. 2 insert operations are performed on it. Find the new degree and cardinality of the table? **[1 or 2 Marks]**

Ans. Degree 5; Cardinality 8

	SQL COMMANDS	[1 or 2 Marks]
	Data Definition Language (DDL)	
1	**CREATE DATABASE <DATABASENAME>;**	
	To create a new database in the system.	**Create Database office;**
2	**SHOW DATABASES;**	
	To view the names of all the databases in the database system.	**Show Databases;**
3	**USE <DATABASENAME>;**	
	To open a database to work in it.	**use office;**
4	**DROP DATABASE <DATABASENAME>**	
	To remove or delete a database.	

5 CREATE TABLE **[2 Marks/ Query Based]**

To create a new table in the current database.

```
CREATE TABLE EMP
(
        EMPID       INT             PRIMARY KEY,
        ENAME       CHAR(10)        NOT NULL,
        DOB         DATE            CHECK (DOB<='01-01-2001'),
        POST        VARCHAR(30)     DEFAULT "WORKER",
        TYPE        VARCHAR(30)     CHECK (TYPE IN ("REGULAR","CONTRACT"),
        AADHAR      INT(12)         UNIQUE,
        BASIC       FLOAT           CHECK(BASIC>0),
        DEPT_NO     VARCHAR(25)     REFERENCES DEPT(DEPT_NO)
);
```

** DEPT_NO IS FOREIGN KEY WHICH REFERENCING PRIMARY KEY OF DEPT TABLE

6 ALTER TABLE

To modify the structure of the table. i.e. add a new attribute, delete an existing attribute, change to size and data type of a new attribute, renaming an attribute

i. ALTER TABLE EMP ADD MOBILE INT(10) → Adding attribute

Ii ALTER TABLE EMP DROP MOBILE; → Deleting/removing attribute

Iii ALTER TABLE EMP MODIFY ENAME VARCHAR(25); → Changing data type and size of attribute
ALTER TABLE EMP MODIFY EMPID INT(4);

iv ALTER TABLE EMP CHANGE ENAME EMP_NAME VARCHAR(25); → renaming attribute

7 DROP TABLE <TABLENAME>

To Delete/remove a table from the database. **Drop Table emp;**

8 DESCRIBE / DESC

To view the structure of the table. **Desc emp;**

9 Show Tables

To view the names of the tables in the current database. **Show Tables;**

SQL COMMANDS

Data Manipulation Language (DML)

1 INSERT

To add new record or records into a table

```
INSERT INTO EMP VALUES(101,"RAKESH SHARMA",'1995-05-10", "MANAGER", "REGULAR",
12345678911, 50000, "SALES");
```

2 DELETE

To Remove tuples from a table.

```
DELETE FROM <tablename> WHERE <Condition>;
DELETE FROM emp WHERE Ename = 'Rakesh Sharma';
```

3 UPDATE

To modify or change the data in the tables

```
UPDATE <tablename>
SET Attribute1=<new value>, Attribute2=<new value>,…
WHERE <Condition>
Update emp set sal = sal = 50 where deptno =30;
```

4 SELECT **[3+2 Marks/Query / Output]**

To view / show / fetch / extract rows or tuples from table(s) or relation(s)
SELECT Attribute list/*
FROM table name(s)
WHERE Condition
ORDER BY Attribute name
GROUP BY Attribute name
HAVING Condition
DISTINCT, AS, AND, OR, NOT, IN / NOT IN, BETWEEN / NOT BETWEEN, IS NULL / IS NOT NULL

5 SINGLE ROW FUNCTIONS

NUMERIC FUNCTIONS – **[1 Mark / Output Based]**

- POW(X,Y) - x raise to the power of y	Select Pow(8,2); → 64
- MOD(X,Y) - Remainder of X/Y	Select MOD(80/12) → 8
- ROUND(N,D) - Rounds number N upto given D no. of digits	Select Round(123.7898,2); → 123.79
- SIGN(N) - If N is position then output 1, negative then -1 and Zero then output is 0	Select SIGN(-165); → -1 Select SIGN(0) ; → 0
- SQRT(X) – Returns square root of X	Select SQRT(144): → 12

SRING/CHARACTER FUNCTIONS **[1 Mark / Output Based]**

- LENGTH(STR) : Find Number of characters in given string.	Select LENGTH('APPLE') → 5
- CONCAT(STR1,STR2,STR3….) : Joins the given strings one after the other.	select CONCAT('Ken', 'driya'); → 'Kendriya'
- UPPER(STR)/UCASE(STR): Converts lower case alphabets of given string alphabets to Upper case. Other charters remain as it is.	Select UPPER('Kendriya') → 'KENDRIYA' Select UPPER('orange') → 'ORANGE'
- LOWER(STR)/LCASE(STR) : Converts Upper case alphabets of given string alphabets to lower case. Other charters remain as it is.	Select LOWER('Kendriya') → 'kendriya' Select LOWER('ORANGE') → 'orange'
- LTRIM(STR): Removes Spaces on left side of given string.	Select LTRIM(' APPLE IS RED '); → 'APPLE IS RED '
- RTRIM(STR) : Removes Spaces on Right side of given string.	Select RTRIM(' APPLE IS RED '); → ' APPLE IS RED'
- TRIM(STR) : Removes both leading (left) and Trailing (right)Spaces from given string.	Select TRIM(' APPLE IS RED ') → 'APPLE IS RED '
- LEFT(STR,N) : extract N characters from left side of given String	Select LEFT('Kendriya',4) → 'Kend'
- RIGHT(STR,N) : extract N characters from right side of given String	Select RIGHT('Kendriya',4) → 'riya'
- INSTR(STR,SUBTRING) : returns the position of the first occurrence of a string in another string.	Select INSTR("apple", "p"); →2
- SUBSTR(STR, position, no. of characters) or MID(STR, position, no. of characters)	Select MID('Kendriya',4,2) → 'dr'

DATE FUNCTIONS **[1 Mark / Output Based]**

- CURDATE(): Display current date in YYYY-MM-DD format	Select CURDATE ();
- DATE(DateTime) : returns the date part of date time value specified	Select Date('2013-12-23'); →2013-12-23
- DAYOFMONTH(DATE): returns the day of the month for a given date (a number from 1 to 31)	SELECT DAYOFMONTH('2021-03-04'); → 04
- DAYNAME(DATE) : returns the Day Name corresponding to Date value supplied.	Select DAYNAME('2021-03-04'); → Thursday
- DAYOFWEEK(DATE): Returns the weekday index for a given date (a number from 1 to 7). 1=Sunday, 2=Monday, so on	Select dayofweek('2021-03-04'); →5
- MONTH(DATE): returns the month part for a given date (a number from 1 to 12).	Select month('2013-12-23') → 12
- MONTHNAME(DATE) : returns the name of the month for a given date.	Select MONTHNAME('2013-12-23') → December
- YEAR(DATE): returns the year part for a given date.	Select YEAR('2013-12-23'); → 2013
- NOW():returns the current date and time, as "YYYY-MM-DD HH-MM-SS" (string)	Select Now();

6 AGGREGATE FUNCTIONS [1 Mark / Query Based]

- SUM() : the total sum of a numeric column
- COUNT(): the COUNT() function returns the number of rows that matches a specified criterion. Count doesn't count Null Values.
- AVG() : the average value of a numeric column.
- MAX() : The Maximum value of a column (Numeric/ Varchar/ Date)
- MIN() : The Maximum value of a column (Numeric/ Varchar/ Date)

Table : **EMP**

Empid	Ename	Post	Basic	DEPT_NO
17251	Pratham	Clerk	1500	D101
17855	Vipn	Manager	1800	D202
17884	Nitin	Clerk	1750	D103
17859	Jatin	Manager	2000	D101
17445	NULL	Analyst	1900	D202
17499	Vikas	Manager	2500	D202

Table : **DEPT**

DEPT_NO	DEPT_NAME
D101	Accounts
D202	HRM
D303	IT
D404	Physics
D505	AI

EXAMPLES

COUNT(*) vs COUNT(<col name>)

Ques: Display the no of rows in the table EMP
Query: SELECT COUNT(*) FROM EMP ;
Explanation: Count(*) is used to count no. of rows

Count(*)
6

Ques: Display the no of employees in the table EMP
Query: SELECT COUNT(Ename) FROM EMP ;
Explanation: It will count no. of non null records of that column.
5 because NULL is present in the last row of Ename.

Count(*)
5

SUM,AVG, MAX and MIN

Ques: Display maximum, total and average basic salary
Query: SELECT MAX(BASIC),SUM(BASIC),AVG(BASIC) FROM EMP;

Max(Basic)	SUM(Basic)	AVG(Basic)
2500	11450	1908.33

Where to use GROUP BY?

Ques: Display maximum basic income for each post
Query: SELECT MAX(BASIC) FROM EMP GROUP BY POST
HINT: each time you find word 'each'/ 'wise' in question go for Group by

POST	MAX(Basic)
Analyst	1900
Clerk	1750
Manager	2500

Where to use GROUP BY along with HAVING?

Ques: Display the no of employee post wise having at least two employees.
Query: SELECT COUNT(*) FROM EMP GROUP BY POST HAVING COUNT(*) >=2;
HINT: use having when we have a condition involving a aggregate function. **Never use aggregate function in where Clause**

POST	Count(*)
Clerk	2
Manager	3

7 JOINS – WORKING WITH MORE THAN ONE TABLES [2 Mark / Query Based]

- **Cartesian Product** : is formed by Horizontal joining each row of the first table with every other row of the second table. i.e. table 1 has N rows and table 2 has M rows, Cartesian Product as N X M rows.
- CROSS JOIN / CARTESIAN PRODUCT
  SELECT * FROM CUSTOMER, ACCOUNT
- EQUI JOIN
  SELECT * FROM CUSTOMER, ACCOUNT WHERE CUSTOMER.ANO=ACCOUNT.ANO
- NON-EQUI JOIN
  SELECT * FROM CUSTOMER, ACCOUNT WHERE CUSTOMER.ANO>ACCOUNT.ANO
- NATURAL JOIN
  SELECT * FROM CUSTOMER NATURAL JOIN ACCOUNT

Ques: Display Empid, Ename, Dept_Name and Basic of all Clerks.
Query: Select empid, Ename, Dept_name, basic
from emp as E, Dept as D
where E.Dept_No= D.Dept_No and
Post = 'Clerk';

Empid	Ename	Dept_Name	Basic
17251	Pratham	Accounts	1500
17884	Nitin	IT	1750

TIP Format of a Join Condition : Table1. Common Colum = Table 2.CommonColumn
e.g. emp.deptno= dept.deptno

TIP Wherever, there is a query, in which data is extracted from more than one table, always add a join condition.

Ques: Table 1 has 4 rows and 3 Columns. Table 2 has 5 rows and 4 Columns. Find the Degree and cardinality of the Cartesian Product of Table1 and Table2. **[1 Marks]**

Ans: Degree = Table 1 Cols + Table 2 Cols = 3 + 4 = 7
Cardinality = Table 1 Rows * Table 2 Rows = 4 * 5 = 20

Introduction to Networks

Introduction to Networks: A computer network is a group of computers that are digitally interconnected, for the purpose of sharing resources (Hardware/Software).

Advantages of Computer Network

- File sharing
- Resource sharing
- Sharing a single internet connection
- Increasing storage capacity

Types of Networks: **[1 Mark / Theory]**

Type	Full Form	Distance	Media Used	Devices Used
PAN	Personal Area Network	30-40 ft (A Room)	Bluetooth, Infrared, Data Cable etc.	
LAN	Local Area Network	0-1 Km	Wifi, Twisted Wire Pair, Ethernet Cable	Switch/Hub
MAN	Metropolitan Area Network	1-15Km	Coaxial Cable, Microwaves	Repeaters
WAN	Wide Area Network	∞	Radio Waves, Optical Fiber, Satellite Communication	Gateways, Routers

Network Devices : **[1 Mark / Theory]**

- **NIC :** A network interface controller (also known as a network interface card, network adapter, LAN adapter or physical network interface) is a computer hardware component that connects a computer to a computer network.
- **RJ-45 :** RJ45 is a type of connector commonly used for Ethernet networking**.**
- **Modem: Modulator–Demodulator :** Convert Digital Signals to Analog Waves(Modulation) at Source and Analog waves to Digital Signals at destination (Demodulation). It Connects Computer system to a network through telephone line.
- **Hub :** Act as a Central Device in Star Topology. It is a passive device
- **Switch:** is networking hardware that connects devices on a computer network by using packet switching to receive and forward data to the destination device. Also Known as Intelligent Hub.
- **Repeater:** A repeater is an electronic device in a communication channel that increases the power of a received signal and retransmits them, allowing them to travel further.
- **Router**: A router is a networking device that forwards data packets between computer networks. i.e a router connects networks. Routers are intelligent devices, and they store information about the networks they're connected.
- **Gateway:** are used to connect networks, which may be entirely different from each other.
- **Bridge :** A bridge is a network device that connects multiple LANs (local area networks) together to form a larger LAN.

Network Topology: The physical way in which computers are connected to each other in a network is called Network Topology. **[1 Marks /Theory]**

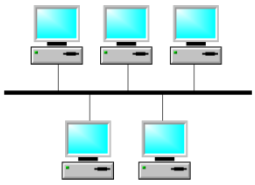
Bus: A bus topology is a topology for a Local Area Network (LAN) in which all the nodes are connected to a single cable. The cable to which the nodes connect is called a "backbone". If the backbone is broken, the entire segment fails.

Ring: A ring topology is a network configuration where device connections create a circular data path. Each networked device is connected to two others, like points on a circle.

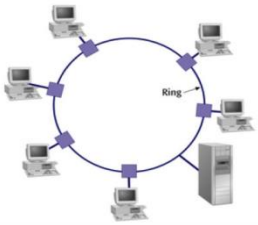
Star: A star topology is a topology for a Local Area Network (LAN) in which all nodes are individually connected to a central connection point, like a hub or a switch.

Tree: A tree topology is a special type of structure where many connected elements are arranged like the branches of a tree.

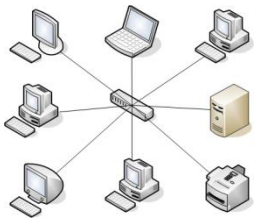
Mesh: A mesh topology is a network setup where each computer and network device is interconnected with one another.



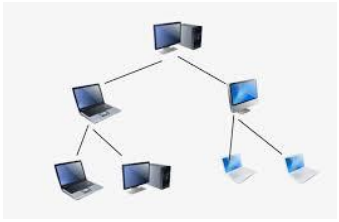
BUS Topology



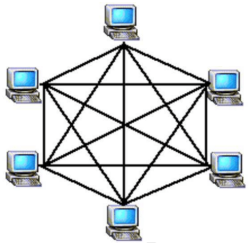
Ring



Star



Tree



Mesh

Point to remember about Topologies:
1. Adding of nodes is the easiest in Bus Topology.
2. Ring Topology provides bi-directional flow of data.
3. Start Topology has central control.
4. Shortest cable length : Bus ; Maximum cable required : Mesh
5. Mesh topology provide multiple paths from source to destination.

Introduction to Internet: The Internet is a vast network that connects computers all over the world.
URL : Uniform Resource Locator : address of a given unique resource on the Web. e.g. http://www.example.com/index.html
Domain Name: A domain name is the permanent address of a website on the Internet. e.g. www.yahoo.com
WWW: World Wide Web : also known as a Web, is a collection of websites or web pages stored in web servers and connected to local computers through the internet.
Web Site: a set of related web pages located under a single domain name, typically produced by a single person or organization.

Web: is a collection of websites or web pages stored in web servers and connected to local computers through the internet.
Email: is an Internet service that allows people who have an e-mail address (accounts) to send and receive electronic letters. These letters may be plain text, hypertext or images. We can also send files with email using attachments.
Chat : is a way of communication, in which a user sends text messages through Internet. The messages can be send as one to one communication (one sender sending message to only one receiver) or as one to many communication (one sender sending a message to a group of people)
VoIP: Voice over Internet Protocol: is a technology that allows you to make voice calls using an Internet connection instead of a regular (or analog) phone line.

Difference between a Website and webpage

Webpage	Website
Webpage is a single document on the Internet	Website is a collection of multiple webpages with information on a related topic
Each webpage has a unique URL.	Each website has a unique Domain Name

Static Web Page: A static web page (sometimes called a flat page or a stationary page) is a web page that is delivered to the user's web browser exactly as stored. i.e. static Web pages contain the same prebuilt content each time the page is loaded

Dynamic web page: The contents of Dynamic web page are constructed with the help of a program. They may change each time a user visit the page. Example a webpage showing score of a Live Cricket Match.

Web Server: Web server is a computer where the web content is stored. Basically web server is used to host the web sites

Hosting of a Website: When a hosting provider allocates space on a web server for a website to store its files, they are hosting a website. Web hosting makes the files that comprise a website (code, images, etc.) available for viewing online

Web Browser: A web browser (commonly referred to as a browser) is a software application for accessing information on the World Wide Web. e.g. Internet Explorer, Google Chrome, Mozilla Firefox, and Apple Safari.

Add-ons/plug-ins : is a software component that adds a specific feature to an existing computer program.

Cookies: are combination of data and short codes, which help in viewing a webpage properly in an easy and fast way. Cookies are downloaded into our system, when we first open a site using cookies and then they are stored in our computer only. Next time when we visit the website, instead of downloading the cookies, locally stored cookies are used. Though cookies are very helpful but they can be dangerous, if miss-utilized.

Protocols: Protocols are set of rules, which governs a Network communication**. Or set of rules that determine how data is transmitted between different devices in a network.**

HTTP : Hyper Text Transfer Protocol : HTTP offers set of rules and standards which govern how any information can be transmitted on the World Wide Web
HTTPs : Hypertext Transfer Protocol Secure: It is advanced and secure version of HTTP.
TCP/IP : Transmission Control Protocol / Internet Protocol : determine how a specific computer should be connected to the internet and how data should be transmitted between them.
FTP : File Transfer Protocol : Transfer file(Upload/ Download) files to or from a remote server.
SMTP : Simple Mail Transfer Protocol : purpose is to send, receive, mail between email senders and receivers.
POP3 : Post Office Protocol version 3 : standard protocol for receiving e-mail.
VoIP : Voice Over Internet Protocol :

HTTP	HTTPs
HTTP is unsecured	HTTPS is secured
HTTP sends data over port 80	HTTPS uses port 443

Hints to solve Case Study based Question: [5 Marks Generally last ques. in QP]

Question Type	Hint Answer
Circuit Diagram	Connects all the units in the question with a unit having maximum no. of computers
Best Place to host Server	Unit having Maximum no. of computers
Placing of Switch/Hub	In each unit
Placing of Repeater	Between units where distance is more than 100m
Most economical Communication medium	Broadband
Communication media for small Distance < 100 m	Ethernet Cable
Communication Media for Desert areas	Radio Waves,
Communication Media for Hilly Areas	Radio Waves/ Microwaves
Hardware/Software to prevent unauthorized access	Firewall

Societal Impacts

Weightage: Part-A Section – I [5 Questions of 1 mark each (Fill in the blank/True False)] =5 Marks
Part-B Section – I [2 Questions of 2 Marks] and [Section – II 1 Question of 3 Marks]= 7 Marks

1. Digital Footprint is the trace you leave on the internet.

Ex. online purchase using your device, Check your insta feed and like a post.

Types: Active (A video uploaded on reels) & Passive (Window shopping on amazon).

How to reduce the footprint?

Logout after you're done surfing a website	Keep comments/likes to a minimum
Think before posting on a public platform	don't post too much personal info online

2. Net and Communication etiquettes:

Net Etiquettes

Be Ethical		**Be Respectful**		**Be Responsible**	
No copyright violation	Share the expertise	Respect privacy	Respect diversity	Avoid cyber bullying	Don't feed the troll

Communication Etiquettes

Be Precise	**Be Polite**	**Be Credible**

Social Media Etiquettes

Be Secure			**Be Reliable**
Choose a strong password	Know who you befriend	beware of fake info	Think before you upload

3. Intellectual property rights (IPR) allow its owners to exclude/include some third parties in order to grant permission to access/modify his/her work through licensing while retaining ownership.

licensing of intellectual property: Technology Transfer, Trademark, Copyright and Patent

4. Plagiarism is the act of using or passing off someone else's work as your own without giving proper credit to the original creator.

crime or not: Under *normal circumstances*, it is considered a *morally unethical* issue but not a crime. If a *copyrighted work* is copied without permission then it becomes a crime.

How to detect: Blockchain technology can be used to counter plagiarism. Services like Turnitin and Grammarly are already used in academia to detect plagiarism.

5. Licence and copyright

Licence	Copyright
One has to explicitly choose, or create, the license. It does not apply automatically.	It exists, without me doing anything to assert it, from the moment of creation.

legal term to describe the terms under which people are allowed to use the copyrighted material.	Copyright is the legal term used to declare and prove who owns the intellectual property
Ex. When you are given a licence of the book from the copyright owner. You may republish or sell it under your name.	Ex. When you buy a book, you're buying the printing copy of the book. You're not buying the copyright in the book.

Type of Open Source Licenses:

- MIT (shortest, most used. Its terms are loose and more open)
- BSD (much fewer restrictions in the distribution of free software)
- GPL (General Public License: more restrictive than MIT)
- Apache (Can be applied to both copyrights and patents)
- CC (Creative Commons: not necessarily open, common for design projects)

6. FOSS: Free and Open Source Software. It means that the *source code of the software is open* for all and anyone is *free to use, study and modify* the code. *Free as in free speech, not free as in free chocolate.*
Ex. MySQL, Linux, Android, LibreOffice, VLC, Mozilla, WordPress etc.

7. Cyber Crime: Any criminal or illegal activity through an electric channel or through any computer network is counted under cyber-crime.

- Crimes Against People Cyber harassment and stalking, distribution of child pornography, various types of spoofing, credit card fraud, human trafficking, identity theft etc.
- Crimes Against Property These crimes include DDOS attacks, hacking, virus transmission, computer vandalism, copyright infringement, and IPR violations.
- Crimes Against Government It includes hacking, accessing confidential information, cyber warfare, cyber terrorism, and pirated software.
- **Hacking:** The act of unauthorised access to a computer, computer network or any digital system. Two kinds: Ethical or White Hat and Unethical or Black Hat
- **Phishing/scam calls/fraud emails:** Generally, a URL that resembles the name of a famous website. Ex. jio2021.com and with very lucrative offer like free internet for a year. When clicked a fake website opens and steals the data or supplies free gift of the viruses to the user. This may lead to identity theft.
- **Identity theft:** when someone uses our personal information—such as our name, license, or Unique ID number without our permission to commit a crime or fraud.
  Common ways how Identity Can Be Stolen: Data Breaches, Internet Hacking, Malware, Credit Card Theft, Mail Theft, Phishing and Spam Attacks, Wi-Fi Hacking, Mobile Phone Theft, ATM Skimmers.
  How to protect identity online: use up to-date security software, try to spot spam/scams, use strong passwords, monitor credit scores, only use reputable websites when making purchases.
- **Cyberbullying**: is the use of technology to harass, threaten or humiliate a target. Examples of cyberbullying is sending mean texts, posting false information about a person online, or sharing embarrassing photos or videos. Different Types of Cyber Bullying: Doxing, Harassment, Impersonation, Cyberstalking.

Virus

Malware: program code that damages the system/network	**Worm**: Self-replicating program that hogs the resources	**Spyware**: sits undetected by the OS or even by the antivirus software
Rootkit: Can't be removed very easily from within the os	**Trojan Horse**: looks like useful software but contains malware	**Adware:** unwanted software that bombards advertisements

8. Cyber Law: "law governing cyberspace". It includes freedom of expression, access to and usage of the internet, and online privacy. The issues addressed by cyber law include cybercrime, e-commerce, IPR, Data Protection.

Indian IT Act, 2000 and **amendment** in **2008** is the cyber law of India.

- Guidelines on the processing, storage and transmission of sensitive information
- Cyber cells in police stations where one can report any cybercrime
- Penalties Compensation and Adjudication via cyber tribunals

9. E-waste: Various forms of electric and electronic equipment that have ceased to be of value to their users or no longer satisfy their original purpose. Include TV, headphone, cell phone etc.

Hazards: It consists of a mixture of hazardous inorganic and organic materials.

- If mixed with water and soil creates a threat to the environment.
- Burning/Acid bath creates hazardous compounds in the air we breathe.

Management: Sell back, gift/donate, reuse the parts, giveaway to a certified e-waste recycler.

10. Technology and Health:

- Health apps and gadgets to monitor and alert. - Virtual Doctor - VR games to improve fitness in a fun manner - Online medical records.	- **Physical**: Eye strain, Muscle Problems. Sleep issues, Depression etc - **Social**: emotional issues, isolation, anti-social behaviour etc

11. Network Security Attacks:

- **Denial-of-Service (DoS) attack**: It is an attack meant to shut down a machine or network, making it inaccessible to its intended users. DoS attacks accomplish this by flooding the target with traffic, or sending it information that triggers a crash.
- **Network intrusion** refers to any unauthorized activity on a digital network. Network intrusions often involve stealing valuable network resources and almost always jeopardize the security of networks and/or their data.
- **Snooping**, in a security context, is unauthorized access to another person's or company's data. The practice is similar to eavesdropping but is not necessarily limited to gaining access to data during its transmission.
- An **eavesdropping** attack, also known as a sniffing or snooping attack, is a theft of information as it is transmitted over a network by a computer, smartphone, or another connected device. The attack takes advantage of unsecured network communications to access data as it is being sent or received by its user.