[This question paper contains 8 printed pages.]

Your Roll No...............

Sr. No. of Question Paper : 1216   F

Unique Paper Code   : 2342011202

Name of the Paper   : Discrete Mathematical
                             Structures

Name of the Course   : **B.Sc. (Hons.) Computer
                             Science (NEP-UGCF-2022)**

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. Question No. **1 (Section–A)** is compulsory.

3. Attempt any **four** questions from **Section–B**.

4. Parts of a question should be attempted together.

5. Use of simple calculator is allowed.

P.T.O.

SECTION A

1. (a) Determine whether the following function is one-to-one and onto from $\mathbb{R}^+$ to $\mathbb{R}^+$

$$f(x) = -3x^2 + 7$$

Also, check whether it is invertible. If invertible, find its inverse. Justify your answer in each case. (5)

(b) Show that $\neg(p \vee (\neg p \wedge q))$ and $(\neg p \wedge \neg q)$ are logically equivalent by developing a series of logical equivalences. (5)

(c) Evaluate 7^{644} mod 645 using Fast Modular exponentiation algorithm. (5)

(d) Prove that if any 14 numbers from 1 to 25 are chosen then one of them will be the multiple of another. (5)

(e) State whether the K_5 graph is/has a

    (i) Tree

    (ii) Euler Path

    (iii) Euler circuit

    Justify your answer.   (5)

(f) Let a be a numeric function such that   (5)

$$a_r = \begin{cases} 2 & 0 \le r \le 3 \\ 2^{-r} + 5 & r \ge 4 \end{cases}$$

    (i) Determine $S^2 a$.

    (ii) Determine ∇a.

SECTION B

2.   (a) Prove that the relation "congruence modulo m" over the set of positive integers is an equivalence relation.   (7)

(b) If no three diagonals of a convex decagon meet at the same point inside the decagon, into how many line segments are the diagonals divided by their intersections?   (8)

3.   (a) Prove the following statement using the Direct Proof method :

If m and n both are perfect squares, then m * n is also a perfect square.   (7)

(b) Using the principle of mathematical induction, prove that

$$1.2.3 + 2.3.4 + \cdots + n.(n + 1).(n + 2) = n(n + 1)(n + 2)/3$$

     (8)

4.   (a) Using the Euclidean algorithm, find the GCD of

1529 and 14039.   (7)

(b) The interest for money deposited in a saving bank

account is paid at a rate of 0.5% per month, with

interest compounded monthly. $50 is deposited in

the saving account each month for a period of 3

years, followed by $20 each month for next 2

years. What is the total amount in the account

(i) 4 years after the first deposit?

(ii) 20 years after the first deposit?

Formulate the numeric functions for each.   (8)

5.   (a) Prove that a tree with n vertices has $n - 1$ edges.

(7)

(b) For the following numeric functions : (8)

$$a_r = 2^r \text{ for all } r$$

$$b_r = \begin{cases} 0 & 0 \le r \le 2 \\ 2^r & r \ge 3 \end{cases}$$

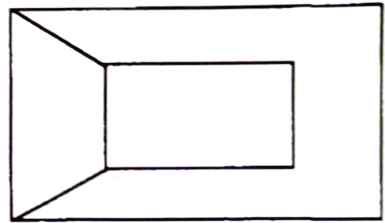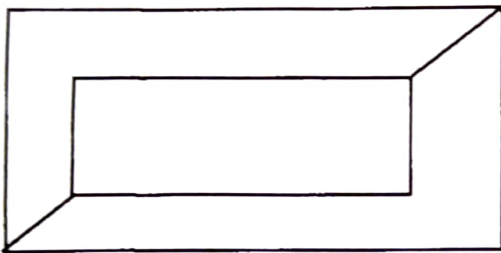Determine a * b in either sketch or closed form expression.

6.   (a) In how many ways can a cricket team of eleven be chosen out of a batch of 14 players? How many of them will:

(i) include a particular player?

(ii) exclude a particular player? (7)

(b) Define graph isomorphism. Check whether the

following pair of graphs are isomorphic. Give

justification in support of your answer. (8)

7. (a) Is Q_3 a planar graph? If planar, draw it in such

a form. Verily your result using Euler formula

also. (7)

(b) Draw Hasse Diagram for the relation R on

A = {1, 2, 3, 4, 5}, whose relation matrix is given

below

$$\begin{pmatrix} 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

Is it a totally ordered set? Justify your answer.

(8)

[This question paper contains 10 printed pages.]

Your Roll No...............

Sr. No. of Question Paper : 4541   E

Unique Paper Code   : 32341201

Name of the Paper   : Programming in Java

Name of the Course   : B.Sc. (H) Computer Science

Year of Admission   : 2019-2020 onwards

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. The question paper consists of **two** sections. **Section A** is compulsory. Attempt any **four** questions from **Section B**.

3. State the assumptions taken, if any, in your answers.

4. All parts of a question must be answered together.

5. The data types of variables/data members/arrays and return types of the methods should be clearly stated.

P.T.O.

SECTION A

(Compulsory)

1. (a) Identify valid and invalid literals from the following : (1×5=5)

    (i) int a = 0_x56;

    (ii) byte b = $xyz;

    (iii) char c = a4;

    (iv) float pi = 3.14_15F;

    (v) int d= 0x85_;

(b) What is the purpose of Dynamic Method Dispatch? How can this method be implemented? Explain with the help of an example. (5)

(c) Assuming that all necessary packages have been imported (where required) in the following Java code snippets, write the output(s) of the following : (2+3=5)

    (i) class ABC {

```
public static void main(String [] args) {
    int a = 5;
    int b = 6;
```

```
        String s1 = "7";
        System.out.println (s1 + a + b);
        System.out.println (a + b);
     }
   }
```

(ii)
```
class Demo {
   static {
      System.out.println ("In static block");
   }
   public static void main(String [ ] args) {
      System.out.println ("In main method");
   }
}
```

(d) (i) How is a class prevented from being inherited? Illustrate with the help of an example. (3)

(ii) Given the following hierarchy of Java classes, write the order in which the constructors are called when an object of class z is instantiated. (2)

class A {...}

class B extends A {...}

class C extends B {...}

(e) Name the event listener interface(s) notified when each of the following event occurs in a Java program. $(1\times5=5)$

(i) When a mouse is pressed.

(ii) When a component gains focus.

(iii) When a key is typed.

(iv) When a mouse is dragged.

(v) When a window is activated

(f) Write statements in Java to create a two-dimensional array that has 3 rows. Row 1 has 3 columns; row 2 has 1 column and row 3 has 2 columns. Also write a for-each loop statement to print this array. (5)

(g) Given two integer variable x = −1 and y = 0, write the value of x and y after the following expressions are executed : (5)

(i) x++;

(ii) y = x++;

(iii) x > 24;

(iv) x >> 24;

(v) x >>> 24;

SECTION B

2. (a) What is the purpose of the super keyword in Java?   (2)

    (b) Assuming that all necessary packages have been imported (where required) in the following Java code snippets, write the output(s) of the following :   (4+4=8)

    (i) class X {

        int 1 = 9;

        class Y extends X {

        int i = 90;

        void showSuper () {

        System.out.println (i);

        System.out.println (super.i);

        }

        }

```
class Demo {

    public static void main (String args[ ]) {

        Y a = new Y ();

        a.showSuper ( ) ;

    }

}
```

(ii)
```
class Show {

    public static void main (String [ ] args) {

        int x = 9; y = 0;

        if (++x == 1 && ++y == 1)

        System.out.println (x);

        System.out.println(y);

    }

}
```

3. (a) What is AWT in Java? How are events handled using AWT? Explain using an example. (5)

(b) Using Java AWT, write a program to create two buttons named "Alpha" and "Beta". When a user clicks on the Alpha button, the background color changes to Red color while clicking on the Beta button, the background color changes to Blue color.

(5)

4. (a) How can a protected member of Java class be accessed by its subclass in a different package? Illustrate with an example.

(4)

(b) Explain the use of try with resources statement in Java.

(2)

(c) Write a program in Java using enhanced for loop to find out the sum of values in an array.

(4)

5. (a) Explain the usage of the keywords throw, throws and finally used in managing exception handling in Java. Is it possible to use multiple catch blocks with a single try block? Explain with an example.

(6)

(d) Rewrite the following code segment to handle the exception(s) that will occur on executing the following codes segments :

(2+2=4)

(i) public static void main (String [ ] args) {

int x = 97, y = 0;

int z = x/y;

System.out.println (z);

}

(ii) int a[ ] = new int [20];

a[20] = 20;

6. (a) Explain with suitable example, the concept of method overloading and method overriding in java. (4)

(b) Differentiate between final and abstract modifier in Java. (2)

(c) Assuming that all necessary packages have been imported (where required) in the following Java code snippets, write the output(s) of the following : (4)

```
class Base {
    public final void show( ) {
        System.out.println("Base class function called");
    }
}

class Derived extends Base {
    public void show( )
        System.out.println("Derived class function called");
    }
}

class Main {
    public static void main (String[ ] args) {
        Base b = new Derived ();
        b.show();
    }
}
```

7. (a) What are Event Listeners in Java? Mention its two major requirements. How they are helpful in the delegation event model? (4)

(b) Write a program in Java using AWT to display a string "Hello" in frame window and set its background color as Red.   (3)

(c) Write the prototypes of any three methods of the MouseListener interface.   (3)

8.   (a) Write a program in Java to print the following pattern.   (5)

1

2 4

3 6 9

4 8 12 16

5 10 15 20 25

(b) Write a program in Java to input a 2-dimensional array of integers and print the greatest odd number and the smallest even number present in the array.   (5)

3

Sr. No. of Question Paper : **4803**   **E**

Unique Paper Code   : 32341403

Name of the Paper   : Database Management Systems

Name of the Course   : **B.Sc. (H) Computer 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. **Section A** is compulsory.

3. Attempt any **four** questions from **Section B**.

4. Parts of a question must be answered together.

5. Marks are indicated against each question.

Section A

1. (a) When is it necessary to have a surrogate key while mapping EER to a relational database? Justify with an example.   (2)

(b) In the relation R (A, B, C, D, E) given below:

A	B	C	D	E
a1	b1	60	d1	2
a2	b2	80	d2	3
a3	b1	50	d3	4

Which amongst the following dependencies are violated? Justify your answer.

  (i) B –> C

  (ii) D –> E   (2)

(c) Why is it necessary to give role names in a recursive relationship? Justify with an example.

                                       (2)

(d) Explain the usage of the following clauses in the SQL Query "ON UPDATE CASCADE" and "ON DELETE NULL".   (2)

(e) Find out the closure of CD in the following relation R (A, B, C, D, E, F, G) for the given set of functional dependencies

F = {A –> BC, E –> C, CD –> AEG, ABG –> BD, DG –> BC}

Show the steps to compute the closure for CD. Using the closure, can we say that CD is a candidate key, if yes, Justify.   (3)

(f) Consider the following Medical Database relations to keep track of Patients and Physicians :

Patient (PP#, PName)

Physician (Dname, Specialization)

Test (PP#, Test_name, Date, Time, Dname)

Identify the primary and foreign keys for the relations given above (State any assumptions made). (3)

(g) Give an example of the following with its proper notation used in ER Model

    (i) Identifying Relationship

    (ii) Complex attribute (3)

(h) Differentiate between the following : (6)

    (i) Database Definition language and Database Manipulation language

    (ii) Logical data independence and Physical data independence

    (iii) Database Intension and Database Extension

(i) Find the output of the following expressions in relational algebra on the tables A, B1, B2, B3 as given below :   (1+2)

A1

S.No.	P.No.
S1	P1
S1	P2
S1	P3
S1	P4
S2	P1
S2	P2
S3	P2
S4	P2
S4	P4

B2

P.No.
P2

B1

P.No.
P2
P4

B3

P.No.
P1
P2
P4

     (i) B1–B2

     (ii) A/B3, where '/' is a division operator.

(j) Consider the Relation given below :

STUDENT_COURSE

Name	Course	Grade	Ph_no	Major	Department

Does this given relation STUDENT_COURSE suffer from any of the following anomalies? Justify your answers using appropriate example.

(i) Insertion

(ii) Deletion

(iii) Modification (3)

(k) Two transactions T1 and T2 are executing concurrently (assuming concurrency control is not in place) with initial value of X=15 and Y=5.

T1	**T2**
1. Read_item(X)	
2. X = X+10	
3. write_item (X)	
	4. Read_item(X)
	5. X = X+Y
	6. write_ item (X)
7. Read_item(X)	

Transaction T1 fails during the execution of statement number 7. After the completion of the transaction T2 what will be the value of X. Is this the correct value, if not, identify the name of the concurrency control problem. (3)

Section B

2. (a) Consider a database PROJECT_EXAMINATION that maintains data about the project reports submitted for consideration by the examiners. Comments by the examiners are recorded for use in the project selection process. The database system caters primarily to examiners who record answers to pre-decided questions for each report they evaluate. The examiners make recommendations regarding whether to accept or reject the project. The data requirements are summarized as follows : (6)

- Students write the project reports.

- Students are uniquely identified by e-mail id. first and last names are also recorded.

- Each project is assigned a unique identifier by the system and is described by a title, abstract, and the name of the electronic file containing the project report.

- Multiple students may be involved in the same project, but one of the students is designated as the coordinator.

- Examiners of project reports are uniquely identified by e-mail address. Each examiner's first name, last name, phone number, areas of interest are also recorded.

- Each project report is assigned to two and four reviewers. An examiner rates each report assigned to him or her on a scale of 1 to 10 in four categories: technical merit, readability, originality, and presentation. Finally, each examiner provides an overall recommendation regarding each report.

Design an Entity–Relationship Diagram (ER) for the above database and identify existing composite attributes (if any).

(b) For the given binary relationship, suggest the cardinality ratio of the relationship based on the general context of entity types and state the context clearly :   (4)

Entity Set1	Entity Set2
I. Country	President
II. Teacher	Course
III. Players	Team
IV. Book	Author

3. Consider the relation R, which has attributes to store timetable of courses and

(a) 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}.

Suppose that 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}

{Room_no, Days_hours, Semester, Year} → {Instructor_ssn, Course_no, Sec_no}

  (i) Identify the Primary key in relation R?

  (ii) Apply normalization to convert it into 3NF stating the reasons behind each decomposition (assume R is already in 1NF).

(b) Find the minimal cover of Functional dependency set F: $\{B \to A, \ D \to A, \ AB \to D\}$. (4)

4. (a) Map the following ER-diagram into a Relational database (Assume appropriate cardinality ratios for each of the given relationships), Here CCI denotes a ternary relationship between candidate, company and interview. (6)
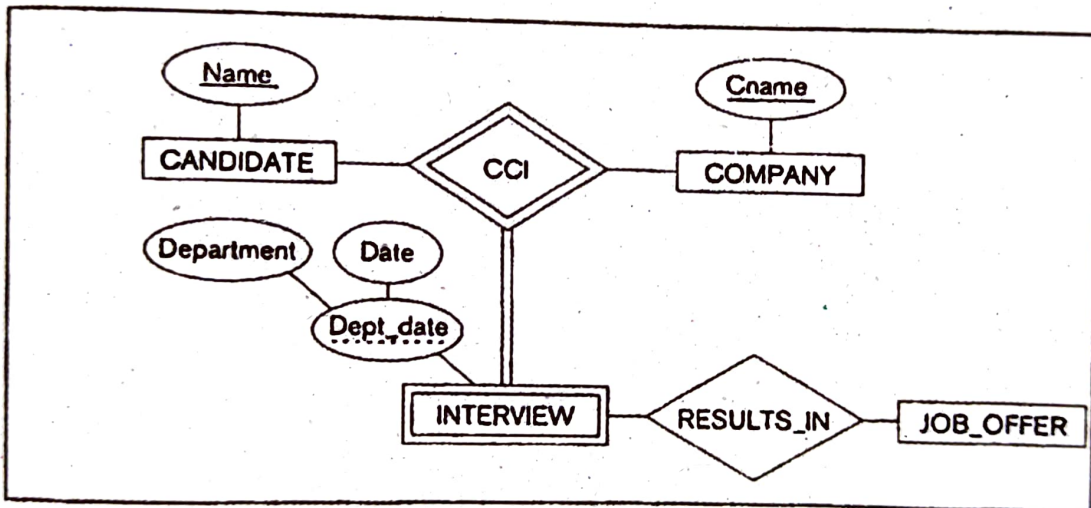
(b) Differentiate between a Specialization Hierarchy and a Specialization Lattice using appropriate examples. (4)

5. Given the following relations for an EMP_PROJ database :

(a) Employee (Emp#, Name, Age, Salary, City, Mobile)

Allotted (Project#, Emp#)

Project (Project#, Project_Name, Project_Manager)

Solve the following Queries on the above-mentioned database using SQL :

    (i) Get Emp# of employees working on both Project# 353 and Project# 354.

    (ii) Get details of employees working on all "database" project.

    (iii) Get Emp# of employees who work on all the projects that Emp # 107 works on.

    (iv) Insert a tuple <555 , "Operation Research", "Jim"> in the Project table.

    (v) Change the city of an employee from "Delhi" to "Chennai" whose name is "James".   (1+1+2+1+1)

(b) List all the FDs satisfied by the following table

A	B	C	D
a1	b1	c1	d1
a1	b1	c2	d2
a2	b2	c2	d2
a2	b2	c4	d4

(4)

6. (a) Create a B-tree of order 4 inserting following values in the given order (in steps)

   1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 (6)

   (b) Consider the following relations for the EMP-PROJ database with the following relations :

   Employee (Emp#, Name, Age, Salary, City, Mobile)

   Allotted (Project#, Emp#)

   Project (Project#, Project_Name, Project_Manager)

   Write the following queries in Relational Algebra for the relations given above :–

   (i) Display the project details of projects managed by "James".

   (ii) Count the number of employees working on the "Artificial Intelligence" Project.

   (4)

7. (a) Compute the number of blocks of access required to get records from an ordered file with r = 20,000 records stored on a disk with Block size B = 1024 bytes with or without primary index. Also, calculate

blocking factor. Assume that file records are of fixed size with record length R = 100 bytes, ordering key field is 9 bytes long and block pointer is 6 bytes long. (6)

(b) What are the four desirable properties of a Transaction that should be enforced by the concurrency control? (4)

[This question paper contains 8 printed pages.]

Your Roll No...............

Sr. No. of Question Paper : 4506   **E**

Unique Paper Code   : 32341601

Name of the Paper   : Artificial Intelligence

Name of the Course   : **B.Sc. (H) Computer Science**

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. Question **1** is compulsory.

3. Attempt any **four** questions from Question **2** to Question **8**.

4. Parts of a question must be answered together.

1. (a) What do you understand by the term "Rational Agent"?   (2)
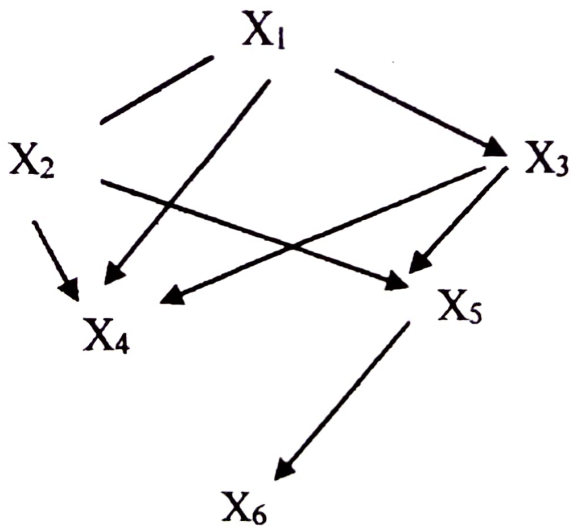
P.T.O.

(b) What would be the output of the following statement in Prolog, and Why? (2)

?- A is 6+3, B = 5+4, A=B.

(c) Construct the truth table for the expression (A & (A V B)). What single term is this expression equal to? (2+1)

(d) Write the joint distribution of x1, x2, x3, x4, x5 and x6 as a product of chain conditional probabilities for the following network : (3)

(e) Develop a parse tree for the sentence "Raja slept on the sofa". (2)

(f) Compare and contrast Depth first search and Breadth first search? (4)

(g) Transform the following into Conjunctive Normal Form (CNF) : (6)

    (i) P V (~P & Q & R)

    (ii) (~P & Q) V (P & ~Q) & S

(h) Express the sentences given below into the conceptual dependency structure : (4)

    (i) Ram drove the car fast.

    (ii) Rita gave Sita a bunch of flowers.

(i) Give the properties of Type 1 and Type 2 grammars from the Chomsky Hierarchy of grammars. (4)

(j) In the following two-ply game tree, the terminal nodes show the utility values computed by the utility function. Use the Minimax algorithm to compute the utility values for other nodes in the given game tree. (2)
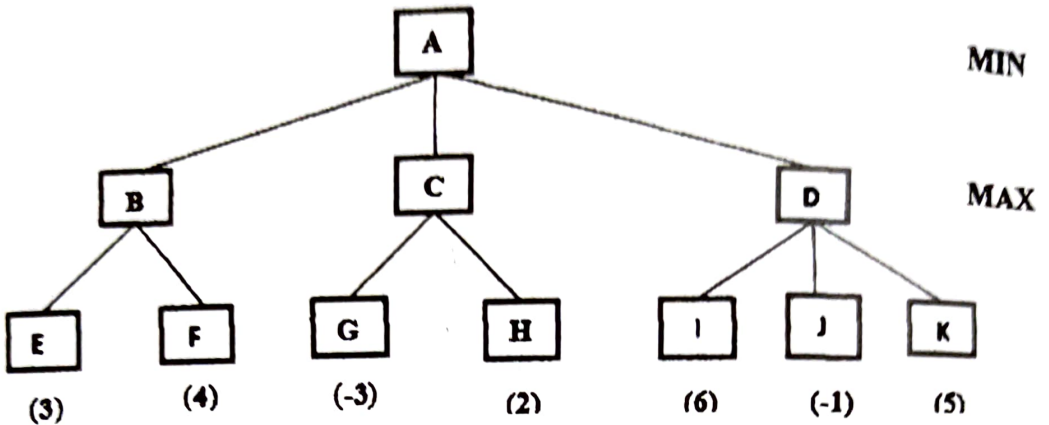
(k) Write about the limitations of Hill Climbing search? (3)

2   a) Describe the water-jug problem. Also give a suitable state space representation for this problem? (2+3)

(b) Transform the following into clausal form : (5)

$$\exists x\ \forall y\ (\forall z\ P(f(x), y, z) \rightarrow (\exists u\ Q\ (x, u)\ \&\ \exists v\ R(y, v)))$$

3.   (a) Write a Prolog program maxlist (L, Max) to find the greatest number Max in the list L. (5)

(b) Find the probability of the event A when it is known that some event B occurred. From experiments, it has been determined that $P(B|A)$ = 0.84, $P(A)$ = 0.2, and $P(B)$ = 0.34. (5)

4. (a) Determine whether the following sentence is satisfiable, contradictory or valid :

$$S : (P \lor Q) \rightarrow (P \& Q) \qquad (2)$$

(b) Find whether the following sets are unifiable or not? If they are unifiable, find most general unifier (m.g.u.) otherwise give justification why they are not unifiable.

   (i) {S(x, Ram), S(y, Sita)}

   (ii) {P(x, y), P (f(x),z), P(z, x)}   (4)

(c) Give PEAS description for Taxi Driver Agent?

                                                        (4)

5. (a) When do we say that the search is admissible? You can take the example of A*.   (3)

(b) What is a horn clause? Given an example.   (3)

(c) Solve the following crypt arithmetic problem using constraint satisfaction.   (4)

TWO

+ TWO

FOUR

----

6. (a) What is a Truth Maintenance System (TMS)? Give the architecture of a problem solver with a TMS in the form of a diagram. (2+2)

(b) Express the following concepts as an associative network structure with interconnected nodes and labeled arcs.

Company ABC is a software development company. Three departments within the company are Sales, Administration and Programing. Joe is the manager of programming. Bill and Sue are the programmers. Sue is married to Sam. Sam is an editor for the Prentice Hall. They have three children and they live on Elm Street. Sue wears glasses and five feet four inches tall. (6)

7. (a) What is default reasoning? (2)

(b) Given the following information for a database :

A1. If x is on top of y, y supports x.

A2. If x is above y and they are touching each other, x is on top of y.

A3. A cup is above a book.

A4. A cup is touching a book.

(i) Translate the statements A1 through A4 into clausal form.

(ii) Show that the predicate supports(book, cup) is true using resolution.   (4+4)

8. (a) Based on the context free grammar represented by the following parse tree, draw the corresponding Recursive Transition Network (RTN).   (5)
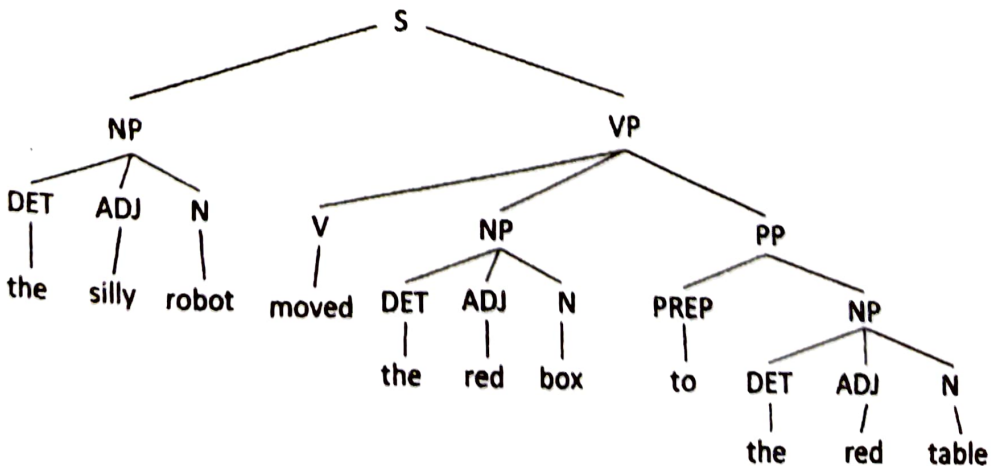
(b) Draw the block diagram of learning agent and explain its working.

(5)

Your Roll No...............

Sr. No. of Question Paper : 4711   **E**

Unique Paper Code   : 32347611

Name of the Paper   : Data Mining

Name of the Course   : **B.Sc. (Hons.) Computer Science**

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. Question No. **1 (Section A)** is compulsory.

3. Attempt any **4** Questions from Nos. **2** to **8 (Section B)**.

4. Parts of a question must be answered together.

Section A

1. (a) Determine the attribute type for the following :

(2)

P.T.O.

(i) Bronze, Silver, Gold medals awarded at Olympics

(ii) Number of patients in hospital

(iii) Car color

(iv) Dates in a Calendar

(b) List two applications where graph data structure is used to model the data. (2)

(c) Consider an association rule between items from market basket domain which has high support and high confidence. What does it signify? (2)

(d) Explain the following terms with respect to a density-based clustering algorithm: Core point and Border point (2)

(e) Consider a categorical attribute with five values {awful, poor, OK, good, great}. Covert this attribute to asymmetric binary attributes. (3)

(f) List any two ways in which a noise object differs from an outlier? Explain with the help of the example. (4)

(g) Consider the given dataset with two attributes Age and Salary measured on different scales. What problems might arise if the dataset is directly used for k-means clustering? What steps will you suggest to handle the problem? (4)

	Age (in years)	Salary (in rupees)
1	44	72000
2	27	48000
3	30	54000
4	38	61000
5	50	83000
6	37	67000

(h) How is an eager learner classifier different from a lazy learner classifier? Support your answer with an example from both category of classifiers. (4)

(i) Specify whether each of the following activities should fall under the purview of a data mining task or a database query. Justify your answer.

    (i) Dividing the customers of a company according to their gender.

    (ii) Predicting the future stock price of a company using historical records. (4)

(j) Explain the concept of following types of clustering schemes :

    (i) Fuzzy clustering

    (ii) Hierarchical based clustering

(4)

(k) Consider the following values for two attributes corresponding to four data points: P1(0,2), P2(2,0), P3(3,1), and P4(5,1). Compute the proximity matrix using the metric as Euclidean Distance.

(4)

Section B

2. (a) Consider the following dataset for binary classification problem :

(6)

Instance	A	B	C	Target Class
1	T	T	1	+
2	T	T	6	+
3	T	F	5	-
4	F	F	4	+
5	F	T	7	-
6	F	T	3	-
7	F	F	8	-
8	T	F	7	+
9	F	T	5	-

Calculate the information gain when splitting on A and B. Which attribute would the decision tree induction algorithm choose?

(b) For evaluating the performance of a classifier, how does holdout method and 4 differ from k-fold cross validation? For k=5 and datapoints- D1, D2, D3, D4, D5, D6, D7, D8, D9, and D10 in the dataset, mention one possible dataset distribution between training and test partition for k-fold cross-validation.

(4)

3. Consider the dataset shown below : (10)

Outlook	Temperature	Humidity	Windy	Play Golf
Rainy	Hot	High	False	No
Rainy	Hot	High	True	No
Overcast	Hot	High	False	Yes
Sunny	Mild	High	False	Yes
Sunny	Cool	Normal	False	Yes
Sunny	Cool	Normal	True	No
Overcast	Cool	Normal	True	Yes
Rainy	Mild	High	False	No
Rainy	Cool	Normal	False	Yes
Sunny	Mild	Normal	False	Yes
Rainy	Mild	Normal	True	Yes
Overcast	Mild	High	True	Yes
Overcast	Hot	Normal	False	Yes
Sunny	Mild	High	True	No

(i) Estimate the conditional probabilities for P(Outlook|Yes), P(Temperature|Yes), P(Humidity|Yes), P(Windy|Yes), P(Outlook|No), P(Temperature|No), P(Humidity|No), and P(Windy|No).

(ii) Use these estimate of conditional probabilities to predict the class label (*Play Golf*) for a test sample (*Outlook* = *Rainy, Temperature* = *Cool, Humidity* = *High, Windy* = *True*) using the naive Bayes approach.

4. The DM Pizza Parlour sells pizzas with optional toppings: pepperoni, pineapple, and pickled-onion. Suppose, you have tried five pizzas (P1 to P5) and kept a record of which you liked :

	Pepperoni	pineapple	pickled-Onion	liked
P1	True	True	True	False
P2	True	False	False	True
P3	False	True	True	False
P4	False	True	False	True
P5	True	False	False	True

Show binarization of the above data and use it to calculate Euclidean distances, to demonstrate how the k-Nearest-Neighbor (k-NN) classifier with majority voting would classify a tuple <*False, True, True*>, for k = 1 and k = 3 respectively. (10)

5. Suppose we have height, weight and T-shirt size of some customers and we need to predict the T-shirt size of a new customer given only height and weight information we have. Use k-Nearest-Neighbor classifier to classify the tuple <161, 64>. Assume

$k = 5$. Note that the data set should be scaled to range [0-1] prior to classification, using min-max normalization. (10)

Height (in cms)	Weight (in kgs)	T-shirt Size
157	58	S
158	59	S
158	63	M
160	59	M
157	56	S
163	60	M
163	61	M
160	64	M
168	64	L
165	61	L
171	62	L
169	63	L

6. Considerthe following data set with nine transactions. Use Apriori algorithm to compute all frequent itemsets of size one and two, considering 1/3 as the minimum support. Also, generate strong association rules using frequent 2-itemsets, considering 0.65 as the minimum confidence. (10)

TID	Items
T1	I1, I2, I5
T2	I2, I4
T3	I2, I3
T4	I1, I2, I4
T5	I1, I3
T6	I2, I3
T7	I1, I3
T8	I1, I2, I3, I5
T9	I1, I2, I3

7. Consider the following data set: {4, 8, 12, 20, 32, 36, 48}. Assuming that k = 2, and initial cluster centers for k-means clustering are 32 and 48. Perform the k-means clustering to arrive at final set of cluster solutions. Also, at the end of every iteration, compute the SSE. (10)

8. Use the distance matrix given below to perform hierarchical clustering using single link and show the dendrogram. (10)

	P1	P2	P3	P4	P5	P6
P1	0					
P2	0.24	0				
P3	0.22	0.15	0			
P4	0.37	0.20	0.15	0		
P5	0.34	0.14	0.28	0.29	0	
P6	0.23	0.25	0.11	0.22	0.39	0

(500)

Your Roll No...............

Sr. No. of Question Paper : 4786   E

Unique Paper Code   : 32341602

Name of the Paper   : Computer Graphics

Name of the Course   : **B.Sc. (H) Computer Sc.**

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. **Section A** is compulsory.

3. Attempt any **four** questions from **Section B**.

4. Parts of a question must be answered together.

SECTION A

1. (a) What is a polygon Mesh? List any one polygon mesh representation. (2)

2

(b) Consider a polygon with vertices ABCD with co-ordinates A(1,2), B(6,6), C(8,3) and D(5,10). Trace the contents of Active Edge Table according to scan line fill algorithm. (3)

2. (a) Define horizontal and vertical retracing. (2)

(b) What are the properties of unweighted area sampling technique of anti-aliasing? (3)

3. (a) Why is depth-sort algorithm for visible surface determination called painter's algorithm? (2)

(b) Prove that parallel lines remain parallel under 2-D Transformations. (3)

4. (a) Differentiate between orthographic and oblique projections. (2)

(b) Rotate a triangle with coordinates A(0,0), B(1,1), C(5, 2) by 45° about coordinate C in clockwise direction. (3)

5. (a) How to convert RGB color model to CMY color model? (2)

(b) Draw a 3 X 3 pixel grid pattern to display 10 intensities on a bi-level system display. Show patterns for all the intensity values. (3)

6. (a) What is the condition to switch from region 1 to region 2 of the first quadrant of an ellipse in mid-point ellipse drawing algorithm? (2)

(b) What is diffuse reflection? How is it different from specular reflection? (3)

7. (a) Differentiate between cabinet and cavalier parallel projections. (2)

(b) Write the 4X4 3-D transformation matrices for each of the following transformations respectively :

(i) Uniform scaling to double the size of an object.

(ii) Translate an object 2 units in x direction and 3 units in y direction. (3)

SECTION B

8. (a) Explain briefly raster scan display architecture. (4)

4

(b) Give the steps to clip the lines PQ and RS (having co-ordinates P(5,12), Q(20,25), R(11,8) and S(25,16)) against the clip rectangle ABCD (having co-ordinates A(10,20), B(20,20), C(10,10), D(20,10)) using Cohen Sutherland line clipping Algorithm. (6)

9. (a) Consider a 3D object with coordinate points P(0,3,3), Q(3,3,6), R(3,0,1) and S(0,0,0). Perform a local scaling on the object with scaling factors of 2, 3 and 3 along X, Y and Z axes respectively, to obtain the new coordinates of the transformed object. (4)

(b) A cubic Bezier curve segment is described by control points $P_0(2,2)$, $P_1(4,8)$, $P_2(8,8)$ and $P_3(9,5)$. Another curve segment is described by $Q_0(a,b)$, $Q_1(c,2)$, $Q_2(15,2)$ and $Q_3(18,2)$. Find the values of a, b, c, such that the curve segments join smoothly and C^1 continuity exist between them. (6)

10. (a) Write steps to shade an object using Phong shading method of polygon rendering? How does it overcome the drawback of Gouraud shading method? (5)

(b) Consider a line from (0,0) to (5,5). Rasterize the line using Bresenham line drawing algorithm.

(5)

11. (a) Reflect the polygon whose vertices are A(−1, 0), B(0, −2), C(1,0) and D(0,2) about the line x = 2 using homogeneous co-ordinates.   (4)

(b) Clip the polygon ABCD with the vertices A(0,7), B(5,12), C(7,7) and D(6,2) against the window P (2,0), Q(10,0), R(10,10) and S(2,10) using the Sutherland-Hodgeman Polygon Clipping algorithm. Also show out vertex array at each step.   (6)

12. (a) Explain Hue, Saturation and Value in HSV color model.   (3)

(b) Consider a line segment AB parallel to the Z axis with end points A[3 2 2 1] and A[3 2 4 1], Overall scale to double the size of line AB followed by 2-point perspective projection with COP along x-axis and Y-axis as Xc=10 and Yc=20 respectively. Also, write the corresponding vanishing points.

(7)

13. (a) Explain depth sort algorithm for visible surface determination.   (5)

(b) A rectangular parallelopiped is given. Its length on x-axis, y-axis and z-axis is 3, 2 and 1 respectively. Perform a rotation by an angle $90°$ about x-axis followed by a rotation by an angle $90°$ about y-axis. (5)

14. (a) Consider a rectangular parallelepiped with coordinates :

$$\begin{bmatrix} 0 & 0 & 1 & 1 \\ 3 & 0 & 1 & 1 \\ 3 & 2 & 1 & 1 \\ 0 & 2 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 3 & 0 & 0 & 1 \\ 3 & 2 & 0 & 1 \\ 0 & 2 & 0 & 1 \end{bmatrix}$$

Apply a trimetric projection on the given position vectors by performing rotation by an angle $\phi = 30°$ about the y-axis, followed by a rotation by an angle $\theta = 45°$ about the x-axis, followed by orthographic parallel projection onto the $z = 0$ plane. Also, find the three foreshortening ratios. (6)

(b) Given two keyframes for an object transformation, first keyframe contains a triangle and the second keyframe contains a quadrilateral. Convert the triangle into the quadrilateral by equalizing vertex counts. (4)

500)

Your Roll No..............

E

Sr. No. of Question Paper : 4835

Unique Paper Code : 32347607

Name of the Paper : Machine Learning

Name of the Course : **B.Sc. (Hons.) Computer Science (LOCF)**

Year of Admission : (Admission of 2019)

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. **Section A** is compulsory.

3. Attempt any **four** questions from **Section B**.

4. Use of scientific calculator is allowed.

Section A (Compulsory)

1. (a) Explain the cost function of logistic regression.

(3)

P.T.O.

(b) Give a formula for the binary sigmoid activation function. Also obtain the first derivative of this function.

(3)

(c) What is K-means clustering algorithm used for?

(3)

(d) Explain two applications of machine learning.

(3)

(e) Consider the following data. Find the information gain if A2 is selected as the root of the decision tree.

(6)

A1	A2	A3	Class
True	Hot	High	No
True	Hot	High	No
False	Hot	High	Yes
False	Cool	Normal	Yes
False	Cool	Normal	Yes
True	Cool	High	No
True	Hot	High	No
True	Hot	Normal	Yes
False	Cool	Normal	Yes
False	Cool	High	Yes

(f) Can a single layer perceptron solve the XOR problems? Justify your answer.

(3)

(g) Find the line of best fit using least square regression method, given the following data :

x	y
2	6
6	13
10	28
12	30

Predict the value of y for the test data $x = 11$.

(4)

(h) Given two situations :   (4)

(i) A publishing house wants to predict the number of copies of a book would be sold. They want to use the popularity rating of the author, success index of her/his previous books and one other variable.

(ii) Based on the blood test reports, a researcher builds a model to identify the type of diabetes (type 1, type 2, gestational diabetes) that a patient has.

Identify each of these situations as a classification problem or a regression problem. Justify your answer.

(i) Consider the Confusion matrix given below:

		Actual Values	
		True	False
Predicted	True	10	11
Values	False	4	20

Compute :

    (i) Accuracy

    (ii) Precision

    (iii) Recall   (6)

Section B

2. (a) Differentiate between supervised, unsupervised and reinforcement learning. (6)

    (b) Using a diagram, depict the following scenarios for a machine learning model :

        (i) High variance, low bias

        (ii) Low variance, high bias   (4)

3. (a) It is found that a classification model performs with a high accuracy on training data, but with new instances, it generalizes poorly. What could be the problem in this model? Explain using a suitable diagram. Give two possible solutions to this problem. (6)

(b) Define and elaborate the terms : (4)

   (i) Hypothesis space

   (ii) Inductive bias

4. (a) Apply the K-nearest neighbor algorithm on the following dataset : (4)

a	b	Class
7	7	False
7	4	False
3	4	True
1	4	True

Predict the class for X (a = 3, b = 7). Assume K = 3 (Use Euclidean distance to compute the distance)

(b) What is the disadvantage of the filter approach for feature selection?

List the steps for feature selection using Principal Component Analysis (PCA). (6)

5. (a) Design a neural network for the Boolean function AND (for two variables) with the help of a neat diagram. (4)

(b) Explain the back-propagation algorithm for a multilayer perceptron. (6)

6. (a) What do you understand by the following terms w.r.t. Support Vector Machine (SVM) learning algorithm?

　　(i) Support vectors

　　(ii) Marginal distance (4)

(b) For the following data, apply one iteration of K-means clustering to partition the data in 2 clusters. Assume points C1 = (1,2,3) and C2 = (3,4,5) as the initial cluster centers. Show the generated clusters and cluster centers after the first iteration. (Use Manhattan distance to compute the distance). (6)

A	B	C
1	2	2
2	4	1
2	3	1
6	3	8
5	2	9
1	4	3

7. (a) What is the basic assumption of a Naive Bayes classifier? (2)

(b) Consider the following training data set for car theft :

Sample No.	Color	Type	Origin	Stolen?
1	Red	Sports	Domestic	Yes
2	Red	Sports	Domestic	No
3	Red	Sports	Domestic	Yes
4	Yellow	Sports	Domestic	No
5	Yellow	Sports	Imported	Yes
6	Yellow	SUV	Imported	No
7	Yellow	SUV	Imported	Yes
8	Yellow	SUV	Domestic	No
9	Red	SUV	Imported	No
10	Red	Sports	Imported	Yes

Use the Naive Bayes classification rule to classify a Red Domestic SUV. (8)

8. (a) Consider the following linear regression problem :

x	1	2	4	3	5
y	1	3	3	2	5

Given the initial values of θ_1, θ_2 as 0.5, 0.5 and learning rate as 0.1. Compute the next set of values for regression coefficients, using gradient descent method. (6)

(b) Answer the following for 5-fold cross validation on a training data set of 45 tuples :

(i) How many rounds of learning will be performed?

(ii) Statethe size of the training and testing set for each round of learning.

(iii) How would the accuracy of the classifier be calculated in 5-fold cross validation? (4)

[This question paper contains 12 printed pages.]

Your Roll No................

Sr. No. of Question Paper : 1235   **F**

Unique Paper Code   : 2342011203

Name of the Paper   : Probability for Computing

Name of the Course   : **B.Sc. (H) Computer Science**

Semester / Type   : II / DSC

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. **First** question is compulsory and attempt any **four** questions from remaining.

3. Part of the questions to be attempted together.

4. Attempt all questions from **Section A**.

5. Attempt any four questions from **Section B**.

6. Use of non-programmable scientific calculator is allowed.

P.T.O.

SECTION A

1. (a) State the Central Limit Theorem. (2)

(b) A box contains six red, four orange, and two blue balls. Two balls are randomly selected. What is the sample space of this experiment? Let X represent the number of orange balls selected. What are the possible values of X? Calculate $P\{X = 0\}$. (5)

(c) (i) For any two random variables X and Y, prove that :

$$Cov(X, Y) = E[XY] - E[X]E[Y]$$

(ii) Calculate the expected sum obtained when three fair dice are rolled. (4+3)

(d) Coming home from work, Neha always encounters traffic signal. The probability that she makes it through a traffic signal is 0.2. How many traffic

signals can she expect to hit before making it through one? What is the probability of the third traffic light being the first one that is green? (5)

(e) Assume that each child who is born is equally likely to be a boy or a girl. If a family has two children, what is the probability that both are girls given that :

    (i) the eldest is a girl?

    (ii) at least one is a girl? (2+2)

(f) (i) When are two states of a Markov chain said to communicate with each other?

    (ii) For the given transition probability matrix of a four-state Markov chain with states 0,1,2, and 3, answer the following :

$$P = \begin{Vmatrix} \frac{1}{2} & \frac{1}{2} & 0 & 0 \\ \frac{1}{2} & \frac{1}{2} & 0 & 0 \\ \frac{1}{4} & \frac{1}{4} & \frac{1}{4} & \frac{1}{4} \\ 0 & 0 & 0 & 1 \end{Vmatrix}$$

(a) Which state is an absorbing state?

(b) Do states 0 and 2 communicate?

(c) Do states 0 and 1 communicate?   (2+3)

(g) Name and define one technique to generate pseudorandom numbers.   (2)

SECTION B

2.   (a) Suppose the joint density of two random variables X and Y is given by :

$$f(x,y) = \begin{cases} 6xy(2 - x - y), & 0 < x < 1, 0 < y < 1 \\ 0, & otherwise \end{cases}$$

Compute the conditional expectation $E[X| Y = y]$, where $0 < y < 1$. (7)

(b) Calculate $E[X]$ for a Poisson distribution with parameter λ. (3)

(c) Consider two bags. The first contains two white and seven black balls, and the second contains five white and six black balls. We flip a fair coin and then draw a ball from the first bag or the second bag depending on whether the outcome was heads or tails. What is the conditional probability that the outcome of the toss was heads given that a white ball was selected? (5)

3. (a) Prove that for all discrete random variables X and Y: $E[X] = E[E[X|Y]]$. (5)

(b) Suppose that we toss two coins. What is the sample space for this experiment? What is the probability that either the first or the second coin falls heads? (3)

(c) Derive the expectation of a uniform random variable with interval [a,b]. (3)

(d) A manufacturer produces medicine bottles out of which 0.1% are defective. Bottles are contained in a box containing 500 bottles. A drug company buys 100 boxes. Using Poisson distribution, find out how many boxes will contain no defective bottles. (4)

4. (a) Explain the n-step transition probabilities of a Markov chain using Chapman Kolmogorov equations. (6)

(b) A company pays dividends on a monthly basis when it is earning profits, and suspends the dividend payments in unprofitable times. Suppose that after a dividend has been paid in the current month, the dividend is paid in the next month with probability 0.9, while after a dividend is suspended the next one will be suspended with probability 0.6.

(i) What is the one-step transitional probability matrix for the above problem?

(ii) What will be the probability that dividend is paid in March 2023, given dividend is suspended in January 2023? (4+5)

5. (a) Let X denote the number of hours you spend in lab doing programming during a randomly selected college day. The probability that X can take on x values has the following form, where k is some unknown constant :

$$P(X=x) = \begin{cases} 0.1, & if\ x = 0 \\ kx, & if\ x = 1\ or\ x = 2 \\ k(5-x), & if\ x = 3\ or\ x = 4 \\ 0, & otherwise \end{cases}$$

(i) Find value of k.

(ii) What is the probability that you spend time on programming in lab for at least 3 hours?

(3+2)

(b) Let c be a constant. For a continuous random variable X, show the following :

(i) $Var(cX) = c^2 Var(X)$

(ii) $Var(c + X) = Var(X)$ (3+3)

(c) Ram and Shyam go target shooting together. Both shoot at a target at the same time. Suppose Ram hits the target with probability 0.7, whereas

Shyam, independently, hits the target with probability 0.4.

  (i) Given that exactly one shot hit the target, what is the probability that it was Shyam's shot?

  (ii) Given that the target is hit, what is the probability that Shyam hit it?   (2+2)

6.   (a) Consider the Markov chain consisting of the three states 0, 1, 2 and having transition probability matrix P given as :

$$P = \begin{Vmatrix} \dfrac{1}{2} & \dfrac{1}{2} & 0 \\[2mm] \dfrac{1}{2} & \dfrac{1}{4} & \dfrac{1}{4} \\[2mm] 0 & \dfrac{1}{3} & \dfrac{2}{3} \end{Vmatrix}$$

List the classes of the above Markov chain. Verify whether this Markov chain is irreducible or not.   (4)

(b) Suppose that 5 percent of men and 0.25 percent of women are colour-blind. A colour-blind person is chosen at random. What is the probability of this person being male? Assume that there are an equal number of males and females.   (4)

(c) Consider two random variables X and Y. Their joint probability mass function is defined as :

$$p(-1,1)=1/3$$

$$p(0,1)=1/3$$

$$p(1,1)=1/3$$

   (i) Compute the conditional probability mass function of X given that Y = 1 i.e., $p_{X|Y}(x|1)$.

   (ii) Compute probability mass function of X i.e., $p_X(x)$.   (4+3)

7.   (a) State and prove Chebyshev's Inequality.   (5)

(b) A miner is trapped in a mine containing three doors. The first door leads to a tunnel that takes him to safety after two hours of travel. The second door leads to a tunnel that returns him to the mine after three hours of travel. The third door leads to a tunnel that returns him to his mine after five hours. Assuming that the miner is at all times equally likely to choose any one of the doors, what is the expected length of time until the miner reaches safely? (5)

(c) Suppose that whether or not it rains today depends on previous weather conditions through the last two days. Specifically, suppose that if it has rained for the past two days, then it will rain tomorrow with probability 0.7; if it rained today but not yesterday, then it will rain tomorrow with probability 0.5; if it rained yesterday but not today, then it will rain tomorrow with probability 0.4; if it has not rained in the past two days, then

it will rain tomorrow with probability 0.2. Transform this process into a Markov chain. How many states will it have after transformation? Provide the transition probability matrix for the same.   (5)

4

[This question paper contains 6 printed pages.]

Sr. No. of Question Paper : 4679   E

Unique Paper Code   : 32341402

Name of the Paper   : Software Engineering (DSC)

Name of the Course   : B.Sc. (H) Computer 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. The paper has **Two** Sections.

3. All questions in 'Section A' are compulsory.

4. Attempt Any **Four** questions from 'Section B'.

5. Parts of a question must be answered together.

SECTION A

1. (i) What are umbrella activities? Are they applied evenly across the software development life cycle? Justify your answer.   (4)

P.T.O.

(ii) What do you understand by Time-Line Chart? How is it used in project scheduling? (4)

(iii) What are Incremental Process Models? Explain the use of incremental process model with the help of an example. (4)

(iv) Explain any three agility principles. (3)

(v) What is the significance of functional and non-functional requirements? Explain with the help of suitable examples. (4)

(vi) "A software engineer must design the modules with the goal of high cohesion and low coupling". Justify this statement. (4)

(vii) Illustrate the importance of testing. Explain why software fails after it has passed the acceptance testing? (4)

(viii) How do you assess Impact of the Risk? Give the formula for determining the overall Risk Exposure (RE). (4)

(ix) Define the five capability levels of CMMI. (4)

SECTION B

2. What is the purpose of computing cyclomatic complexity? Compute cyclomatic complexity using 3 different methods. List all the independent paths in the given graph. (3+3+4)
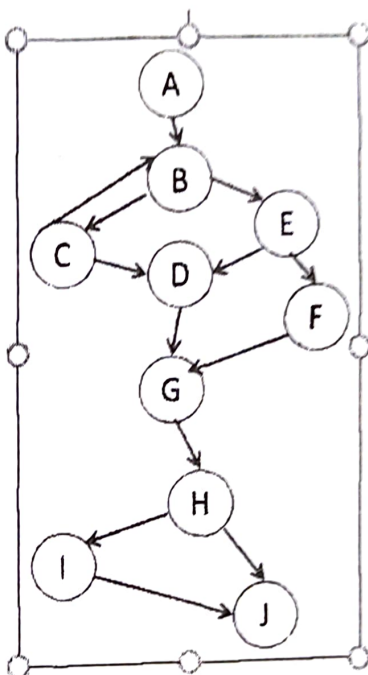
3. (a) Explain the spiral model for software development with the help of diagram. How does "project risk" factor affect this model. (7)

(b) Give three basic assumptionsthat an agile process is expected to handle. (3)

4. Assume that you are asked to build a software system that : (3+4+3)

(i) allows candidates to submit their online admission form to seek admission in a listed course and college

(ii) automatically verify the eligibility of a candidate

(iii) provides an environment to teachers and administrators to verify the records

(iv) allows an eligible candidate to submit fee online

(v) generates acknowledgement slip for candidates and

(vi) generates course-wise students' report for college authority.

Draw the following :

1. Context level diagram (0 Level DFD (Data Flow Diagram))

2. Level 1 DFD

3. Data Dictionary for the above system

5. (a) Compute the Function Point value for a project with the following information domain characteristics : (5)

Assume the measurement parameters equally divided among low, average and high complexity. Further, assume that the complexity adjustment value is 1.5.

Measurement Parameters	count	Weighing factors		
		low	average	high
Number of user inputs	12	3	4	6
Number of user outputs	30	4	5	7
Number of user inquiries	6	3	4	6
Number of files	9	7	10	15
Number of external interfaces	3	5	7	10

(b) At the end of a project, it has been determined that 20 errors were found during the analysis phase and 10 errors were found during the design phase that were traceable to errors that were not discovered in the analysis phase. What is the DRE for the analysis phase? (5)

6. (a) Describe any five activities of software quality assurance that focuses on the management of the software quality. (5)

P.T.O.

(b) What are the characteristics of Risk? Explain different type of risks considered during the software project. (5)

7. Differentiate between the following : (10)

   (i) Coupling and Cohesion

   (ii) Verification and Validation

   (iii) Reactive Risk Strategy and Proactive Risk Strategy

   (iv) Milestone and Deliverable

   (v) Alpha Testing and Beta Testing

8. (a) What is software requirement specification (SRS)? How is it used to bridge the communication gap between the developer and the customer? (5)

   (b) Consider a program for computing the function f(a,b) where the input variables a and b are in the range

$2 <= a <= 5$

$1 <= b <= 10$

Design the boundary value test cases for the program. (5)

(500)

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.

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)
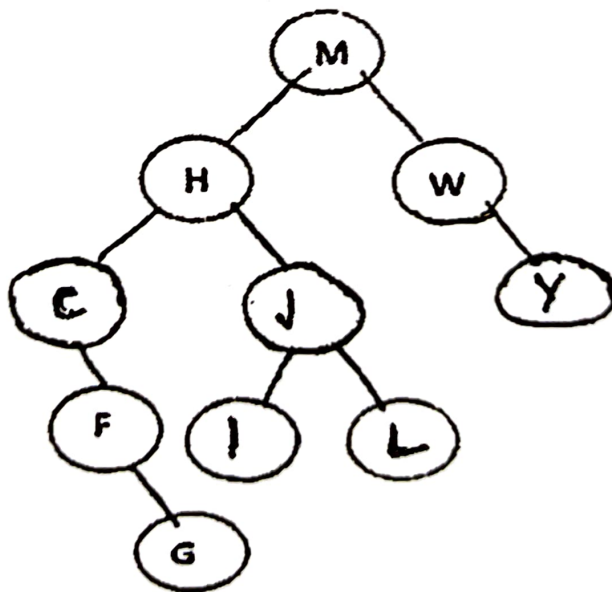
SECTION B

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

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

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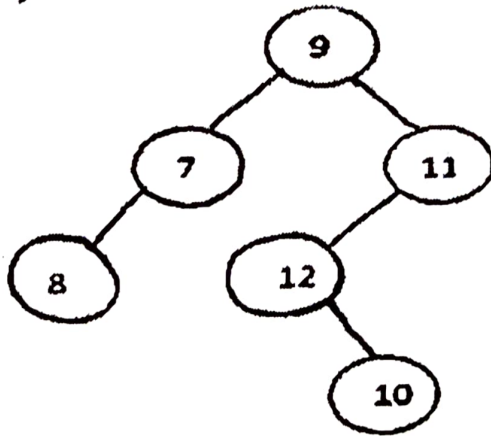
ii)
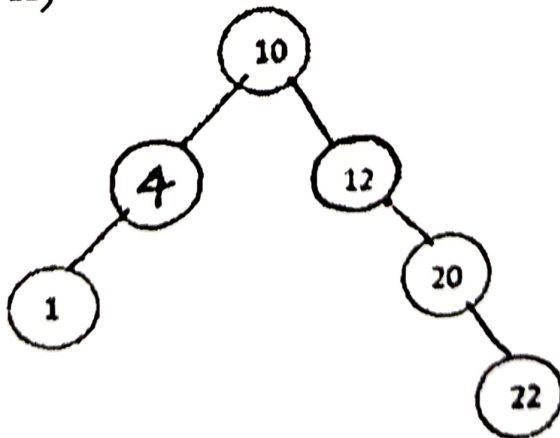
iii)
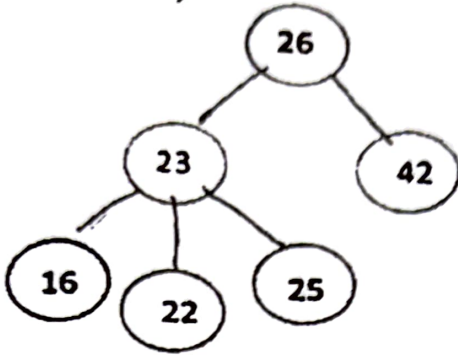
(b) Consider the following sequence of operations performed on a stack of size 5. Show the contents of the stack after each operation. (5)

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)

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

(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)

Your Roll No...............

Sr. No. of Question Paper : 1411   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) How a binary heap is different from a binary search tree. Explain with a suitable example.

(4)

(b) What is the difference between Big-O and Big-Theta notation? Explain.

(4)

(c) When do we use Stack Data structure? Write a program in C++ for 'push' operation in array implementation of stack. Also discuss the stack overflow condition.

(4)

(d) Write a program in C++ to compute the sum of first n natural numbers using recursion. (4)

(e) Create a binary search tree using the following key values;

12, 8, 23, 9, 14, 15

(4)

(f) Give the Breadth-First Traversal of the binary tree given below : (4)
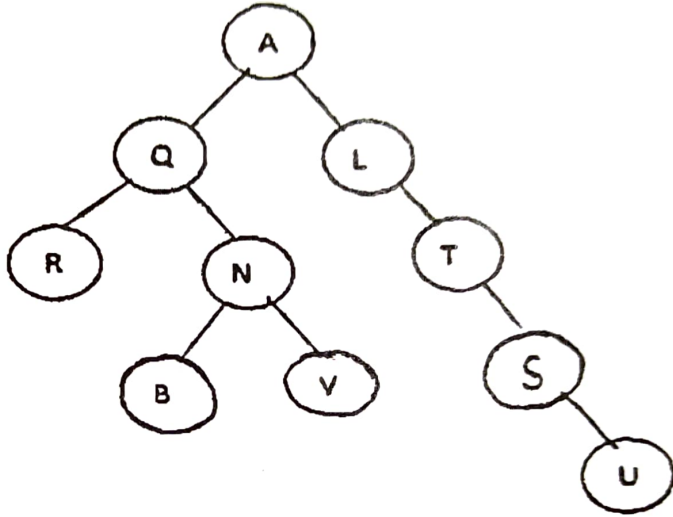
(g) What are height-balanced trees? Explain with the help of a suitable example. (3)

(h) Discuss the role of stacks in the implementation of recursion with the help of a suitable example. (3)

SECTION B

2. Consider the following Binary Search Tree. (15)
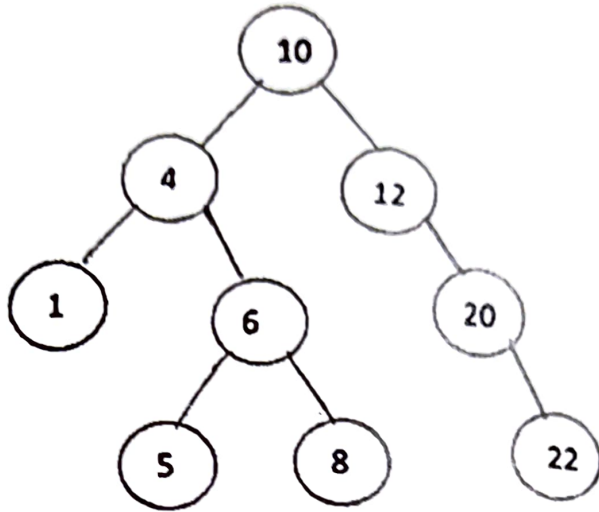
Show the status of the tree after each of the following operations :

(i) Draw the tree after insertion of node with value 11.

(ii) Delete node with value 10 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 4 from the resultant tree.

3.   (a) Write a program in C++ to compute the factorial of a number with and without using recursion.

(6)

(b) Solve the recurrence $T(n) = 3T\left(\dfrac{n}{4}\right) + cn^2$ using

Recursion-tree method.

(5)

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

(4)

4.   (a) Consider the following sequence of operations performed on an initially empty Deque :

InsertFront(10),

InsertFront(5),

EraseFront(),

InsertBack(7),

Front(),

EraseBack()

Show the contents of the deque and output after each operation.

(6)

P.T.O.

(b) Write a program in C++ for computing Fibonacci numbers via Binary Recursion. (5)

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

5. (a) Consider the functions given below, sort the functions in increasing order of asymptotic (big-O) complexity : (6)

$$f_1(n) = n^{0.999999}\log n$$

$$f_2(n) = 10000000\ n$$

$$f_3(n) = 1.000001^n$$

$$f_4(n) = 2^{1000000n}$$

$$f_5(n) = n\sqrt{n}$$

$$f_6(n) = n(n-1)/2$$

(b) Write a program in C++ for performing an enqueue operation for an array-based queue implementation. (5)

(c) Write a program in C++ to search for an element in a doubly linked list and delete it if found.

(4)

6. (a) Explain how Master's theorem can be used for solving recurrences giving suitable example.

(6)

(b) Compare and contrast priority queue and dequeue. Also, give one real-life application of priority queue.

(5)

(c) Write a program in C++ to reverse a given array using recursion.

(4)

7. (a) What is a circular linked list? How a circular linked list is different from a doubly linked list. Discuss different operations performed on a circular linked list.

(6)

(b) Perform the insertion sort on the array {7,1,10,6,3}, show the steps after each iteration. Also, report the number of comparisons.

(5)

(c) Explain any two Abstract Data Types.

(4)

Your Roll No...............

Sr. No. of Question Paper : 1431   **F**

Unique Paper Code   : 2342571201

Name of the Paper   : Data Structure

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

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. Answer any **four** questions from **Section B**.

4. **All** parts of Question must be attempted together.

P.T.O.

SECTION A

1.   (a) Explain Static and Dynamic data structure with the help of a suitable example.   (4)

     (b) Write C++ code for basic operations on Stack using array.   (4)

     (c) Differentiate between Binary tree and Binary heap.   (4)

     (d) Mention advantages of using Tree data structure.

                                                   (3)

     (f) What are Height-balanced trees? Explain with the help of a suitable example.   (3)

     (g) Mention any three applications of Stack.   (3)

(h) Apply insertion sort on given array arr = {12, 4, 34, 6, 8}. Mention the resultant array after the 2nd iteration.   (3)

(i) Differentiate between Queue and Priority Queue.

(3)

(j) What will be the output after performing following operations on an empty stack

Push(4), Push(5), Pop(), pop()Push(5), Push(6), Pop() pop()   (3)

SECTION B

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

(15)
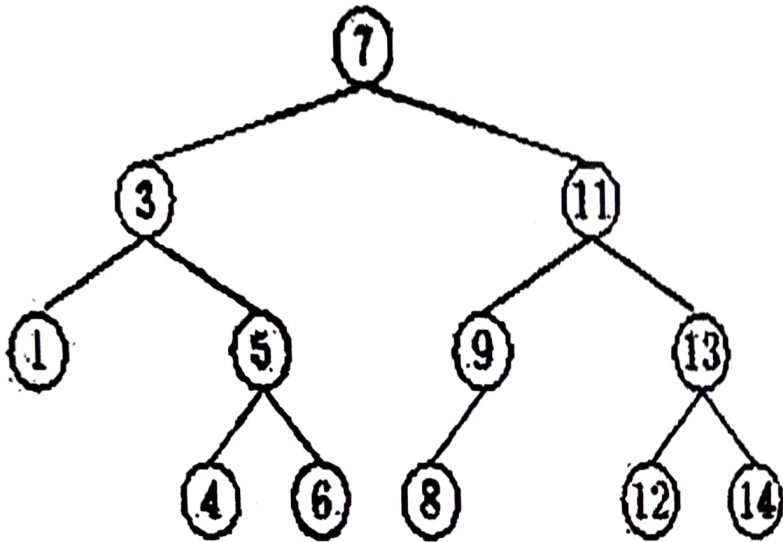
Show the status of BST after each of the following

operations :–

(i) Draw updated tree after inserting a node with

value 2 in the BST.

(ii) Delete node 11 from the updated BST.

(iii) Write post-order traversal of the resultant

BST.

(iv) Add a node with value 10 to the tree constructed

in step (iii) and draw the final tree.

(v) Write BFS traversal of the Final tree.

3. (a) Differentiate between Array and Linked list with

suitable example. (6)

(b) Draw a binary tree whose in-order and preorder

traversals are given below :–

In-order : FBADCE

Preorder : ABFCDE (5)

(c) Write a program in C++ to perform insertion

and deletion at the end of a singly linked list.

(4)

4. (a) Differentiate between Deque and Queue with the help of a suitable example. (6)

(b) Explain Master's theorem for solving recurrences with the help of a suitable example. (5)

(c) Explain Stack overflow and Stack underflow condition. (4)

5. (a) Write a program in C++ to implement Queue using Array. (6)

(b) List any two advantage and two disadvantage of using recursion (5)

(c) Write a C++ program to find n Factorial using recursive function. (4)

6.   (a) Differentiate between (with example) :   (6)

(i) BSF and DFS Traversal

(ii) BST and height-balanced tree

(b) Write C++ code to implement doubly linked list and discuss basic operations to be performed on doubly linked list.   (5)

(c) Explain base case and recursive case in recursion with a suitable example.   (4)

7.   (a) Illustrate and perform count sort on the array {4,7,2,0,7,5}   (6)

(b) How many iterations are required to sort an array {6,12,5,8,4,7} using insertion sort?   (5)

(c) Explain Big - analysis with an example.

(4)

[This question paper contains 8 printed pages.]

Your Roll No...............

Sr. No. of Question Paper : 1461   F

Unique Paper Code   : 2342201202

Name of the Paper   : Data Interpretation and Visualization using Python

Name of the Course   : B.A.(Prog.)

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 **4 (four)** questions from **Section B**.

4.   Parts of a question must be answered together.

Section A
(Compulsory)

1.   (a) Write the output of the following code :   (3)

P.T.O.

```
import numpy as np
a=np.array([[[1,2,3], [3,4,2]], [[4,6,5], [3,1,6]]])
b=np.random.randn(4,3)
print(a.shape)
print(b.shape)
```

(b) Explain any two functions that can be used to create numpy array objects, with suitable examples. (4)

(c) Consider the given pandas series object and write the output of the following code statements : (5)

```
import pandas as pd
obj2=pd.Series([4, 6, 5, 8, 7],index=['d', 'b', 'c', 'a', 'e'])
```

   (i) print (obj2['d'])

   (ii) print (obj2 [obj2>5])

   (iii) print (obj2.index)

   (iv) print (obj2*3)

   (v) print (obj2['b' : 'a'])

(d) Write the output of the following code : (2)

```
import numpy as np
arr = np.array([3.7, -1.2, -2.6, 0.5, 12.9, 10.1])
```

```
arr2 = arr.astype(np.int32)

print(arr2)
```

(e) Explain reindex() function for a series object.

(2)

(f) Explain *skiprows* and *na_values* attributes of the read_csv() function. (3)

(g) Explain *bool* and *string* data types of ndarray object. (4)

(h) Write a short note on matplotlib library in python. (3)

(i) Write output of the following code : (4)

```
import pandas as pd

df = pd.DataFrame({'Animal' : ['Falcon', 'Falcon',
                              'Parrot', 'Parrot'],

                  'Max Speed' : [380., 370., 24., 26.]})

print(df.groupby(['Animal']).mean())
```

Section B

2. (a) Write output of the following code : (6)

```
import pandas as pd
d1 = {'Name': ['Pankaj', 'Meghna', 'Lisa'],
        'ID': [1, 2, 3],
        'Country': ['India', 'India', 'USA'],
        'Role': ['CEO', 'CTO', 'CTO']}
df1 = pd.DataFrame(d1)
df2 = pd.DataFrame({'ID': [1, 2, 3],
              'Name': ['Pankaj', 'Anupam', 'Amit']})
print(df1.merge(df2, on='ID'))
print(df1.merge(df2, on='Name'))
print (df1.merge(df2, how='left')
```

(b) Differentiate between loc and iloc operators giving suitable examples. (4)

(c) Write code in python to create a pandas series object of all even numbers from 2 to 30, including 2 and 30, using arange(). (5)

3. (a) Explain hierarchical indexing in dataframes. (4)

(b) Write the names of functions and give example code for each in matplotlib : (6)

(i) for setting tick labels on x axes

(ii) for adding legend to a plot

(c) Given the code below   (5)

```
import numpy as np
import pandas as pd
data = pd.DataFrame(np.arange(12).reshape((3, 4)),
index=['A', 'B', 'C'], columns=['one', 'two', 'three',
'four'])
```

Write the output for following :

  (i) print(data)

  (ii) print(data.sum())

  (iii) print (data.sum(axis= 'columns'))

  (iv) print (data.idxmax())

  (v) print (data.cumsum())

4. (a) Explain the functions used for :   (5)

  (i) Removing duplicates in a dataframe

  (ii) Filling missing entries in a dataframe

(b) Explain how to create subplots using matplotlib, with suitable example.   (5)

(c) Explain fillna and dropna functions in pandas dataframes, with example code.

(5)

5. (a) Consider the given dataframe df and write the Python statements to perform the following operations:

(5)

	ID	marks
B	23	52
A	34	67
C	25	60

(i) Set the title of the row index as name

(ii) Add a column 'semester' with values 2,1,2

(iii) Sort the dataframe in descending order of the marks column.

(iv) Reindex the dataframe in the order A, B and C.

(v) Drop the row corresponding to row index C.

(b) Explain covariance and correlation with suitable examples.

(5)

(c) Consider the fde sales.csv as given below and answer the following questions.

(5)

year;qtr1;qtr2;qtr3;qtr4

2019;3000;3200;;3500

2020;2900;-9999;;

2021;1800;2100;1900;1950

2021;1800;2100;1900;1950

2022;1850;-9999;2900;2550

2023;3400;3200;;

(i) Load the file sales.csv into a dataframe.

(ii) Fill all the NaN values with 0.

(iii) Remove the duplicate rows from the original dataframe.

(iv) Replace all the -9999 values with a 0.

(v) Print the average sales made during qtrl across all the years

6. (a) Write Python statements to plot a horizontal and vertical bar chart of any assumed dataset. (5)

(b) Write the Python statements to do the following using matplotlib package : (10)

    (i) Plot histogram of different colours of 7 days temperature of your city.

    (ii) Set title as "7 Days Temperature".

    (iii) Set label for X-axis "Weekdays"

    (iv) Set label for Y-axis "Temperature"

    (v) Save the image as "temp-pick.jpg"

7.   (a) Write short note on histograms and density plots, with suitable examples.   (4)

    (b) Explain the functions :   (8)

      (i) value_counts()

      (ii) stack()

      (iii) barh()

      (iv) arange()

    (c) Write output of the following code :   (3)

```
import pandas as pd
ages=[15, 47, 56, 23, 78, 90]
bins=[12, 30, 70, 95]
categories = pd.cut(ages, bins)
print(categories)
```

(1000)

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.

(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}

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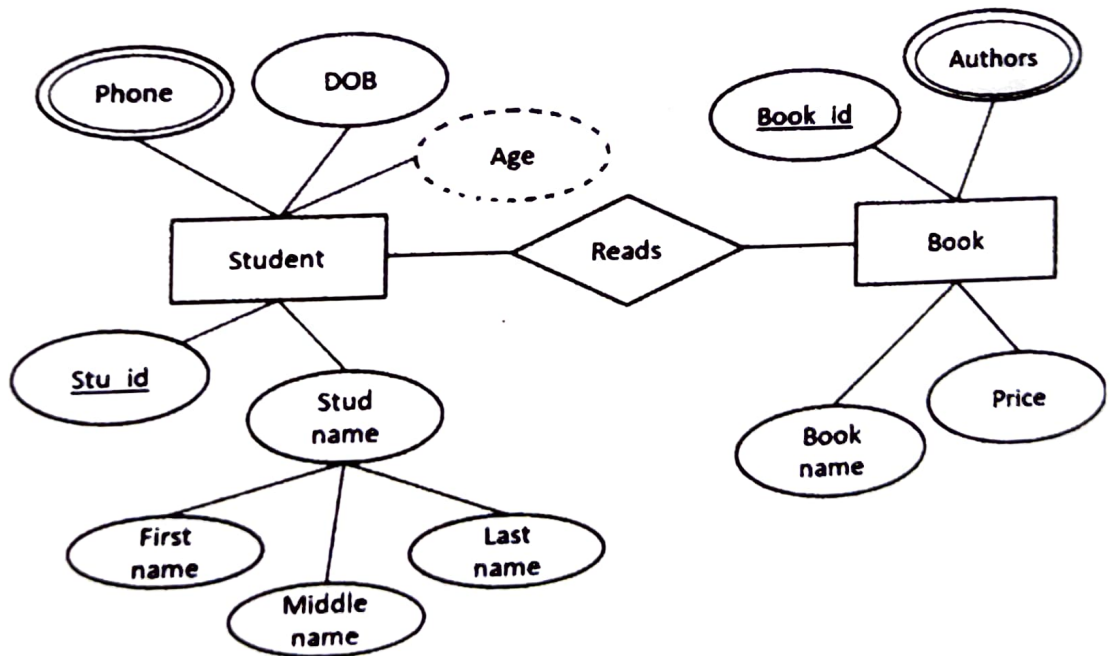
8. Consider a MOVIE database in which data is recorded about the movie industry. The data requirements are summarized as follows :   (10)

   (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.

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

Your Roll No...............

Sr. No. of Question Paper : 5021   E

Unique Paper Code   : 62344414

Name of the Paper   : Multimedia Systems and Applications

Name of the Course   : **B.A. (Programme)** Discipline Course **(LOCF)**

Year Of admission   : 2019 onwards

Semester   : IV

Year of admission   : 2019 onwards

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. Paper has **two** sections. **All** the questions in **Section A** are compulsory. Answer any **five** questions from **Section B.**   Section A

1. (a) What is Multimedia? Differentiate between Linear and Non-Linear Multimedia projects.   (3)

    (b) Define the terms Leading and Kerning.   (2)

    (c) What is a Web-safe color palette? How many colors are there in the palette?   (2)

    (d) Calculate the file size of a five-second recording sampled at 22kHz, 16-bit stereo (two tracks).   (2)

P.T.O.

(e) Differentiate between 2D and 2½ -D animation. (4)

(f) What is the safe title area in the display monitors? (2)

(g) While designing brochure of a product, what kind of fonts should be selected? (2)

(h) Define the role of kinematics in animation. (2)

(i) Why DHTML and XML are preferred over basic HTML to develop web content? (3)

(j) What is Non-Linear editing? Name any two tools used for non-linear editing. (3)

Section B

2. (a) What do you understand by Rendering? How do you transform 2D shapes into 3D shapes? (6)

   (b) What do you understand by Interlacing and progressive scan? (4)

3. (a) Which plug-ins are required in a browser to deliver different elements of multimedia? (5)

   (b) Explain the concept of Cel, keyframes, tweening and pencil test in the process of Cel animation. (5)

4. (a) Describe the team composition of a multimedia production team. Discuss briefly the skills needed by any four members of the team. (6)

(b) While working with bitmapped images, list and explain any four features that an image-editing application must have. (4)

5. (a) What is the role of menus, symbols and icons in the presentation of text in a multimedia project? (3)

(b) What are the different hardware used for production and delivery of a multimedia project? (4)

(c) Multimedia is shifting from being distributed on DVD to be available on the World Wide Web. What are the advantages and disadvantages of this shift? (3)

6. (a) What is the impact of multimedia on e-business? (4)

(b) What kind of editing will be needed, if someone records interviews in informal background settings where noise might also be an issue? Also, what are the important considerations for storing such an audio file? (6)

7. (a) What is virtual reality? How is it different from animation? How is virtual reality used in the entertainment industry? (6)

   (b) List the important steps and considerations in recording and editing digital audio. (4)

8. (a) Explain the use of Web Page Makers and Site Builders with one example of each. (4)

   (b) What do you understand by sampling rate in digital audio? How does it affect the quality of digital audio files produced? Which is the most ideal sampling rate if there is enough storage space? (3)

   (c) In a hypermedia system, what are the advantages and disadvantages of hypertext and hyperlink systems? (3)

9. (a) To create a presentation for the launch of a new product, what are the important points needed to be considered while using public domain images, royalty-free images and rights-managed images in the presentation? (6)

   (b) Discuss the advantages and disadvantages of video compression. (2)

   (c) Differentiate between symbols and icons used in presentation of text. (2)

(200)

Your Roll No...............

Sr. No. of Question Paper : 4911   E

Unique Paper Code   : 62343635

Name of the Paper   : System Administration and
                             Maintenance

Name of the Course   : **B.A. (Prog.)**

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. Question No. 1 is compulsory.

3. Attempt **three** questions from Q. No. 2 to Q. No. 7.

4. Parts of a question must be answered together.

1. (a) Write the features of Windows Operating Systems.

   (2)

   (b) Write differences between Command Line Interface (CLI) and Graphical User Interface (GUI).

   (2)

P.T.O.

(c) Express the following file permission in Linux Operating System in binary and octal forms : (2)

r-x-w-rwx

(d) List any two services provided by an Operating System. Explain how each provides convenience to the user. (2)

(e) Write the difference between absolute pathname and relative pathname. (2)

2. (a) Describe the architecture of Linux Operating System with the help of a diagram. (3)

(b) What is a Firewall. List two applications of firewall? (2)

3. What action will be performed for each of the following commands : (5)

   (i) $ ls > file1

   (ii) $ date + %h

   (iii) $ rm -i file1 file2

(iv) $ cat file1 file2

(v) $ cat > file3

4. (a) What is ASCII Collating Sequence? A Computer uses ASCII as internal representation of characters. In which order will this computer sort the following strings? (3)

CAT, good, 256, CaT, BAT

(b) What information is displayed when ls -l command is executed. (2)

5. (a) Explain the function of each of the following commands with example :- (3)

(i) pwd (ii) pid (iii) md

(b) Differentiate between admin and regular user. (2)

6. (a) Explain three different uses of cat command. (3)

(b) Differentiate between Homegroup and Domain Network types. (2)

P.T.O.

7.   (a) What is the role of the control panel in Windows?

(3)

(b) Differentiate between the ping command and traceroute command.

(2)

Your Roll No...............

Sr. No. of Question Paper : 4953　　　　E

Unique Paper Code　　　: 62347627 (Old Course: CBCS)

Name of the Paper　　　: Information Security and Cyber Laws

Name of the Course　　　: B.A. (Prog.) Computer Applications

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. Section A** is compulsory. Attempt any **five** questions from **Section B**.

3. Parts of a question must be answered together.

SECTION A (Compulsory)

1. (a) What is the role of proxy server in information security? (2)

   (b) Name three password cracking tools. (2)

P.T.O.

(c) What are viruses? Name any three.

(3)

(d) Briefly describe DF1R.

(3)

(e) Explain Caesar cipher with the help of suitable example.

(3)

(f) What is access control? Briefly describe its different approaches.

(4)

(g) List four guidelines of password selection.   (4)

(h) Define the terms - spoofing and phishing.   (4)

SECTION B

2.   (a) Describe the five main components of information security.   (5)

(b) Explain transposition cipher with the help of suitable example.   (5)

3.   (a) What are firewalls? Briefly describe four types of firewalls.   (6)

(b) What do you understand by Hackers? Give classification of hackers.   (4)

4. (a) What are IDS and IPS? Differentiate between the two. (6)

(b) Briefly describe the security issues in an operating system. (4)

5. (a) Describe Steganography. List four different types of Steganography techniques. (3)

(b) Explain the concept of digital signatures. How is it different from digital Certificate? (5)

(c) What do you understand by scanning tools? (2)

6. (a) What is risk analysis? List the steps involved in risk analysis. (4)

(b) What is the difference between DoS and DDoS? (3)

(c) Briefly describe cyber forensics and its importance. (3)

7. (a) Differentiate between : (5)

(i) Active and Passive attacks

(ii) Virus and Trojan Horse

(b) What is TCP session hijacking? (3)

(c) Name four malicious codes. (2)

8. (a) What is a substitution cipher? Obtain the encrypted message for the plaintext UNIVERSITY using Caesar cipher with key 3. Also, decrypt the cipher text VHFXULWB that has been encrypted using a rail fence cipher with key 3. What is the primary advantage of Caesar cipher? Also give one disadvantage of Caesar cipher. (6)

(b) Give the full form of CIA-triad. For each of the following examples, identify which part of the CIA-triad is compromised and how: (4)

  (i) Alice is working on her university application online but the website crashes and she is unable to submit her application on time.

  (ii) Vijay, a class XII student, accesses the CBSE website to check his marks but he was also able to view all the personal details of the students of his school.

  (iii) Alice received a bill of ₹ 80 and accidently she spilled ink on the bill and the bill shows ₹ 8.

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P

[This question paper contains 8 printed pages.]

Your Roll No...............

Sr. No. of Question Paper : 4993   E

Unique Paper Code   : 62341201 (LOCF DSC-2)

Name of the Paper   : Database Management Systems

Name of the Course   : **B.A. (Prog.) Computer Applications**

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. Question no. **1** is Compulsory.

3. Answer any **five** questions from Question No. **2** to **8**.

1. (a) Name the integrity constraint that involves the foreign key. Why is it important?   (2)

   (b) Enumerate three types of relationships used in a relational data model. Explain with the help of examples.   (3)

P.T.O.

(c) Write SQL commands to : (4)

    (i) Create a table Department with following attributes :

Attribute	Data Type
D_id	Integer (5) Primary key
D_Name	VARCHAR (12)
D_Incharge	VARCHAR (10)

    (ii) Assume two suitable input values and insert them in the above table Department.

(d) The College manages the information about its faculty. Draw an ER diagram for the entity Faculty that have single valued attributes F_id (unique), Name, Date_of_joining, Salary, and a multivalued attribute Degrees. (3)

(e) Describe fully functional dependency with a suitable example. (3)

(f) Convert the following code using IN operator :

    Select *

    From Product

    Where p_code = 15 OR p_code=55;   (2)

(g) Consider the following relations :   (2)

A1

ID	value
A	8
B	5
B	8
C	2

A2

Id
A
B

What will be the output on executing the following command :

A1 DIVIDE A2

(h) What do you mean by metadata? Give example.

      (2)

(i) Given the following database Company containing two relations Employee and Project :   (4)

4993

Employee

E_id	NAME	Salary	Proj_Code
1	Kala	70,000	101
2	Rama	30,000	105
3	Rajan	50,000	101
4	Kesh	40,000	103
5	Tarun	80,000	105

Project

Proj_Code	City
101	Delhi
103	Bombay
105	Bangalore

Write the output for the following SQL commands :

(i) SELECT*

FROM Employee

WHERE Salary BETWEEN 40000 AND 80000;

(ii) SELECT NAME, Proj_code, City

FROM Employee, Project

WHERE NOT (E_id =3);

2. (a) Define data redundancy? Illustrate with the help of an example (using relations) how data redundancy leads to the following :

(i) Inconsistency

(ii) Update anomaly (1+4)

(b) Give any three advantages and two disadvantages of DBMS. (5)

3. (a) A Company maintains the following database tables : (6)

Sales_executive, Product, Customer and P_Sales.

Table	Attributes
Sales_executive	S_Id, S_Name, Address, Salary, Date_of_Joining,
Product	P_Id, P_Name, P_Rate
Customer	C_Name, C_Id.
P_Sales	Invoice_No., Date_of_Purchase, P_Id, S_Id. C_Id. Quantity

Construct an ER diagram incorporating the following business rules :

(i) Each Sale executive can write many Invoices but each Invoice is written by only one Sale executive,

(ii) The invoice is written for a single customer but each customer can have many invoices.

(b) Differentiate between strong and weak entity with the help of suitable example.   (4)

4. (a) Explain the three schema architecture with the help of a diagram.   (6)

(b) Differentiate between simple and composite attributes. Explain with the help of an example.   (4)

5. Consider a relation CUSTOMER consisting of the following attributes :   (10)

Attribute Name	Data type
Cus_Code	Varchar(20) Primary key
Name	Varchar(20)
City	Varchar(10)
Agent_Code	Integer
Item_id	Integer

Write SQL code to :

(i) Create the relation CUSTOMER.

(ii) Display the records sorted in ascending order of their Agent_Code.

(iii) List the names and cities of Customers that have item_id between 21 to 30.

(iv) Display number of customers in the relation.

(v) Delete relation CUSTOMER.

6. Consider the following relation instances T1 and T2 :   (10)

Relation *T1*

T_Id	T_Name
1008	Anil
3012	Kusu
2000	Tarun
2002	Ratika

Relation *T2*

T_Id	T_Name
1015	Amit
2105	Varun
2002	Ratika
1008	Anil

Find the result of the following operations :

(i) T1 UNION T2

(ii) T1 DIFFERENCE T2

(iii) T1 INTERSECTION T2

(iv) T1 JOIN T2

(v) SELECT T_Id > 2000

(Note: use the relation T1)

7. (a) Explain network data model. Explain any two disadvantages of the network model. (4+2)

(b) Describe the following DBMS functions : (4)

(i) Database communication interfaces

(ii) Security management

8. (a) Convert the following table in first normal form and identify the primary key in the table. (4)

Project_No	Project_Name	Emp_id	Emp_name	Job_class
1	Ereen	101	Raja	Engineer
		102	Rahul	Designer
2	Star	103	Akansha	Designer
		104	Bharati	Programmer
3	Ambel	101	Raja	Engineer
		104	Bharati	Programmer
		105	Parul	Designer

(b) Differentiate the following with the help of an example : (6)

(i) Centralized and Distributed database

(ii) COMMIT and ROLLBACK command.

(200)

Your Roll No...............

Sr. No. of Question Paper : **5721**   **E**

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? Give an example. (2)

(c) How is the concept of filtering the frames used in bridging? How is a bridged network able to exhibit higher overall performance than a single LAN? (2)

(d) In which mode of communication can data flow in one direction only? Define that mode with an example. (2)

(e) A bit string, 0111110111101111111, needs to be transmitted at the data link layer. What is the 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 HTM1L 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)
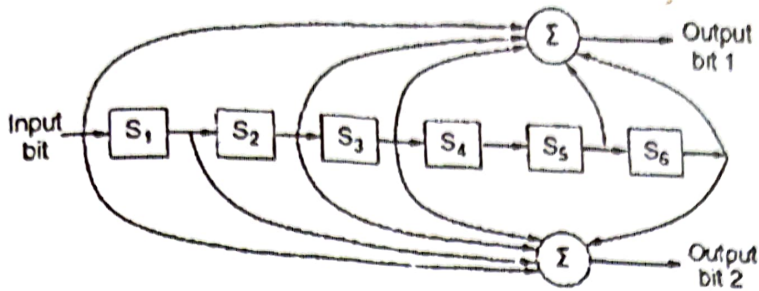
(b) Find the first and last address in the block if one of the addresses is 190.87.140.202/29. How many addresses are there in the block?. What is the network mask? (4)

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)

(200)