[This question paper contains 16 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2012 **F**

Unique Paper Code : 2344001201

Name of the Paper : Data Analysis and Visualization Using Python

Name of the Course : **Computer Science: Generic Elective (G.E.)**

Semester : II

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. This question paper has **two** sections **A** and **B**.
3. Question **1** in **Section A** is compulsory.
4. Attempt any **4** questions from **Section B**.
5. Parts of a question must be attempted together.
6. **Section A** carries **30** marks and each question in **Section B** carries **15** marks.
7. Use of Calculator is not allowed.

P.T.O.

Section A

Assume numpy has been imported as np and pandas has been imported as pd.

1. (a) Explain unimodal, bimodal and multimodal distribution with the help of examples. (5)

(b) Consider the DataFrames First and Second given below : (5)

One	Two
0	'A'
2	'B'
5	'D'
6	'C'

First

One	Two
0	'B'
1	'C'
5	'E'
2	'A'

Second

Consider the following python code segment :

```
right = pd.merge(first, second, how='right', on='One')
left = pd.merge(first, second, how='inner', on='Two')
```

Show the content of the new DataFrames right and left.

(c) Write python commands to create a figure object using matplotlib. The Figure object has one subplot that contains 3 line graphs. Define legend and chart title of the graph. Define a different style and colour for each line in the subplot. Import appropriate libraries. (5)

(d) List and describe the steps involved in process of Data Analysis. (5)

(e) Give the output of the following code snippets: (4)

(i)
```
y=np. arange(12).reshape(4,3)
print(y)
y[(y > 5)] = -1
print(y)
```

(ii)
```
x = np.array ([[2, 4], [5,1]])
z=np.ones_like(x)
print(z)
w=np.eye(2) * x
print(w)
```

(f) Consider the series S1 and S2 given below : (6)

S1		S2	
A	1	A	5
B	2	B	6
C	3	D	7
D	4	E	8

Give the output of the following python pandas commands :

(i) S1 [: 3] * 10

(ii) S1 + S2

(iii) S2 [: : –1] * 5

Section B

2. (a) Consider the DataFrame Frame given below : (7)

Name	Age	Weight	Height
Ram	15	45.6	140
Ravi	23	34.9	160
Reena	32	45.6	145
Rita	20	60.7	155
Rishi	33	54.7	170
Romi	21	34.6	144

Write python commands to perform the following operations :

(i) Compute the correlation of Age with both Weight and Height.

(ii) Sort Frame in descending order of Age.

(iii) To find the index for the row with minimum Age.

(iv) Calculate cumulative sum for Weight for all Students.

(v) To set height of 'Rita' and 'Romi' to NA.

(vi) Replace the value 32 with 18 and 33 with 19 in Age column.

(vii) Define map function to convert values of Name column to upper case.

(b) Refer to the DataFrame Frame given in question 2 (a), Write a python program to perform the following operations in the given dataset with columns Name, Age, Weight, Height. (8)

(i) Create a figure and include 2 subplots in it.

(ii) In the first subplot create a scatter plot between two variables Age and Height.

(iii) In the second subplot draw a horizontal bar plot between Name and Weight.

(iv) Set the title for the figure as 'Data Analysis'.

(v) Give appropriate labels for x and y axis.

(vi) Save the figure to file with name 'analysis.png'.

3. (a) Consider the following numpy array matrix : (10)

[[5,10,20],

[20,13,43],

[34,27,67],

[12,46,77]]

Give the output of the following numpy commands :

(i) matrix.T

(ii) matrix[:1,1:]

(iii) matrix[[1,3,0],[2,1,0]]

(iv) matrix[[–2,–4]]

(v) matrix[[True, False, False, True]]

(vi) matrix[3] [:2]

(vii) matrix[::–1]

(viii) matrix.ndim

(ix) np.swapaxes(matrix, 1, 0)

(x) matrix+10

(b) Consider the following DataFrame df. (5)

Items	Sugar Type	Price
Yogurt	Low Fat	45
Chips	Regular	30
Soda	Low Fat	50
Yogurt	High Fat	70
Cake	Regular	140
Chips	Low Fat	40
Yogurt	Regular	50

Give commands to perform the following operations:

(i) List the name of unique items sold.

(ii) Count the number of times each value in items is stored.

(iii) Delete the rows which have duplicate values of Items.

(iv) Give the average price of all Low Fat items.

(v) Check if 'Juice' ims one of the items sold.

4. (a) Consider the DataFrame data given below. (4)

One	Two	Three	Four	Five
1	14	34	NaN	NaN
34	21	NaN	12	NaN
NaN	23	NaN	2	NaN
34	21	32	33	NaN

Write python commands to perform the following operations :

(i) Drop columns with any null values.

(ii) Replace the null values with the mean of each column.

(iii) Drop the null values where there are at least 2 null values in a row.

(iv) Replace all null values by the last known valid observation.

(b) What are outliers? How can you detect outliers using boxplots? (5)

(c) Consider the given numpy array mat : (6)

mat = np.array([[[-1,2], [3,4]], [[-5,6], [7,8]]])

Write numpy commands to perform the following operations :

(i) Create an array of zeros with the same shape as mat.

(ii) Print the shape of the mat.

(iii) Print the datatype of the elements in mat.

(iv) Print the elements which are greater than 6 in mat.

(v) Convert all the elements in mat as float type.

(vi) Multiply each element in mat with 25.

5. (a) Give the python commands to create a dictionary with 5 keys – 'A', 'B', 'C', 'D', 'E' and value as follows. (10)

Key	Value
A	List of numbers from 1 to 10 skipping 2 at a time.
B	List of Strings from A to E.
C	List of 5 numbers obtained using random normal distribution function.
D	List of 5 random integers from 20 to 30.
E	Square root of 5 random numbers from 50 to 70.

Give python commands to perform the following operations :

(i) Create DataFrame data using the above dictionary.

(ii) Convert Column A to index.

(iii) Rename the rest of the columns as Area, Temperature, Latitude and Longitude.

P.T.O.

(iv) Delete the column Longitude from data.

(v) Save data as a csv with separator as ';'.

(b) Write a python code to create a figure and a subplot using matplotlib functions. Plot a rectangle of size 3.5 x 8.5 at point (2.0, 7.0), a circle of radius 2.5 at point (7.0, 2.0) as patches in the subplot, functions for plotting. Set the colour of rectangle as 'Green' and color of circle as 'Blue'. Set the x-scale and y-scale to 1-10. Import appropriate libraries. (5)

6. (a) Consider the following dataset student. (10)

Year	Name	Roll No	Marks	Age
1	Rani	23	70	18
2	Rita	24	75	20
3	Raj	25	80	22
1	Rahul	26	65	25
2	Rohit	27	80	28

Give the output of the following python commands :

(i) student [['Roll No ',' Name ']] [2 : 4]

(ii) student [student ['Age'] >20]

(iii) student [student ['Age'] >20] ['Name']

(iv) avg_marks = np.mean (student.Marks)
student[student['Marks']>avg_marks]

(v) first = student [student ['Year'] == 1]['Marks']
np.mean(first)

(b) Consider the following list 11. (5)

11 = [10, 10, 20, 40, 50, 60, 70, 80, 90, 90]

Discretise the 11 into 4 bins using cut() and qcut(). Give the names ['first', 'second', 'third', 'fourth'] to the bins. What type of object is returned by the pandas after binning? What output is generated by attributes codes and categories of binning object?

7. (a) Consider the DataFrame df given below : (8)

EmployeeID	Department	Salary	Age
1001	English	1000	23
1002	English	1002	34
1003	English	1004	39
1004	English	1005	43
1003	Maths	1004	34
1004	Maths	1005	43
1001	Maths	1006	53
1002	Maths	1002	43

Write the python code to perform the following operations :

(i) Create a hierarchical index on Department and Employee ID.

(ii) Give the summary level statistics for each column.

(iii) Give the output for the following :

1. df.stack()

2. df.unstack()

(b) Give the output of the following code segment : (4)

```
arr = np.array([89, 54, 76, 32, 47, 21, 92, 39, 82])
arr1 = arr[5:9]
arr2 = arr[5:9].copy()
arr1 = 36
arr2 = 7
print(arr)
print(arr1)
print(arr2)
```

(c) Consider the series a given below and give the output of the following commands : (3)

```
a = pd.Series([4, 1, 7, 1, 8, 9, 0, 8, 2, 3, 9])
```

(i) a.rank()

(ii) a.rank(method = 'first')

(iii) a.rank(ascending = False)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2013 **F**

Unique Paper Code : 2344001202

Name of the Paper : Data Analysis And Visualization Using Spreadsheet

Name of the Course : **Generic Elective**

Semester : II

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Attempt any **four** questions from **Section B**.
4. Parts of a question must be answered together.

Section A
(Compulsory)

1. (a) Differentiate between absolute and relative cell referencing in Excel with the help of a suitable example. (5)

P.T.O.

(b) What are the advantages of using a pivot table for data analysis? Write steps for creating a pivot table. (5)

(c) Define measures and calculated columns in DAX. (2)

(d) Consider the following data in a spreadsheet : (3)

	A	B	C
1	Item	Status	Amount(Rs)
2	Banana	Delivered	70
3	Apple	Cancelled	90
4	Banana	In transit	90
5	Cherry	Delivered	100
6	Cherry	In transit	115
7	Apple	Delivered	130
8	Banana	Delivered	250

(i) Write a formula to calculate the mean for the "Banana" sales with the status "Delivered".

(ii) Write a formula to calculate the mode of Amount.

(iii) Write a formula to calculate the median of Amount.

(e) Differentiate between :

(i) Excel formulas and functions. (2)

(ii) COUNT and COUNTX function in excel. (2)

(g) Write a short note on the following **(Any four)** : (8)

(i) Linear regression

(ii) Pivot charts

(iii) Cell formulae

(iv) Array formulae

(v) Multilayer Sorting

(vi) Data validation

(h) Explain any three TEXT functions in excel. (3)

Section B

2. (a) Differentiate between excel functions and DAX functions. Describe any four DAX aggregation functions. (6)

(b) Explain HLOOKUP and VLOOKUP with the help of suitable examples. (5)

(c) Consider the following employee table : (4)

	A	B	C
1	Empid	EmpName	Project
2	E001	Anamika	ABC
3	E002	Sushil	XYZ
4	E003	Annie	ABC
5	E004	Chinu	ABC
6	E005	Kritika	XYZ

Give the formula to extract the records of employees where name

(i) Begins with 'A'

(ii) Ends with 'A'

3. A year-wise sales figure of salesmen is given in the following spreadsheet :

	A	B	C	D	E
1	Salesman	2020	2021	2022	2023
2	Ram	10000	12000	20000	50000
3	Shyam	15000	18000	50000	60000
4	Rohan	20000	22000	70000	70000
5	Rahul	30000	30000	100000	80000
6	Sumit	40000	45000	125000	90000

Write a formula to :

(i) Calculate total sale year-wise. (2)

(ii) Calculate the net sales made by each salesman. (2)

(iii) Calculate the commission for each salesman under the condition that if total sales is greater than Rs. 400000/-, then commission is 5% of total sales made by the salesman, if total sales is between Rs. 300000/- and Rs. 400000/-, then commission is 3% of total sales made by the salesman otherwise, 2% of total sales. (3)

(iv) Calculate the maximum sale made by each salesman. (2)

(v) Calculate the maximum sale made in each year. (2)

(vi) Draw a bar graph representing the sale made by each salesman. (2)

(vii) Draw a pie graph representing the sales made by a salesman in 2021. (2)

4. (a) Describe any four DAX logical functions. (8)

(b) Describe any three types of charts. Also, mention when it is beneficial to use a particular chart. (6)

(c) Differentiate between SEARCH and FIND. (1)

5. (a) Give the syntax and example of the following functions in MS Excel : (10)

(i) COUNTIF

(ii) MIN

(iii) IF

(iv) SUM

(v) SUMIF

(b) Consider the following table : (3)

	A	B	C	D	E	F
1	Reference rating	Movie	Release date	Box office gross revenue(in $)	All time ranking	Budget(in million)
2	1	Avengers: End game	April 26, 2019	2797800564	2	356
3	3	Avengers: Infinity war	April 27,2018	2048359754	5	316-400
4	6	Avengers: Age of Ultron	May 1, 2015	1402805868	11	365.3
5	Budget for Avengers: Age of Ultron	?				

Write an excel formula to find the budget for Avengers: Age of Ultron using index and match function in cell B5.

(c) What is legend in a chart? (2)

6. (a) Calculate the regression equation of Y on X from the data given in the following table : (5)

X	10	12	13	12	16	15
Y	40	38	43	45	37	43

Estimate the value of Y when X is 20.

(b) Differentiate between Descriptive and Inferential statistics. Describe any two types of Descriptive statistics. (5)

(c) Calculate the correlation coefficient for the following variables X and Y : (5)

X	4	8	12	16
Y	5	10	15	20

7. (a) Explain Goal-seek, Scenario manager and Data tables with the help of suitable examples. (6)

(b) List any four chart elements in excel charts. (2)

(c) Consider the following PRODUCT data in excel : (5)

	A	B	C	D	E
1	Date	Product	Region	Quantity	Price
2	1/05/2023	Laptop	Noida	30	150
3	3/05/2023	Tablet	Noida	40	100
4	4/05/2023	Laptop	Delhi	20	100
5	5/05/2023	Mobile	Pune	10	200
6	6/05/2023	Mobile	Delhi	20	300
7	7/05/2023	Laptop	Noida	40	100

Write the formula to :

(i) Calculate the total sales.

(ii) Calculate the average price of products

(iii) Find the maximum quantity sold.

(iv) Count the number of sales transactions.

(v) Filter data for the region Noida.

(d) Differentiate between SUBSTITUTE and REPLACE in excel. (2)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1263 **F**

Unique Paper Code : 2342571201

Name of the Paper : Data Structures

Name of the Course : **B.Sc. (Programme) and B.A. (Programme)**

Year of Admission : 2019 & onwards

Semester : II

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Attempt any **four** questions from **Section B**.
4. Parts of the question must be answered together.

P.T.O.

SECTION A

1. (a) Perform the insertion sort on the array {8,2,1,9,3}, show the steps after each iteration. Also, report the number of comparisons. (4)

(b) Explain the properties of a binary heap. How is it different from a binary search tree. (4)

(c) Differentiate between the following : (4)

(i) Arrays and Linked list

(ii) Queue and Priority queue

(c) Consider a function f() to compute Fibonacci numbers as defined below : (4)

f()

0 if n=0

1 if n=1

Fib(n)

Fib(n-1)+Fib(n-2) if n>=2

How many times will f() be called when n=4 ?

(d) Draw a binary search tree using the following key values; 16, 7, 23, 22, 14, 15 (4)

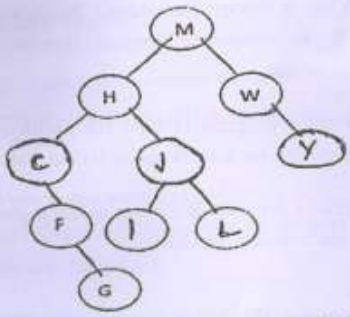
(e) What are the different operations that can be performed on a Dequeue. Explain using an example. (4)

(f) What are height-balanced trees? Explain using suitable example. (3)

(g) 'Stacks play a role in the implementation of recursion'. Justify the statement using a suitable example. (3)

SECTION B

2. Consider the following Binary Search Tree. (15)



Show the status of the tree after each of the following operations :

P.T.O.

(i) Draw the tree after insertion of node with value 'K'.

(ii) Delete node with value 'H' from the resultant tree.

(iii) Write the pr-order traversal of the resultant tree.

(iv) Is the resultant tree a height-balanced tree? Give justification for your answer.

(v) Finally, delete the node with value 'M' from the resultant tree.

3. (a) What is Binary Recursion? Write a program in C++ for computing Fibonacci numbers via Binary Recursion. (6)

(b) Write a program in C++ for performing a push operation on a stack using linked list. (5)

(c) Write a program in C++ to delete a given element from a doubly linked list. (4)

4. (a) Consider the following sequence of operations performed on an initially empty doubly linked list : (6)

InsertBeginning(10),

InsertBeginning(5),

InsertEnd(7),

InsertEnd(2),

DeleteBeginning(),

Deletenode(2)

Show the contents of the list, links between the nodes, head and tail after each operation.

(b) What is an abstract data type? Differentiate between Stack and Queue with the help of a suitable example. (4)

(c) Illustrate the operation of counting-sort on the array A = {6,0,2,0,1,3,4,6,1,3,2} (5)

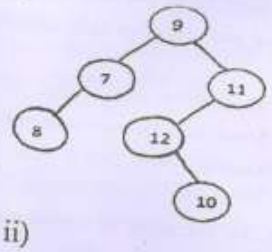
5. (a) What is the advantage of using a circular linked list? Explain different operations performed on a circular linked list. (6)

(b) Give the asymptotic analysis for the Big-O notation using a suitable example. (5)

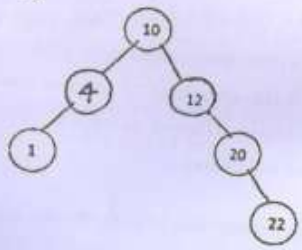
(c) Write any two real-life applications each of stack and queue. (4)

6. (a) For each of the following trees, specify whether it is a binary search tree or not. Give reasons for your answers. (6)

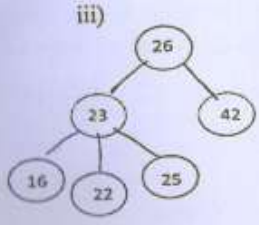
i)



ii)



iii)



(b) Consider the following sequence of operations performed on a stack of size 5. Show the contents of the stack after each operation. (5)

push (10),

push (5),

pop (),

push (2),

push (16),

push (12)

push (22)

push (6)

pop ()

(c) Write a C++ program to sum 'n' number of elements of an array using a recursive function. (4)

P.T.O.

7. (a) What do you understand by the Recursion-tree method for solving recurrences. Draw a Recursion tree for the recurrence $T(n)=T\left(\frac{n}{3}\right)+T\left(\frac{2n}{3}\right)+cn$. (6)

(b) Explain Master's theorem for solving recurrences giving a suitable example. (5)

(c) Write a C++ program to insert an element at the front of a singly linked list. (4)

May-June-2023

[This question paper contains 12 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6025 **E**

Unique Paper Code : 32345202

Name of the Paper : Database Management Systems

Name of the Course : **Generic Elective (Computer Science) For all Hons**

Year of Admission : 2019, 2020 & 2021

Semester : II

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section – A** is compulsory.
3. Attempt any **five** questions from **Section – B**.
4. Parts of a question should be attempted together.

P.T.O.

SECTION – A

1. (a) Identify Composite and Multivalued attributes in the following diagram – (2)

(b) Consider the set of FDs, F for a relation R(A,B,C,D,E):

$F=\{A\rightarrow B,\ AB\rightarrow C,\ D\rightarrow AC,\ D\rightarrow E\}$

What will be the candidate key for R? Is this relation in 2NF, why? (3)

(c) What is Entity Integrity constraint in a relation? Explain, with example, why Primary key cannot be Null in an entity. (3)

(d) Consider the following relations (the Primary keys are underlined): (7)

WORKER(<u>WORKER_ID</u> number, FIRST_NAME char(20), LAST_NAME char(20), SALARY number, JOINING_DATE Date, DEPARTMENT char(10))

BONUS(<u>WORKER_ID</u> number, <u>BONUS_DATE</u> date, BONUS_AMOUNT number)

TITLE(<u>WORKER_ID</u> number, <u>WORKER_TITLE</u> char (10) AFFECTED_FROM date)

Note: WORKER_TITLE can be Manager, Assistant, Secretary etc.

(i) Write an SQL query to fetch unique values of DEPARTMENT.

(ii) Write an SQL query to print details of the Workers whose FIRST_NAME ends with 'a'.

(iii) Write an SQL query to print the details of worker who has received maximum amount of bonus.

P.T.O.

(iv) Write an SQL query to print details of the 'Manager' Workers with SALARY in the range of Rs. 100000 and Rs. 500000.

(e) In the following relations identity all the Candidate Keys : (2)

Suppliers(*sid:* integer, *sname:* string, *address:* string, *panNumber:* string)

Parts(*pid:* integer, *pname:* string, *color:* string)

Catalog(*sid:* integer, *pid:* integer, *cost:* real)

Note: **Supplier**(identifxed by *sid)* can supply multiple **Parts**(identified by *pid).*

The information about what **Parts** can be supplied by a Supplier is kept in **Catalog**.

(f) What all anomalies can be caused if a table is dropped from database? (2)

(g) What is the difference between a Database Schema and a Database State? (2)

(h) Consider the following relations : (4)

Library_Books

AccNo	Title	Author	Dept	PurDate	Price
A101	Python Programming	Lafore	CS	3/3/2020	750
A102	R Programming	Navathe	Maths	4/7/2021	450
A103	Statistics	Rosen	Economics	6/2/2020	475
A104	Algebra	Navathe	Maths	6/9/2019	600
A105	Probability	Diesel	Maths	9/5/2022	700

Issued_Books

AccNo	Borrower
A102	Ritwik
A105	Rhea
A104	Arena
A105	Timothy
A103	John

Give output of the following queries :

(i) Select AccNo, Title, Author, Dept
from Library_Books
where Dept = "Maths" and Author = "Navathe";

(ii) Update Library_Books
set Dept = "CS"
where Title = "R Programming";

(iii) Select * from Library_Books

where Price>500 or PurDate between '7/5/2019' and '4/8/2021';

(iv) Select AccNo, Title, Dept

from Library_Books

where Dept = "CS";

Section – B

2. (a) What are the responsibilities of a Database Administrator and Database Designer? (4)

(b) Consider the following relations for a database that keeps track of business trips 6 of salespersons in a sales office: (6)

SALESPERSON(Ssn, Name, Start_year, Dept_no)

TRIP(Trip_id, Ssn, From_city, To_city, Departure_date, Return_date)

EXPENSE(Trip_id, Account#, Amount)

One trip can be charged to one or more accounts. Construct diagram for this Database Schema, specifying the entity integrity constraints and referential integrity constraints for this schema. Please state any assumptions you make.

3. Consider the following relational database : (10)

EMPLOYEE (emp_id, emp_name, dept_id, contact_no, email_id)

DEPARTMENT (dept_id, dept_name, dept_off, mgr_id)

Give SQL queries for the following :

(i) Select the detail of the employee whose name contains double a.

(ii) Select the details of the employee who work either for department HR or Admin.

(iii) Select the department name assigned to the employee whose employee id is 103.

(iv) Select the name of the employee who is working in the department with 'Abhishek' as manager.

(v) How many employees take salary more than 5000.

4. (a) Construct an E-R diagram for a car insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents. Two cars will participate in one accident and we store damage amount for each accident. Specify key attributes and all constraints on the relationships. (5)

(b) Consider the universal relation $R = \{A, B, C, D, E, F, G, H, I, J\}$ and the set of functional dependencies $F = \{\{A, B\} \rightarrow \{C\}, \{A\} \rightarrow \{D, E\}, \{B\} \rightarrow \{F\}, \{F\} \rightarrow \{G, H\}, \{D\} \rightarrow \{I, J\}\}$. What is the key for F? Decompose R into 2NF and then 3NF relations. (5)

(a) Consider the following relation– (6)

STUDENT

Attributes	Datatype	Constraint
Roll_no	Number	Primary Key
Name	String of maximum 20 characters	Not Null
Address	String of maximum 30 characters	
Phone	Integer	Not Null
Courseld	String of maximum 10 characters	

Give SQL queries for the following :

(i) Create the table for the above relation.

(ii) Alter the size of the *Address* to 50 characters.

(iii) Remove *Phone* attribute from the table.

(iv) Make *Courseld* as foreign key in the relation. (Assume that another relation **COURSE**, with primary key as *CID*, already exists)

P.T.O.

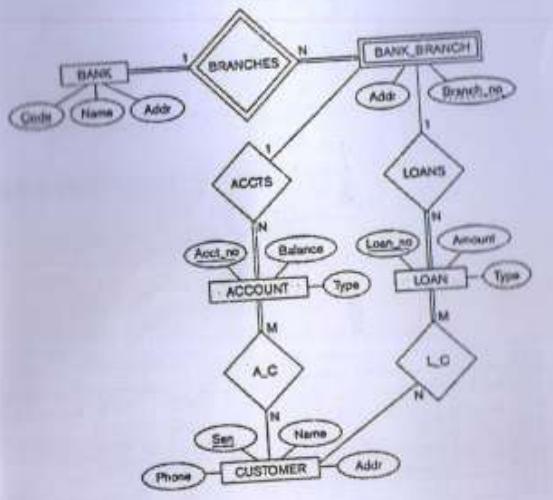
(b) What is Data independence? What is the difference between logical data independence and physical data independence? Explain with example. (4)

7. (a) Define degree, participation constraint and cardinality ratio of a relation with example. (3)

(b) Consider the ER diagram given below for a BANK database. Each bank can have multiple branches, and each branch can have multiple accounts and loans.

(i) List the weak entity type, its partial key, and identifying relationship. (2)

(ii) List the names of all relationships, and specify the (min, max) constraint on each participation of an entity type in a relationship type. (5)



8. (a) What is a Prime attribute? What undesirable dependencies are avoided when a 4 relation is in 3NF? Explain with example? (4)

(b) Show the results of the following operations on the two relation R1 and R2 6 given below : (6)

(i) R1 Union R2

P.T.O.

(ii) R1 Intersect R2

(iii) R2 Minus R1

(iv) R1 join R2 (Join attribute is Roll No.)

(v) R1 left outer join R2 (Join attribute is Roll No.)

(vi) R1 Cartesian Product R2

R1:

Roll_No	Name
101	Raman
102	Shyam
103	Gagan
104	Aarna
105	Riya

R2:

Roll_No	Name
105	Riya
103	Gagan
102	Shyam
106	Saif
107	Rohan

[This question paper contains 12 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5654 **E**

Unique Paper Code : 42341202

Name of the Paper : Database Management Systems

Name of the Course : **B.Sc. (Prog.) Physical Science with Computer Science / B.Sc. (Prog.) Mathematical Science**

Semester : II

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Attempt any **5** questions from **Section B**.

Section A

1. (a) Give two responsibilities of each of the following : (3)

(i) DBA (Database Administrator)

(ii) database designers

(b) An EMPLOYEE table has following two attributes Emp_Id and Emp_Name. Write an SQL statement to insert a new attribute Emp_Address to the EMPLOYEE table. (3)

(c) Identify multivalued, composite and complex attributes the following expression : (3)

Address_EmPhone({Email}, [Phone], Address (House, number, street, city, state))

(d) Write and draw the symbols used in Entity Relationship diagram for the following : (3)

(i) To represent multi-valued attribute

(ii) To represent derived attribute

(iii) To represent weak entity type

(e) For the given table, write down its degree, cardinality and identify any one candidate key. (3)

Emp – Ssn	Emp – Name	Date_of_Birth	Telephone
ES1	Smith John	11/03/1999	9999999988
ES2	Hood Robert	12/06/1987	9988999988
ES3	Brit Paul	12/04/1997	8889999999

(f) What is data redundancy? What are the disadvantages of having redundancy within a database? (3)

(g) What is the difference between logical data independence and physical data independence? (3)

(h) What is meant by an entity relationship (E-R) model? Explain the terms Entity, Entity type, and Entity set in DBMS (Database Management System). (4)

Section B

2. Consider the relational schema given below : (10)

STUDENT (ROLL_NO, S_NAME, BATCH_YR, PH_NO, COURSE_CODE)

COURSE (COURSE_CODE, COURSE_NAME, DEPARTMENT)

RESULT (ROLL_NO, C_CODE, TOTAL_MARKS)

A. Write the 'Create table' **commands in SQL** for STUDENT and RESULT table. Ensure the use of INTEGER and STRING data types, NOT NULL constraint, PRIMARY KEY constraint, FOREIGN KEY constraint at least once.

B. Write the following SQL queries based on the above relation schema :

(i) Retrieve all the student records whose name starts with the letter 'M' or 'R'.

(ii) Count the total number of students in a COURSE

(iii) Retrieve the TOTAL_MARKS of student with name 'XYZ'.

3. (a) List two main characteristics of the database approach and how it is different from the traditional file systems. (4)

(b) Consider the following schema : (6)

STUDENT (SID, SNAME, GENDER)

SUBJECT (SUBID, FACULTY)

ENROLLED (SID, SUBID)

Write the relational algebra queries for each of the following :

(i) Display *SNAME* and *GENDER* of the student having SID equal to 2.

P.T.O.

(ii) Display all details of the *SUBJECT* having SUBID as 720 or 340.

(iii) Display SNAME of the students taking a SUBJECT taught by *'Roger'*.

4. (a) Explain entity integrity and referential integrity constraints. What is the importance of each constraint? (4)

(b) What is the cardinality (1: 1 / 1: N / M: N) for each of the following binary relationships based on the meaning of the entity types? Justify your answer. (6)

(i) Subject and Textbook

(ii) Class and Instructor

(iii) Student and Class

5. (a) What is the function of the following SQL statements? (4)

(i) on delete set null

(ii) on update cascade

(b) Consider the following relation *R*, which has attributes that hold schedules of courses and sections at a university; (6)

R = {Course_no, Sec_no, Offering_dept, Credit_hours, $Course_{level}$, $Instructor_{ssn}$, Semester, Year, Days_hours, Room_no, No_of_students}

The following functional dependencies hold on R :

{Course_no} → {Offering_dept, Credit_hours, Course_level}

{$Course_{no}$, Sec_{no}, Semester, Year}

→ {Days_hours, Room_no, No_of_students, Instructor_ssn}

P.T.O.

{Room_no, Days_hours, Semester,}

→ *{Instructor_ssn, Course_no, Sec_no}*

(i) Determine which sets of attributes form keys of R.

(ii) Normalize the above relation *R* upto 3NF.

6. (a) Observe the following two union-compatible relations R and S. Give the output of the SQL queries given below : (4)

R

RollNo	SName	*Course*
1012	Smith	CS
1013	Lily	PBU
1014	John	AP

S

EmpCode	EName	Dept
2212	Ria	Sales
2213	Smith	Accounts
2214	Amit	Marketing

(i) Select SName from R UNION Select EName from S

(ii) Select SName from RINTERECT Select EName from S

(b) Consider the following relation : (6)

STUDENT (RollNo, SName, Marks, Attendance, Course)

Rollno	SName	Marks	Attendance	Course
1	Smith	95	30	B.A
2	Paul	70	33	B.Sc.
3	James	90	40	B.A
4	John	85	32	B.A
5	Lizza	75	29	B.Sc.

Give the output of the following :

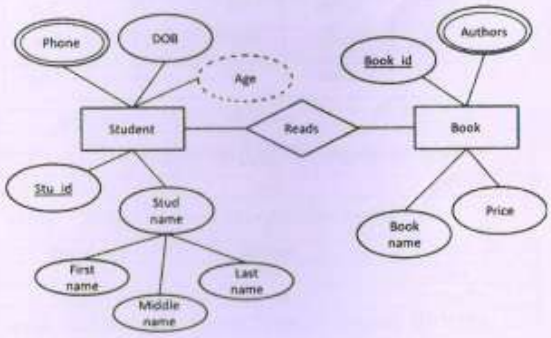
(i) Select *max(Marks)* from STUDENT group by Course.

(ii) Select *SName, Marks, Attendance* from STUDENT where *Course = 'B.A.'*

(iii) Select *SName* from *STUDENT* where attendance between 30 and 40.

7. (a) What is specialization? Give an example for disjointedness constraint. (3)

(b) Map the given ER Diagram to Relational model. (7)



8. Consider a MOVIE database in which data is recorded about the movie industry. The data requirements are summarized as follows : (10)

(i) Each movie is identified by title, year of release, length in minutes. Each movie has a production company and is classified under one or more genres (such as horror, action, drama and so forth). Each movie has one or more directors and one or more actors appear in it. Each movie also has a plot outline.

(ii) Actors are identified by name and date of birth and appear in one or more movie. Each actor has a role in the movie.

(iii) Directors are also identified by name and date of birth and direct one of more movies.

(iv) Production companies are identified by name and each has an address. A production company produces one or more movies.

P.T.O.

Design an entity-relationship diagram (ERD) for the movie database. (Specify the entities, attributes, relationships, cardinality ratio and participation constraints in the ERD).

(2)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5650 E

Unique Paper Code : 42344403

Name of the Paper : Computer System Architecture

Name of the Course : B.Sc. (Prog) / Mathematical Science

Semester : IV

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. 1 is compulsory.
3. Attempt any 5 of questions Nos. 2 to 9.
4. Parts of a question must be answered together.

1. (a) Write the characteristic table of SR flip-flop. (2)

   (b) Perform the following operations using signed-2's complement notation for negative numbers in 8-bit representation :

P.T.O.

(i) +42 + (–13)

(ii) –42 – (–13) (2)

(c) Convert the following numbers to the indicated bases : (2)

(i) $(12121)_3$ to $(----)_{10}$

(ii) $(A675)_{16}$ to $(----)_8$

(d) Differentiate between selective-set and selective-clear. (2)

(e) What is Register? State the use of PC. (2)

(f) Consider the given micro-operation : (2)

M[AR] ← AC, SC ← 0

Write the name of given instruction and state its function.

(g) What is cycle stealing in DMA? (2)

(h) Draw the truth table and logic diagram of Half-Adder. (2)

(i) Specify the output of the following micro-operation : (2)

R3 ← R1 + (R2)' ← 1

(j) Expand the following terms : (2)

(i) CMOS

(ii) ASCII

(iii) TTL

(iv) ECL

(k) Write micro-operations for a following instruction in the basic computer : (2)

LDA (Load to AC)

(l) Construct an 8-to-1 -line multiplexer with two 4-to-1-line multiplexers and one 2 to-1-line multiplexer. Use block diagrams for the three multiplexers. (3)

2. (a) Simplify the following function in Sum-Of-Products (SOP) form using K-map. Also draw the logic diagram.

$F(P, Q, R, S) = \Sigma(0, 2, 5, 7, 8, 10, 11, 12, 14)$

$d(P, Q, R, S) = \Sigma(4, 6)$ (6)

(b) Given the following Boolean function : (4)

$F = A'B + ABC' + ABC$

(i) Simplify the given function F using Boolean algebra.

(ii) Find complement of F using DeMorgan's theorem.

3. (a) A two-word instruction is stored in memory at an address designated by the symbol W. The address field of the instruction (stored at W + 1) is designated by the symbol Y. The operand used during the execution of the instruction is stored at an address symbolized by Z. An index register contains the value X. State how Z is calculated from the other addresses if the addressing mode of the instruction is

(i) direct

(ii) indirect

(iii) indexed (6)

(b) Draw the logic diagram of a 2-to-4-line Decoder with only NOR gates including an enable input. (4)

4. (a) Design a combinational circuit with three inputs a, b, c and three outputs P, Q, R. When the binary input is 0, 1, 2 or 3, the binary output is one greater than the input; otherwise, the binary output is one less than the input. (6)

(b) Obtain the 9's complement of the following 8-digit decimal numbers :

(i) 90009951

(ii) 12349876 (2+2)

5. (a) Explain the functioning of a DMA Controller with the help of a block diagram. (6)

(b) A computer has 32-bit instructions and 12-bit addresses. If there are 250 two-address instructions, how many one-address instructions can be formulated? (4)

8. (a) A computer uses a memory unit with 512K words of 3 2 bits each. A binary instruction code is stored in one word of memory. The instruction has four parts: an indirect bit, an operation code, a register code part to specify one of 64 registers, and an address part. (6)

(i) How many bits are there in the operation code, the register code part, and the address part?

(ii) Draw the instruction word format and indicate the number of bits in each part.

(iii) How many bits are there in the data and address inputs of the memory?

(b) List the micro-operations for Fetch and Decode Phase of Instruction Cycle. (4)

9. (a) Draw the block diagram for the hardware that implements the following :

$$x + yz : AR \leftarrow AR + BR$$

where AR and BR are two n-bit registers and x, y and z are the control variables. Include the logic gates for the control function. (6)

(b) Write a program to evaluate the arithmetic statement :

$$X = (A+B) * (C+D)$$

using two address and three address instructions. (4)

[This question paper contains 8 printed pages.]

Your Roll No.....

E

Sr. No. of Question Paper : 5673

Unique Paper Code : 42343409

Name of the Paper : Programming in C++ (SEC)

Name of the Course : **B.Sc. (Prog.) Physical Science / Mathematical Science**

Year of Admission : 2019

Semester : IV

Duration : 2 Hours Maximum Marks : 25

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question no. **1** is compulsory.
3. Attempt any **three** questions from Q. no. **2** to Q. no. **7**.

1. (a) What is a constructor? Why does a constructor not have a return type? (2)

P.T.O.

(b) Differentiate between a structure and a class. (2)

(c) Rewrite the following program after removing the syntax error(s) if any. Underline each correction. (2)

```
#include<iostream>
using namespace std;
int main()
{
    var1 = 1, var2=2;
    myFunc(var1; var2);
    return 0;
}
void myFunc(int arg1, int arg2)
{
    arg1 = arg1 + arg2;
    count<<arg1>>arg2;
}
```

(d) Explain function overloading with suitable examples. (2)

(e) Consider the value of x = 367 and y = 5 for each of the following expression. What is the value of each of the expression? (2)

(i) x % 10

(ii) (x / 10) % 10

(iii) x++ + y++

(iv) x+ = y

2. (a) Change the following while loop code fragment to an equivalent for loop. (2)

```
cin >> x;
while (x ! = -1)
    {
     cout << x << endl;
     cin >> x;
    }
```

(b) Write a recursive function to return the sum of the first n natural numbers. Show the stepwise execution for n = 5. (3)

3. Write a function that receives two numbers as arguments and displays all prime numbers between these two numbers. Incase no arguments are passed,

3 and 10 should be treated as the default arguments. Call this function from main( ), with one call taking the two arguments from the user and another call with no arguments. (5)

4. (5)

```
class A
{
   int pri_A;
protected:
   int prot_A;
public:
   int publ_A;
};
class B:private A
{
public:
   void display()
   {
      pri_A=10;   (1)
      prot_A=10;  (2)
      publ_A=10;  (3)
   }
};
```



```
class D:public B
{
public:
   void display()
   {
      pri_A=10;   (4)
      prot_A=10;  (5)
      publ_A=10;  (6)
      B::display(); (7)
   }
};
class C:public A
{
public:
   void display()
   {
      pri_A=10;   (8)
      prot_A=10;  (9)
      publ_A=10;  (10)
   }
};
```

For the statements labelled (1) to (10), mention if they are valid. Give reasons.

P.T.O.

5. Write function in C++ which accepts a one-dimensional integer array and its size as arguments and replaces elements having odd values with twice its value and elements having even values with thrice its value.

Example:

If an array of five elements initially contains elements as

3, 4, 5, 16, 9

then the function should replace the content of the array as

6, 12, 10, 48, 18. (5)

6. Write a program that reads the text from the standard input unit (keyboard) and create a text file "File.txt". Write a function name *count(filename)* that accepts the filename as argument and counts the number of characters and blank spaces present in the text file. The output of the function should be as shown in the example below.

Example:

If the content of file are : Hello how are you Have a nice day

The function **count(filename)** should display:

Number of blank spaces in file are 7

Number of character in file are 26 (5)

7. Create a class TwoDim which contains x and y coordinates as int. Define the following :

I. Default constructor to initialize data members with zero

II. Parameterized constructor to initialize data members with the values passed

III. Function print1() to print coordinates of the class

Derive a class ThreeDim from the class TwoDim, assigning data member z in the derived class. Define the following :

I. Default constructor to initialize data members with zero

II. Parameterized constructor to initialize data members with values passed

IV. Function print2() to print coordinates of the class

Write a main() function to create an object of class ThreeDim and print its coordinates. (5)

(9)

[This question paper contains 6 printed pages.]

Your Roll No.....

E

Sr. No. of Question Paper : 5721

Unique Paper Code : 42347610

Name of the Paper : Computer Networks

Name of the Course : **B.Sc. (Programme) DSE**

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. The paper has **two** sections.
3. **All** questions in '**Section A**' are compulsory.
4. Attempt any **five** questions from '**Section B**'.
5. Parts of a question must be answered together.

SECTION A

1. (a) Which OSI layer provides reliable message delivery from process on sender to process on destination? Which layer is responsible for framing in the OSI model. (2)

P.T.O.

(b) What is a PAN in computer networks? Giv example.

(c) How is the concept of filtering the frames in bridging? How is a bridged network abl exhibit higher overall performance than a sir LAN?

(d) In which mode of communication can data flow one direction only? Define that mode with example.

(e) A bit string, 0111110111101111111, needs to b transmitted at the data link layer. What is th string actually transmitted after bit stuffing? (2)

(f) Differentiate between unicasting, multicasting and broadcasting. (3)

(g) What are the main functions of the network layer in the ISO OSI model? (3)

(h) Explain the purpose of caching for web access? What happens if the document on the web server changes after a browser stores a copy in its cache? (3)

(i) Eight channels, each with a 100 kHz bandwidth, are to be multiplexed together. What is the minimum bandwidth of the link if there is a need for a guard band of 10 kHz between the channels to prevent interference? Explain with the help of a diagram. (3)

(j) Convert the IP address whose hexadecimal representation is C22F1582 to dotted decimal notation. Which class does this address belong to? (3)

SECTION B

(Attempt any **five***)*

2. (a) What principles were applied to arrive at the seven layers of OSI reference model? How are OSI and ISO related to each other? (6)

(b) Suppose a computer sends a packet at the network layer to another computer somewhere in the Internet. The logical destination address of the packet is corrupted. What happens to the packet? How can the source computer be informed of the situation? (4)

3. (a) How is HTML structured? What are tags in HTML? Explain using examples of any two tags. How is XML similar to HTMIL and how is it different? (6)

(b) Name any four network topologies? Give an advantage of each type. (4)

4. (a) Compare and contrast LED and semiconductor laser the two light sources used for signalling in Optical Fiber. (6)

(b) Explain working of MEO (Medium Earth Orbit) satellites in communication. (4)

5. (a) Frames of 1000 bits are sent over a 1-Mbps channel using a geostationary satellite whose propagation time from the earth is 270 msec. Acknowledgements are always piggybacked into data frames. The headers are very short. Three-bit sequence numbers are used. What is the maximum achievable channel utilization for:

(i) Stop-and-wait?

(ii) Go-back-n?

(iii) Selective repeat? (6)

(b) What is the remainder obtained by dividing $x^7 + x^5 + 1$ by the generator polynomial $x^3 + 1$? Show the binary division steps. (4)

6. (a) What do you understand by Multiplexing? Two channels, one with a bit rate of 190 kbps and another with a bit rate of 180 kbps, are to be multiplexed using pulse stuffing TDM with no synchronization bits. Answer the following questions :

(i) What is the size of a frame in bits?

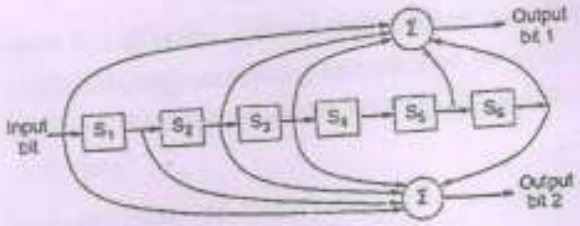
(ii) What is the frame size?

(iii) What is the duration of a frame?

(iv) What is the data rate? (6)

(b) Why do bridges need to implement a Distributed Spanning Tree (DST) algorithm? Explain with the help of a suitable bridged network diagram. (4)

7. (a) What is a linear, block error correcting code? Are convolutional codes linear, block codes? The NASA convolutional coder of rate $r = 1/2$ and constraint length $k = 7$ is shown in the figure below. What is the output sequence when the input sequence is 111 (left to right) and the internal state is initially all zero? (6)



(b) Find the first and last address in the block if one of the addresses is 190.87.140.202/29. How many addresses are there in the block?. What is the network mask? (4)

8. (a) Explain stop and wait protocol for noise free channels. What are the issues of stop and wait protocol? (6)

(b) Give two characteristics each of a mail access protocol and a mail transfer protocol. How is a mail access protocol distinct from a mail transfer protocol? (4)

9. (a) Differentiate the following :

(i) Bus topology and mesh topology

(ii) Twisted pair and Coaxial cable (6)

(b) What is the overall purpose of the Domain Name System? When does a domain name server send a request to an authoritative server, and when does it answer the request without sending to the authoritative server? (4)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5629 **E**

Unique Paper Code : 42343602

Name of the Paper : PHP Programming

Name of the Course : **B.Sc. (Program) / B.Sc. Mathematical Science : SEC**

Semester : VI

Duration : 2 Hours Maximum Marks : 25

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Q.1** is compulsory.
3. Attempt any **three** questions from **Q2** to **Q7**.

1. (a) List four features of PHP. (2)

   (b) How do we create a constant in PHP? Declare a constant with name *flower* and value *Rose*. (2)

   (c) What will be the output of the following code : (2)

P.T.O.

```
<?php
  $a =10;
  $b = 0;
  $val = $a && $b;
  echo ($val ? 'TRUE' : 'FALSE'),"\n";
  $val = $a and $b;
  echo (Sval ? 'TRUE' : 'FALSE');
?>
```

(d) Write PHP command to connect to a MySQL server with address "127.8.8.1". (2)

(e) Whatis the difference between substr() and strstr() functions? Explain with an example of each. (2)

2. (a) What is the purpose of using $_POST[]? Explain its usage with an example. (3)

(b) Write PHP script to delete a record from the table *Qppr(UPC integer, ppr_title varchar(2))* where UPC is *42343602*. (2)

3. What is a regular expression? Why do we require them? Create an HTML form containing Name and Phone number. Using regular expressions, (5)

(i) Check whether the entered name starts with an "A" or not.

(ii) Phone numbers should follow the format "xxx-xxxxxx" where x is a number.

4. (a) What will be the output of the following code : (2)

```
<?php
function increment(&$a)
        { ++$a; }
function decrement($a)
        { --$a; }
$val = 10;
echo "Value is = $val <br>";
increment($val);
echo "Value after incrementing is = $val <br>";
decrement($val);
echo "Value after decrementing is $val <br>";
?>
```

(b) What is difference between an associative array and an indexed array? Explain with the help of an example. (3)

P.T.O.

5. Create an HTML form that gets *Name of employee* and *Basic salary* entered by user in text boxes. Write PHP functions to perform the following calculations : (5)

   (i) Calculate DA-

      (a) DA is 5% of basic salary if basic is less than 10000.

      (b) DA is 10% of basic salary if basic lies between 10000 and 15000.

      (c) DA is 15% of basic salary if basic is greater than 15000.

   (ii) Calculate HRA-
   HRA is 20% of DA.

   (iii) Total Salary is sum of basic, DA and HRA

6. What is meant by three tier web application development? What is the role of PHP in web application development? (5)

7. Explain the following functions with a suitable example :

   (a) ucwords() (b) implode()

   (c) substr_replace() (d) die()

   (e) stripslashes() (5)