

[This question paper contains 8 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : **2206** **IC**

Unique Paper Code : 32341201

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

Name of the Paper : Programming in Java

Semester : II

Time : 3 Hours

Maximum Marks : 75

Instructions for Candidates :

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
- (b) The question paper consists of **two** Sections.
- (c) **Section-A** is compulsory.
- (d) Attempt any **four** questions from **Section-B**.

Section-A

35

1. (a) What is the difference between Java Application and Applet ? 2
- (b) What is the result after execution of following expression in Java ? 2

P.T.O.

(i) `int n=4, m=6, p=5;`

`n += m % p + 2;`

(ii) `int p=2, n=4;`

`int k= n<<p;`

(c) How is the class prevented from being inherited ? Give an example. 3

(d) Give output for the following code : 3

```
class A
```

```
{ static
```

```
    { System.out.println( "THIRD" ); }
```

```
}
```

```
class B extends A
```

```
{ static
```

```
    { System.out.println( "SECOND" ); }
```

```
}
```

```
class C extends B
```

```
{ static
```

```
    { System.out.println( "FIRST" ); }
```

```
}
```

```
public class X
```

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

```
    { C ob = new C( ) ; }
```

```
}
```

- (i) `int n=4, m=6, p=5;`
`n += m % p + 2;`
- (ii) `int p=2, n=4 ;`
`int k= n<<p ;`
- (c) How is the class prevented from being inherited ? Give an example. 3
- (d) Give output for the following code : 3

```
class A
{ static
  { System.out.println( "THIRD"); }
}
class B extends A
{ static
  { System.out.println( "SECOND"); }
}
class C extends B
{ static
  { System.out.println( "FIRST"); }
}
public class X
{ public static void main (String args[])
  { C ob = new C(); }
}
```

- (e) Given the following hierarchy of classes 3

```
class Alpha {.....}
class Beta extends Alpha {.....}
class Gamma extends Beta {.....}
```

In what order are the constructors called when "Gamma" object is instantiated ?

- (f) Given a class **TwoDshape** as below : 4

```
class TwoDshape
{
    private double radius;
    TwoDshape( double r )
    { radius=r; }
    double Getr() { return radius; }
    void setr( double r ) { radius = r; }
    void show() { System.out.println ( " radius: " +
    radius); }
}
```

Create a subclass **Circle** of superclass **TwoDshape** . Define a method **area()** that computes the area of the circle and a constructor that uses "super" to initialize the radius in the class **Circle**.

- (g) What is an Interface ? Show with a suitable example how does a class implement more than one interfaces ? 4
- (h) Describe the following methods, each with suitable example along with their prototypes : 4

- (i) equals()
(ii) indexOf()

- (i) Given the following enumeration, write a Java program that uses "values()" to show the list of constants. 4

```
enum Tools
{ SCREWDRIVER, WRENCH, HAMMER,
  PLIERS }
```

- (j) Given a superclass **shape** as shown below : 6

```
class shape
{ void show()
  { System.out.println("superclass show"); }
}
```

Create two subclasses **rectangle** and **triangle**. Override method **show()** and illustrate dynamic method dispatch.

Section - B

40

2. (a) Rewrite the following statement using ternary operator '?:' : 2

```
if ( num != 0 )
  result= 100/num ;
else
  result=0;
```

- (b) Give output for the following code 3

```
public class T
{ public static void main (String str[])
```

```
{ char ch='5';
int a=4, d, e;
//Character '4' has Unicode 52
char f='4',p='3';
String city="Delhi";
System.out.println("City="+city+5+6);
System.out.println("City="+city+(5+6));
e = a+ch;
d = e+2;
long z=p+a;
System.out.println("f="+f+"e="+e);
System.out.println("d="+d+"z="+z);
}
}
```

- (c) Write a method called **sum()** that takes a variable number of integer arguments and returns the sum of arguments as integer value. 5

3. (a) Find the error from the following snippet : 4
class X

```
{ int a;
X ( int i )
{ a = i; }
```

```

    }
    class Y extends X
    {
        int b;
        y ( int i , int j )
        { b = i ; }
    }
    class M
    { public static void main( String args[] )
    {
        X xob1 = new X(10);
        X xob2;
        Y yob = new Y(5,6);
        xob2 = xob1;
        System.out.println( " xob2.a = " + xob2.a );
        xob2 = yob;
        System.out.println( " xob2.a = " + xob2.a );
        xob2.a = 21;
        xob2.b = 32;
    } }

```

- (b) Write a program to read file **A.txt** and copy the text in **B.txt** file after removing the vowels. 6
4. (a) How can a protected member of a class be accessed by its subclass in a different package? Illustrate with an example. 4

- (b) Create a user defined exception class **MyException** and use this class to signal an error condition if the number is negative. Write a program to compute the square root of a number using user defined method **MySqrt()** which raises exception of type **Myexception** for negative number. 6
5. (a) Describe the following "Applet" class methods with an example along with the prototype 4
- (i) paint()
 - (ii) destroy()
- (b) Create a child thread using "Runnable" interface to print the even numbers from 1 to 10, with the sleep time of 500 ms. 6
6. (a) Write the prototype for methods handling following Frame window functions : 4
- (i) Hiding and showing window
 - (ii) Setting window dimension
 - (iii) Setting window title
 - (iv) Closing a frame window
- (b) What are EventListeners ? Explain any **three** methods of "MouseListener" interface along with respective prototypes. 6

7. (a) Create two push buttons '**No**' and '**Yes**' on Applet window and write a program to display the label of the button when the button is pressed. 5

(b) What is Autoboxing and Autounboxing ? Identify statements where autoboxing and auto-unboxing takes place in the following code and find the output : 5

```
1 class AB
2 { static int m(Integer v)
3   { return v; }
4 public static void main( String args[ ] )
5 {
6   Integer iob = m(1000);
7   System.out.println( iob );
8 }
9 }
```

[This question paper contains 8 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : **2207** **IC**

Unique Paper Code : 32341202

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

Name of the Paper : Discrete Structures

Semester : II

Time : 3 Hours

Maximum Marks : 75

Instructions for Candidates :

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
- (b) Question **No.1** is compulsory in **Section-A**.
- (b) Attempt any **four** questions from **Section-B**.
- (d) Parts of a question should be attempted together.

Section - A

35

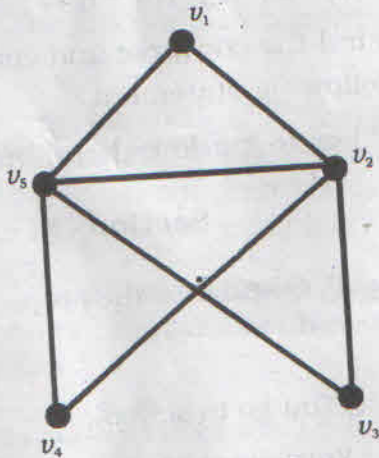
1. (a) In a class of 50 students, there are 2 choices for optional subjects. It is found that 18 students have physics as an optional subject but not chemistry and 25 students have chemistry as an optional subjects but not physics.

5

P.T.O.

- (i) How many students have both optional subjects ?
- (ii) How many students have chemistry as an optional subject ?
- (iii) How many students have physics as an optional subject ?
- (b) Given $A = \{1, 2, 4, 5, 10\}$. Find greatest lower bound and least upper bound for A. 4
- (c) Eight chairs are numbered 1 to 8. Two women and three men are to occupy one chair each. First the women choose the chairs from amongst the chairs 1 to 4 and then men select from the remaining chairs. Find the number of possible arrangements. 4
- (d) A graph has 12 edges, two vertices of degree 3, two vertices of degree 4, and other vertices of degree 5. Find the number of vertices in the graph. 3

- (e) What is the condition for a graph G to have Euler Circuit ? Determine whether the given graph G has Euler circuit or not. Justify your answer. 4



Graph - G

- (f) Sam received a yearly bonus and deposited Rs.10,000 in a local Bank yielding 7% interest compounded annually. Sam wants to know the total amount accumulated after n years. Determine the recurrence relation, initial conditions and total amount accumulated after 3 years. 4

- (g) Consider the function $f: \mathbb{R} \rightarrow \mathbb{R}$ and $g: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = x^2 + 1$ and $g(x) = x + 1$. Find $f \circ g$ and $g \circ f$. 4
- (h) Use Master method to solve the given recurrence relation : 5
 $T(n) = T(9n/10) + n$
- (i) Find the converse and contrapositive of the following statement : 2
If I go to market, then I buy a pen.

Section - B**40**

2. (a) Let P, Q and R be the propositions as follows : 3

P : You go to school.

Q : You appear in the exam.

R : You pass the exam.

Write the following statements in symbolic form :

- (i) You do not go to school and you do not appear in the exam.

(ii) If you do not go to school and you do not appear in the exam, then you do not pass the exam.

(iii) You go to school and you appear in the exam, but you do not pass the exam.

(b) Consider the following statements :

5

Riya is preparing food. If Riya is preparing food then Riya is not going to school. If Riya is not going to school then her father does not make her take the examination.

Using the rules of inference prove "Riya's father does not make her take the examination."

(c) How many vertices does a full 5-ary tree with 100 internal vertices have ?

2

3. (a) Let a be the numeric function such that :

6

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

Determine $S^2 a$ and $S^{-2} a$

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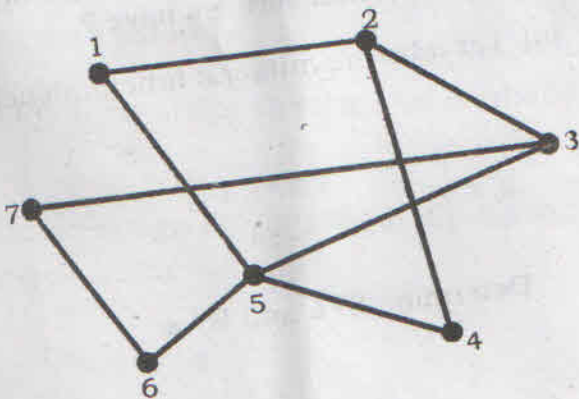
(b) Let $A = \{1, 2, 3, 4\}$ and $B = \{5, 6, 7, 8\}$. A relation R from A to B is defined as $x R y$ if and only if $2x = y$ ($x \in A, y \in B$). Find the elements of R^n . 4

4. (a) Let $A = \{1, 2, 3\}$. Consider the relation $R = \{(1, 1), (2, 2), (2, 3), (3, 3), (3, 2)\}$. 4

Determine the whether relation R is reflexive, symmetric, anti-symmetric or transitive.

(b) What is the chromatic number χ (Chi) of the complete bipartite graph $K_{m, n}$ and C_n where $n \geq 3$. 4

(c) Show that the given graph G is bipartite. Also find the bipartition of graph G : 2



5. (a) Determine the particular solution for the given difference equation : 5

$$a_n + 3a_{n-1} - 10a_{n-2} = n^2 + n + 1$$

- (b) For the second order linear recurrence relation as follows : 5

$$a_r + a_{r-1} + a_{r-2} = 5$$

Given $a_0 = 2$, prove that fewer than 2 values of the numeric function will not be sufficient to determine the numeric function uniquely.

6. (a) (i) Define Big-O notation. 2

(ii) Use the definition of big-theta to prove that $7x^2 + 1 = \theta(x^2)$ 3

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- (b) Use the bubble sort to sort 6, 3, 5, 2, 1, 4, 8, 7 showing the lists obtained at each step.

5

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2208 IC

Unique Paper Code : 32341401

Name of the Paper : Design & Analysis of Algorithms

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. Question No. 1 is compulsory.
3. Attempt any **four** of Questions Nos. 2 to 7.

1. (a) Consider an input of n numbers that are all equal. What would be the running time of the following algorithms for the input :

(i) Merge Sort

(ii) Heap Sort (4)

P.T.O.

(b) Give a recurrence for the running time of the following algorithms to sort n elements.

(i) Maxheapify

(ii) Quicksort (2)

(c) Can Insertion Sort be used as an intermediate sort for Radix sort? Explain why or why not. (3)

(d) Compare the worst case running times of the following operations with respect to red-black trees and binary search trees.

(i) Searching a given key

(ii) Inserting a given key (4)

(e) Recall that the usual implementation of quicksort makes two recursive calls. Consider a variant that optimizes on stack space as follows. It recurses on the smaller subarray as usual, but whenever it needs to recurse on the larger subarray, it uses an iterative module instead. What would be the depth of recursion for this variant? Compare it to the depth of recursion for usual implementation of quicksort. (4)

(f) Give an example graph with 5 nodes that gives two different Minimum Spanning Trees when computed with Prim's algorithm and Kruskal's algorithm. (4)

(g) Consider the following recurrence relation for computing the sum of n natural numbers.

$$F(n) = F(n-1) + n. \quad n > 1$$

$$F(1) = 1$$

What is the running time of the recursive implementation of the above recurrence? Would memoizing the recursive solution improve the running time? Explain. (4)

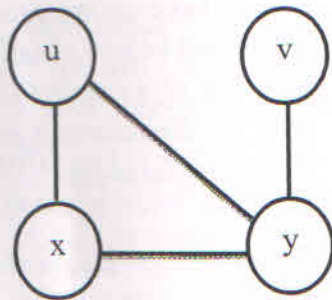
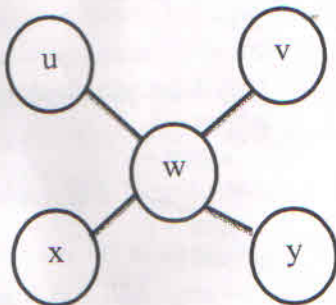
(h) In a certain application it is required to find the nodes adjacent to a given node in a sparse graph. Which of the two representations, namely adjacency list and adjacency matrix, is more suitable? Justify. (4)

(i) Can Depth First Search algorithm be used to determine a shortest path from a source node to a destination node in an unweighted graph? Justify. (3)

- (j) Consider the Interval Scheduling problem wherein we are given a resource and a set of requests each having a start time and a finish time. The goal is to maximize the number of requests scheduled. Show that the following greedy strategy does not give an optimal solution for the above problem: select the request with fewest number of incompatible requests. (3)
2. (a) Let T be a red-black tree and x be a node in it. Let h be the height of the node x in T and d be its depth. Left rotate operation is performed on the node x to give resultant tree T' .
- (i) How does the height of x change post rotation?
- (ii) How does the depth of x change post rotation? (4)
- (b) Give a scenario in which the naive string matching algorithm demonstrates its worst case behaviour. (3)
- (c) Give a recurrence relation for solving the subset sum problem. (3)
3. (a) Consider the following graphs :

2208

5

 G_1  G_2 

For each of the graphs, specify whether the graph is bipartite or not. If it is bipartite then give the two partitions else justify. (4)

- (b) Recall the scheduling problem wherein we are given a single resource and a set of requests having deadlines. A request is said to be late if it misses the deadline. Our goal is to minimize the maximum lateness. With respect to a schedule S , we define idle time as the time during which the resource is idle, in between two requests. S is

P.T.O.

said to have an inversion when request i has been scheduled before j , and $d(i) > d(j)$ ($d(k)$ being the deadline of a request k). Argue that all schedules with no idle time and no inversions have the same maximum lateness. (6)

4. (a) Consider the Heapsort Algorithm. Fill in the missing details correctly. (3)

Assume $A[1 \dots \text{length}]$ be the array to be sorted

MaxHeapify(A,i)

$l=2*i$

$r=2*i+1$

if $l \leq A.\text{heapsize}$ and $A[l] > A[r]$

largest = l

else largest = i

if $r \leq A.\text{heapsize}$ and $A[r] > A[\text{largest}]$

largest = r

if largest $\neq i$

exchange $A[i]$ and $A[\text{largest}]$

Maxheapify(A, _____)

BuildMaxHeap(A)

$A.\text{heapsize} = A.\text{length}$

for $i =$ _____

MaxHeapify (A,i)

Heapsort(A)

BuildMaxHeap (A)

for $i = A.\text{lengthdownto } 2$

exchange $A[_]$ with $A[i]$

$A.\text{heapsize} = A.\text{heapsize} - 1$

MaxHeapify (A, $_$)

- (b) Is the following recurrence for the Knapsack problem correct? If not, give the correct recurrence. Justify your answer in either case.

If $w < w_i$, then $OPT(i,w) = OPT(i-1,w)$

Otherwise, $OPT(i,w) = \max(OPT(i-1,w), v_i + OPT(i-1, w - w_i))$ (4)

- (c) Give an algorithm to determine if a given undirected graph is connected. (3)
5. (a) Consider a stack that supports the operations Push, Pop and Multi-push (pushes k items onto the stack). Suppose a sequence of n operations is performed on the stack. Would the amortized cost of an operation be $O(1)$? Explain. (4)
- (b) If quick sort is run on an n sized array such that the array is always divided into 2 equal halves. How many times is the partition algorithm called? Explain briefly. (3)
- (c) Consider the weighted interval scheduling problem. Will the following greedy strategy work? Justify. While requests remain, Choose and add a request to solution that has the largest starting time and delete all non-compatible requests. (3)

6. (a) In randomized-select algorithm randomized partition subroutine is used. If we replace the

randomized partition by a partition subroutine which chooses the last element of the list as pivot and call the modified algorithm as the *select* algorithm. What affect does it have on the running time of the select algorithm? (3)

(b) Show that any directed graph having a topological ordering must be acyclic. (4)

(c) For the elements 6, 2, 8, 3, 10; give a valid Red Black tree. (3)

7. (a) A d-ary heap is like a binary heap, except that nodes may have d children instead of two children. Consider a 3-ary heap represented using an array, how would the indices of the three children of a node be computed? (3)

(b) A thief wants to steal all the gold dust from a store having W kg of it. The thief has n sacks having different capacities. Give an efficient algorithm for the thief to fill his sacks with dust so that the number of sacks used is minimized. (3)

(c) Discuss the running time of the following function :
func(A)

```

for i = 0 to A.length - 2
  for j = i+1 to A.length - 1
    if (A[j-1] > A[j] )
      exchange (A[j-1] and A[j] ) (4)

```

[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2209 **IC**
Unique Paper Code : 32341402
Name of the Paper : Software Engineering
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. **All** questions in '**Section A**' are compulsory.
3. Attempt any **five** questions from '**Section B**'.
4. Parts of a question must be answered together.

SECTION A

1. (i) Which of the following Software Process Model is more effective? Give one reason. Incremental Model or Linear sequential Model. (2)

P.T.O.

- (ii) Write the difference between Direct and Indirect metric. Give one example for both the metrics. (3)
- (iii) What do you mean by Reactive and Proactive risk strategies? (3)
- (iv) Explain the following characteristics of SRS :
- (a) Verifiable
 - (b) Traceable (3)
- (v) State the significance of a Gantt Chart for scheduling and monitoring a software project. (2)
- (vi) Explain the following two measures of Software Quality :
- (a) Usability
 - (b) Correctness (3)
- (vii) Explain with the help of a diagram failure curves for software. (3)
- (viii) At the conclusion of a project, it has been determined that 30 errors were found during the modeling activity and 12 errors were found during the construction activity. What is the Defect Removal Efficiency for this activity? (2)

- (ix) Write any three ways to achieve reliable cost and effort estimates. (3)
- (x) A system has 2 external inputs, 5 external outputs, 3 external queries, manages 5 internal logical files, and interfaces with 3 external legacy systems. All of these data are of simple complexity 3, 4, 3, 7, and 5 respectively. The overall system is relatively simple. Compute Function Point for the system. (3)
- (xi) State the advantages & disadvantages (three each) of Spiral model. (3)
- (xii) List different types of System Testing. (3)
- (xiii) What are the two approaches used for designing hierarchy of components when we are designing a software? (2)

SECTION B

2. (a) What is cohesion? Discuss briefly any three levels of Cohesion? (6)
- (b) Explain briefly the first four layers of CMMI. (4)
3. (a) What are software reviews? Explain Defect Amplification Model when no reviews are conducted. (5)

- (b) Differentiate between white box and black box testing methods. (5)
4. (a) A supermarket develops the following software to encourage regular customers. For this,
1. The customer needs to supply his/her residence address and telephone number.
 2. Each customer who registers for this scheme is assigned a unique customer number (CN) by the computer.
 3. A customer can present his CN to the check out staff when he makes any purchase. In this case, the value of his purchase is credited against his CN.
 4. At the end of each year, the supermarket intends to award surprise gifts to 10 customers who make the highest total purchase over the year.
 5. Also, it intends to award a 22 carat gold coin to every customer whose purchase exceeded Rs. 10,000. The entries against the CN are reset on the day of every year after the prize winners' lists are generated.

Draw a Context level and level 1 Data Flow Diagram for the system given above. Also develop Data Dictionary for the same. (8)

(b) What is Transform Mapping? (2)

5. (a) Use the flow graph to find Cyclomatic Complexity of the following code. Also Write the independent paths and show the regions :

Begin

Int x,y,power;

Float z;

Input(x,y);

If(y<0)

 Power = -y;

Else

 Power = y;

Z=1;

While(power !=0) {

 Z=z*x;

 Power = power-1;

}

If(y<0)

 Z=1/z;

Output(z);

End

(6)

P.T.O.

- (b) What do you understand by Risk Exposure? In a component based system 60 reusable software components were planned. From these components only 70 percent can be used, rest have to be developed from the scratch. Cost for each LOC is \$14.00. The probability of this risk occurrence is 80%. Compute Risk Exposure. (4)
6. (a) What is boundary value testing? State the guidelines to create boundary value testing for test cases with two examples. (5)
- (b) Use the COCOMO II model to estimate the effort required to build software that produces 10 screens and 8 reports, and will require approximately 80 software components. Assume average complexity Screen-2, Reports-5, 3CGL components-10 and average/developer/environment maturity as 13. Use the application composition model with object points. (5)
7. Write short notes on :- (Any two)
- (i) Unit Testing
 - (ii) Prototyping Model
 - (iii) Software Engineering a layered technology
- (10)

[This question paper contains 10 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2210

IC

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) In the Restaurant relation given below : (4)

P.T.O.

RESTAURANT

DishNo	Dish_Desc	Price (Rs.)	Bill_No	Qty	Table_No	Day	Waiter
D1	Idli	60	B1	2	T1	Mon	Wt1
D2	Dosa	80	B2	3	T1	Mon	Wt2
D3	Poha	50	B3	2	T3	Tues	Wt3

Find out which of the following dependencies are violated? Justify your answer.

(i) Dish_Desc \rightarrow Price

(ii) Bill_No \rightarrow Qty

(b) What are the four different types of database users. Specify their roles. (4)

(c) Justify that primary key cannot be null. (2)

(d) Two transactions T1 and T2 are executing concurrently (assuming concurrency control is not in place) with initial value of X=50 and Y=5

T1
 read_item(X)
 X = X+10

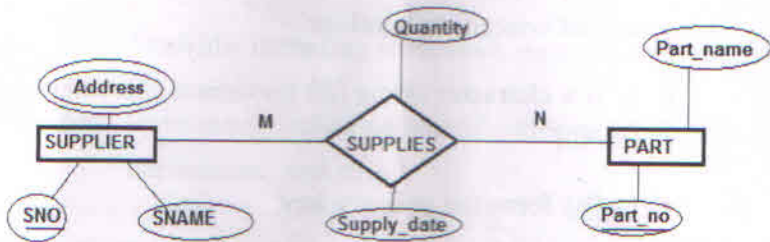
write_Item(X)
 read_item(Y)

T2
 read_item(X)
 X = X+Y

write_Item(X)

After the completion of the transactions T1 and T2 what will be the value of X. Is this the correct value, if not specify the problem. (4)

(e) Map the following ER diagram to their corresponding relational tables. (4)



(f) Consider the tables T1 and T2 given below : (2×3)

T1

A	B	C
1	3	1
3	2	1

T2

X	Y	Z
1	3	1
2	5	4

Show the results of the following operations :

(i) $T1 \bowtie_{T1.X=T2.C} T2$

(ii) $T1 \cap T2$

(iii) $\Pi_{T1.Z, T2.C} (\sigma_{T1.Y=T2.B} (T1 \times T2))$

P.T.O.

(g) Why is it necessary to give role names in a recursive relationship? (2)

(h) Give SQL command to create a relational table T having attributes A, B, C, D where : (5)

- A is a number (maximum 10 digits in length) and cannot contain null values.
- B is a character string (50 maximum characters in length)
- (A, B) form the primary key
- C and D are integer values.
- Default value of C is 6
- D is a foreign key referring to E from another table S of the database (assuming S is already created).

(i) Give EER diagram illustrating each of the following : (4)

(i) total-disjoint specialization and

(ii) partial-disjoint specialization

Section B

2. A university registrar's office maintains data about the following entities : (10)

- (i) Courses, including number, title, credits, syllabus, and prerequisites;
- (ii) Course offerings, including course number, year, semester, section number, instructor(s), timings, and classroom;
- (iii) Students, including student-id, name, and program;
- (iv) Instructors, including identification number, name, department, and title.

Design an ER schema for this application. Specify key attribute of each entity type and structural constraints on each relationship type.

3. (a) Consider the following relations : (1+1+2+2)

CUSTOMER(Customer#, Customer_Name, City, Product#)

PRODUCT(Prod#, Prod_Name, Prod_Details)

- (i) Write a command to insert a new attribute Price in PRODUCT relation.
- (ii) Write a command to delete rows from PRODUCT table for Prod_Name = 'P2'.

- (iii) Retrieve the list of customers who have purchased product with Prod_Name as 'P3' and 'P4'.
- (iv) Retrieve the total number of products bought by each customer.

(b) Two sets of FDs for a relation R (A, B, C, D, E) are given as follows: (4)

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

$G = \{A \rightarrow BC, D \rightarrow AE\}$

Find out whether F and G equivalent. Justify your answer.

4. (a) Consider the following relation: (6)

STUDENT

<u>ID</u>	NAME	COURSE	PHONENO.	PROJECTNO	PROJECTNAME
-----------	------	--------	----------	-----------	-------------

Assume that ID is primary key and the following dependency holds in the above relation:

PROJECTNO \rightarrow PROJECTNAME

Give an instance of the STUDENT table and in the context of that instance illustrate the following concepts :

- (i) updation anomaly
 - (ii) insertion anomaly
 - (iii) deletion anomaly
- (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)

Entity1

College

Student

Course

Book

Entity2

Principal

Course

Book

Author

5. Consider the given relations :

WORKER

<u>ID</u>	Name	Salary	JoiningDate	Department#
-----------	------	--------	-------------	-------------

DEPARTMENT

<u>DepID</u>	DName	Location	Mgr#
--------------	-------	----------	------

Write following queries in relational algebra for the relations given above :- (2×5)

- (i) Display name of all the workers along with their department name and manager name of that department.
- (ii) Count number of workers working in finance department.
- (iii) Show number of workers working in each department along with department name.
- (iv) Find Average salary of each department.
- (v) Retrieve the names of workers who have joined after the year 2010.

6. (a) Consider the following relation : (2+3)

BOOK

BookID	GenreID	GenreType	Price
--------	---------	-----------	-------

Following dependencies hold in the relation :

BookID \rightarrow GenreID, Price

GenreID \rightarrow GenreType

- (i) Find Primary key of the above relation.
- (ii) Apply normalization to convert it into 3NF stating the reasons behind each decomposition.
- (b) Consider an ordered file with number of records $r = 30000$ stored on a disk with block size $B = 1024$ bytes and record size = 100 bytes.
- (i) Find the blocking factor for the file.
- (ii) The number of blocks needed for the file and
- (iii) Number of block accesses needed by a binary search on this data file.
- (iv) How many block accesses would be required if you create a primary index on a key field of size 9 bytes and size of block pointer 6 bytes. (1+1+1+2)
7. (a) Consider a file with the following key values: 19, 5, 12, 7, 40, 3, 15. Suppose these search key values are inserted in the given order in a B+ tree of order $p = 3$. Show the tree at each step. (6)
- (b) Consider the database schema given below :- (4)

Book(Book Id, Title, Publisher)

Book_copies(Book Id, Branch Id, No. of Copies)

Library_branch(Branch Id, BranchName, Address)

Book_Authors(Book Id, AuthorName)

Depict the referential integrity constraints diagrammatically using schema diagram.

[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2211 IC

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. **Section A** is compulsory.
3. Attempt any 4 of questions from **Section B**.
4. Parts of a question must be answered together.

SECTION A

1. (a) What is a Horn clause? Give an example. (2)
(b) In the following expression, add parenthesis at appropriate places (as per operators precedence).

$$P \& Q \vee \sim R \& S \rightarrow \sim T \vee X \rightarrow Y \quad (2)$$

P.T.O.

- (c) How FOPL is better than Propositional logic? (2)
- (d) Describe the following terms :
- (i) Rationality
 - (ii) Software Agent (4)
- (e) Give the architecture of a problem solver with a Truth Maintenance System. (3)
- (f) Write a Prolog program to calculate the length of a given list, L. (4)
- (g) Describe the limitations of Hill climbing search. (3)
- (h) Define the PEAS for taxi Driver Agent. (3)
- (i) Define Heuristic Search technique. What is the role of a heuristic function? (4)
- (j) Find whether the following set is unifiable or not? If unifiable, find most general unifier (m.g.u.).
{S(x, Ram), S(y, Sita)} (2)
- (k) Give the conceptual dependency representation for the following :
Ram gave Sita for a pencil. (2)

- (l) Develop a parse tree for the sentence "Raja slept on the sofa" using the following rules: (4)

S → NP VP
NP → N | DET N
VP → V | PP
PP → PREP NP
N → Raja | sofa
V → slept
DET → the
PREP → on

SECTION B

2. (a) Define utility based agents and list their benefits. (5)
- (b) Elaborate on the additional capabilities of an Augmented Transition Network (ATN) as compared to a Recursive Transition Network (RTN). (2)
- (c) Draw an associative network for the following sentence :

Tweety is a Yellow bird that has wings and tail. (3)

P.T.O.

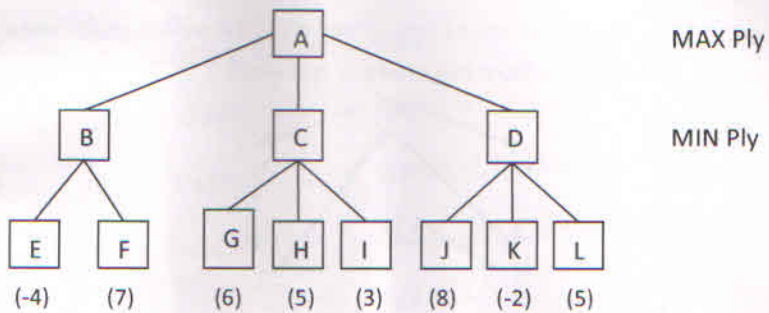
3. (a) Write a script for watching a movie in a cinema hall. (5)
- (b) Find the probability of the event A when it is known that some event B occurred. From experiments, it has been determined that $P(B|A) = 0.84$, $P(A) = 0.2$, and $P(B) = 0.34$. (3)
- (c) Determine if the following sentence S is satisfiable, contradictory or valid.

$$S: P \rightarrow Q \rightarrow \neg P \quad (2)$$

4. (a) Solve the crypt arithmetic problem :

$$\begin{array}{r} \text{TWO} \\ + \text{TWO} \\ \hline \text{FOUR} \end{array} \quad (4)$$

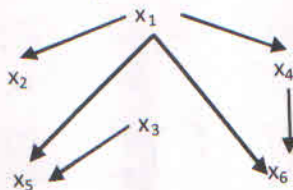
- (b) Transform the following sentence into CNF :-
 $(\sim A \ \& \ B) \vee (A \ \& \ \sim B) \ \& \ C$ (3)
- (c) Consider the following game tree with ply depth 2, in which the indicated scores are from the MAX player's point of view. What move should MAX choose, and why? (3)



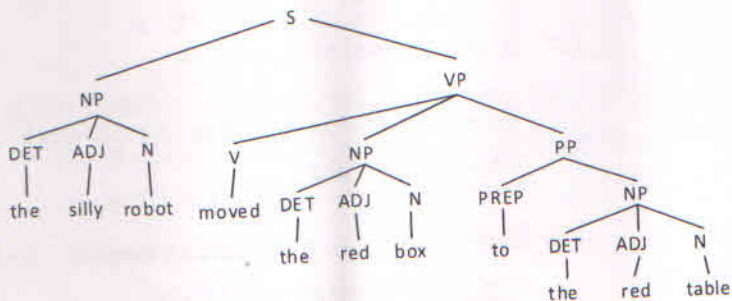
5. (a) What do you understand by default reasoning in knowledge representation? (2)
- (a) How a problem is solved using Mean-Ends Analysis. Explain in your own words. (2)
- (c) Given the following information for a database:
- A1. If x is on top of y, y supports x.
 - A2. If x is above y and they are 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. (6)

P.T.O.

6. (a) Write the joint distribution of $x_1, x_2, x_3, x_4, x_5,$ and x_6 as a product of the chain conditional probabilities for the following causal network: (3)



- (b) What do you understand by alpha-beta cutoffs. Describe the method of alpha-beta pruning using these cutoffs with the help of an example. (4)
- (c) Explain, why should the heuristic function of A^* underestimate? (3)
7. (a) What is the use of "cut" utility in Prolog? (2)
- (b) Describe Water-Jug problem and give its suitable state space representation. (4)
- (c) Based on the context free grammar represented by the following parse tree, draw the corresponding Recursive Transition Network (RTN). (4)



(1400)

[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2212

IC

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 the condition for trivial rejection of a line segment PQ with $P(0,5)$ & $Q(1,5)$ in Cohen Sutherland Line Clipping algorithm using rectangular window defined by vertices $A(0,0)$, $B(1,0)$, $C(1,1)$, and $D(0,1)$.
(3)

P.T.O.

- (b) Consider a Bezier Curve with end point P1 and P4 in x direction as 3 and 7 respectively. The two intermediate control points P2 being 5 and P3 being 6 in x direction. What will be the magnitude of starting tangent vector R1 and magnitude of ending tangent vector R4 in x direction? (3)
- (c) Suppose we have a video monitor with a display area that measures 12 inches across and 9.6 inches high. If the resolution is 1280 by 1024 and the aspect ratio is 1:1, what is the diameter of each screen point? (3)
- (d) What should be the pattern of frame spacing in order to simulate
- (i) Negative acceleration in an animation scene?
 - (ii) Positive acceleration in an animation scene?
 - (iii) Constant acceleration in an animation scene? (3)
- (e) Explain why a CMY color model is a subtractive color model. What does C, Y and M in this color model represent? (3)

- (f) How can you compute the depth value $Z(x,y)$ in z-buffer algorithm. Using incremental calculations find out the depth value $Z(x+1, y)$ and $Z(x, y+1)$. (3)
- (g) Using homogeneous co-ordinates, write the transformation matrix in order to double the size of an object. Use overall scaling. (3)
- (h) What is dithering? What is its advantage over half toning? (3)
- (i) What is anti-aliasing? Give any two techniques to avoid aliasing in a line. (3)
- (j) Consider a rectangle ABCD with $A(5,5)$, $B(10,5)$, $C(10,10)$ and $D(5,10)$. Using Odd parity rule, discuss whether the following horizontal lines of the rectangle will be drawn or not?
- (i) AB
- (ii) CD (3)
- (k) Indicate the next raster positions which will be chosen by Bresenham's line algorithm when scan converting a line from screen co-ordinate $(1, 1)$ to $(3, 2)$. (3)

- (l) State any two differences between parallel and perspective projection. (2)

Section B

2. (a) Show that a 2D reflection through x axis, followed by a 2D reflection through the line $y=x$, is equivalent to a pure rotation about the origin. (4)
- (b) Using the mid-point circle drawing algorithm, scan convert the first quadrant of a thick circle with centre at $(0, 0)$, radius of 5 units and thickness of 2 units. Give first four raster positions. (6)
3. (a) Derive the specular reflection equation at a surface point using Phong specular reflection model. (4)
- (b) Using Sutherland Hodgeman polygon clipping algorithm, clip the triangle ABC with the vertices as $A(10,17)$, $B(13,12)$, and $C(3,8)$, against a rectangular window $P(5,5)$, $Q(15,5)$, $R(15,15)$, and $S(5,15)$. Give the co-ordinates of the clipped polygons. (6)

4. (a) Consider a triangle ABC with vertices $A(1,0)$, $B(0,1)$, and $C(-1,0)$. Reflect it about the line $y=x$ followed by counter clockwise rotation of 90° , keeping point B fixed. Give the new co-ordinates of the triangle after transformation. (6)

- (b) A unit square is transformed by 2×2 transformation matrix. The resulting position vectors are as shown below. Give the transformation matrix applied to the unit square?

$$\begin{bmatrix} 0 & 2 & 8 & 6 \\ 0 & 3 & 4 & 1 \end{bmatrix} \quad (4)$$

5. (a) In a chromacity diagram of a RGB color model, define complementary colors and pure colors. (4)

- (b) Differentiate between trimetric and isometric axonometric projections. (3)

- (c) List and explain the data structures used in scan line fill algorithm. (3)

6. (a) Derive the Basis Matrix for parametric cubic Hermite Curves. Also, obtain its blending functions. (5)

(b) Explain Warnock's Area Sub Division algorithm for visible surface determination. Does it use edge coherence or area coherence? (5)

7. (a) Specify the rules to equalize the set of edges in key frames 'k' and 'k+1' in an animation scene. Using these rules, transform a triangle into a pentagon. (5)

(b) Consider a triangle ABC with $A(0,0)$, $B(5,0)$ and $C(0,5)$. Apply single point perspective projection onto $y=0$ plane from centre of projection at $y_c = -2$. Also, state the co-ordinates of the vanishing points. (5)

[This question paper contains 10 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2291

IC

Unique Paper Code : 42341202

Name of the Paper : Database Management Systems

Name of the Course : B.Sc. (Prog.) / Math. 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. Question 1 is compulsory.
3. Answer any five questions out of remaining questions (Q2-Q8).
4. Answer all parts of a question together.

1. (a) What is data redundancy? What are the disadvantages of having redundancy within a database? (2)

(b) What is meant by degree of a relationship type? (2)

P.T.O.

(c) From the tables **R** and **S**, find the following :

(i) $R \cup S$ (1)

(ii) $S - R$ (1)

(iii) Cartesian Product of **R** and **S** (2)

R

S

Sno	Dept
S1	Phy
S2	Psy
S3	Chem
S4	Jour

Sno	Dept
S10	Maths1
S3	Chem
S15	Eng
S16	Maths2

(d) Given the following table and its associated functional dependencies. (3)

Emp_proj

<u>Emp_id</u>	<u>Project_id</u>	Hours	Emp_name	Proj_name
---------------	-------------------	-------	----------	-----------

$Emp_id \rightarrow Emp_name$

$Proj_id \rightarrow Project_id$

$Emp_id, Proj_id \rightarrow Hours$

What is the highest normal form that the relation **Emp_proj** satisfies? Justify your answer.

(e) Give an example for each of the following: (2)

(i) Total participation

(ii) Recursive relationship

- (f) Illustrate with the help of an example an anomaly that might arise if referential integrity constraint is not satisfied in a relational schema? (2)
- (g) Consider the following table TABLE 1: (2)

TABLE 1

X	Y	Z
2	3	1
3	4	2
4	5	3
5	6	4
6	7	1
2	3	1

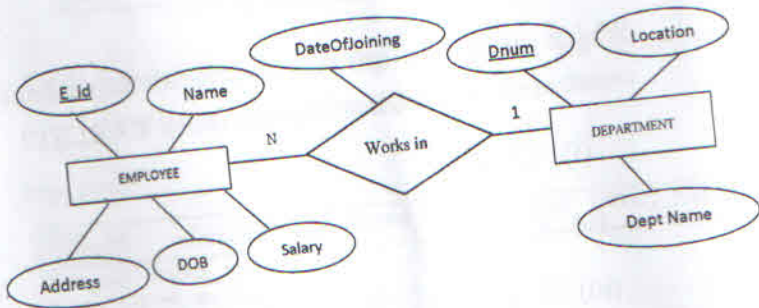
Which of the following functional dependency constraints do not hold in the table TABLE1?

- (i) $YZ \rightarrow X$
- (ii) $X \rightarrow Z$
- (iii) $X \rightarrow Y$
- (iv) $Z \rightarrow X$
- (h) What is Cardinality ratio? For the binary relationships below suggest cardinality ratios based on the meaning of the Entity types. State any assumptions you make. (3)

ENTITY 1	Cardinality	Ratio	ENTITY 2
STUDENT	_____		TEACHER
COUNTRY	_____		CURRENT_PRESIDENT
ITEM	_____		ORDER

(in an order)

- (i) What enhancements distinguish the EER model from the ER model? (2)
- (j) Identify the tables needed to store the following model. You should not introduce tables unnecessarily. (3)



2. (a) What do you mean by the following terms? (4)

(i) Database catalog

(ii) Meta data

- (b) What are the responsibilities of a database administrator? (2)

(c) Describe the 3-schema architecture. Why do we need mappings between schema levels? (4)

3. A University registrar's office maintains a database about the students having the following entities : (10)

- o courses, including number, title, credits, syllabus and prerequisites;
- o course offerings, including course number, year, semester, section number, instructor(s), timings and classroom;
- o students, including student-id, name and program;
- o instructors, including identification number, name, department, and title.

Further, for each student's enrollment in courses and grades awarded in each course in which the student is enrolled must be appropriately modeled.

- (i) Identify the entities of interest.
- (ii) Identify essential attributes associated with each entity with primary attributes marked.
- (iii) Construct an E-R diagram for the registrar's office. State all assumptions that you make about the mapping constraints.

4. (a) Consider the following relational schema : (6)

Employee (eno, ename, dnum, dob, salary, street, city)
Works for (eno, proj no, hrs)
Department (dname, dno, mgr_no)

Give the following queries in relational algebra :

(i) Retrieve the name and address of all employees who work for **Research** department

(ii) Find the employee names who are either working in department no 4 and earn over 25,000 or are in department no 5 and earn over 30,000.

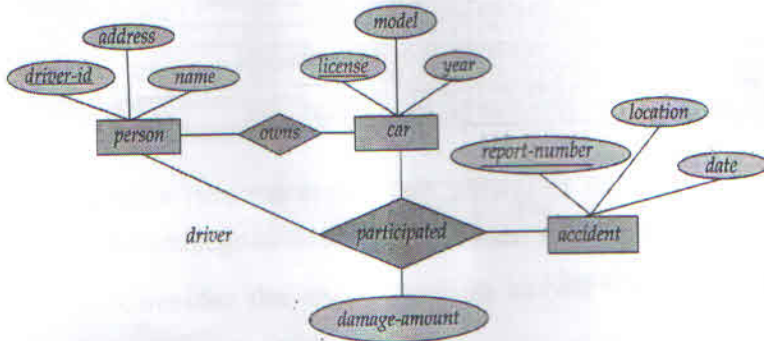
(iii) Find the names and salary of all managers.

- (b) Differentiate between the following : (4)

(i) single valued attributes and multivalued attributes

(ii) intension and extension

5. (a) Given below is the ER diagram which models the **Car Insurance System**. Map the diagram into relational schema. Specify the primary key and foreign key. (6)



ER Diagram for the **Car Insurance System**

(b) Consider a relation **R(A,B,C,D)** with the following functional dependencies. (4)

$$AB \rightarrow C$$

$$CD \rightarrow E$$

$$DE \rightarrow B$$

Find out the candidate key for the above dependencies.

6. (a) Consider the following table : (5)

EMP_DEPT(EId, Ename, bdate, address, dnumber, dname, mgrssn)

EId	Ename	Bdate	Address	dnumber	dname	Mgrssn
E101	Ajay	10/02/1980	H-123, Janakpuri	D1	Sales	E106
E104	Swati	05/07/1974	A-5, Rani Bagh	D2	HR	E112
E105	Riya	12/10/1982	F-19, kirti Nagar	D5	IT	E105
E106	Deepak	07/07/1970	A-66, Pitampura	D1	Sales	E106
E112	Amit	15/03/1972	GH-34, PVIhar	D3	Admin	E112
E110	Deepti	06/05/1985	A1-23, Janakpuri	D5	IT	E105

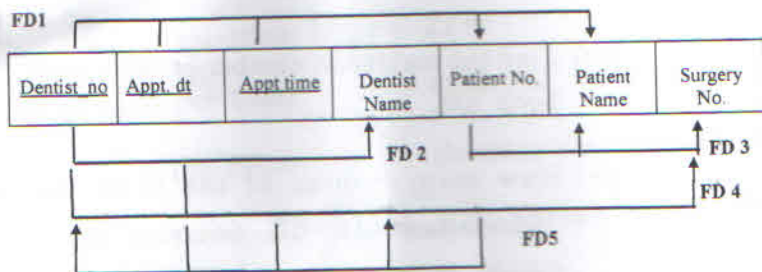
If the following operations are performed, check if one or more of the following constraints are violated :

domain constraint, key constraint, entity integrity constraint

- (i) Insert a tuple ('E106', 'Supriya', '01/01/1992', 'X-22, Vasant Kunj', D5, 'IT', 'E105') into the **EMP_DEPT** table.
 - (ii) Insert a tuple ('E122', 'Rama', '11/07/1989', 'MM-122, Kalu Saray', D1, 'Sales', 'E106') into the **EMP_DEPT** table.
 - (iii) Insert a tuple (NULL, 'Zaheer', '11/02/1995', 'AA-98, Rajpur Road'sant Kunj', D5, 'IT', 'E105') into the **EMP_DEPT** table
- (b) Using diagrams give an examples illustrating the following concepts:
specialization hierarchy and specialization lattice.

7. (a)

(8)



Consider the above relation having the depicted functional dependencies.

Apply normalization successively till 3NF. State the reasons behind each decomposition.

(b) Prove that a relation schema $R(A, B)$ with two attributes is always in BCNF. (2)

8. (a) Consider the following schema about a library system having several branches.

BOOK (BookId , Title , PublisherName)
 BOOK_COPIES (BookId, BranchId , NoOfCopies)
 LIBRARY_BRANCH (BranchId, BranchName , Address)
 BOOK_AUTHORS (BookId , AuthorName)
 BOOK_LOANS (BookId, BranchId, CardNo, DateIssue, DueDate)
 BORROWER (CardNo, Name, phone , Address)

Write the following queries in SQL : (2×5=10)

(i) List the title of books issued to 'Ramesh'.

- (ii) Change the Publisher Name of BookId B10 to '**BPB**'.
- (iii) Find the maximum number of copies that a book has.
- (iv) How many copies of the book titled '**Fundamentals of Accounting**' are owned by each library branch?
- (v) Give the list of book titles, branch-wise.

This question paper contains 7 printed pages]

Roll No.

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S. No. of Question Paper : 2295

Unique Paper Code : 42344403

IC

Name of the Paper : Computer System Architecture

Name of the Course : B.Sc. (Programme) (Physical
Sciences/Mathematical Sciences)

Semester : IV

Duration : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Question No. 1 is compulsory.

Attempt any five questions from Section B.

Section A

(Compulsory)

1. (a) Obtain 10's complement of the six-digit decimal number
909951.

1

P.T.O.

- (b) Given the following : 1

$$R3 \leftarrow R1 + (R2)' + 1$$

Specify the output of this micro-operation.

- (c) List the instructions needed in the basic computer in order to set E flip-flop to 1. 2
- (d) Differentiate between a positive and a negative edge triggered flip-flop. 2
- (e) What is a Binary counter ? How many flip-flops will be required for an n-bit binary counter ? 2
- (f) Convert the following numbers with the indicated bases to decimal : 2
- (i) $(12121)_3$
- (ii) $(4310)_5$
- (g) Give the characteristic table of JK flip-flop. 2
- (h) Simplify the following expression using Boolean algebra (Show all the steps) : 2

$$(B.C' + A'.D) . (A.B' + C.D')$$

- (i) Differentiate between RAM and ROM. 2
- (j) Using zero address instructions, write a program to evaluate the following arithmetic statement : 3

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

- (k) What do you understand by DMA ? Explain the process of DMA transfer. 3
- (l) Explain why the following micro-operation cannot be executed during a single clock pulse : 3

$$DR \leftarrow DR + AC \text{ (AC does not change)}$$

Specify the sequence of micro-operations performed to execute it.

Section B

(Attempt any five questions)

2. (a) Simplify the Boolean function F together with don't care conditions d in the sum of products form : 6

$$F(w, x, y, z) = \Sigma (0, 1, 2, 3, 7, 8, 10)$$

$$d(w, x, y, z) = \Sigma (5, 6, 11, 15)$$

Implement F using minimal number of NAND gates.

- (b) The content of AC in the basic computer is hexadecimal A675 and the initial value of E is 1. Determine the contents of AC, E, PC, AR and IR in hexadecimal after the execution of the CMA instruction (7200). The initial value of PC is hexadecimal 072. 4
3. (a) Draw a block diagram to construct a 5-to-32 line decoder with four 3-to-8 line decoders and one 2-to-4 line decoder. 5
- (b) An instruction is stored at location 300 with address field at location 301. The address field has the value 400. A process register R1 contains the number 200. Evaluate the effective address if the addressing mode of the instruction is : 5
- (i) Direct
 - (ii) Immediate
 - (iii) Relative
 - (iv) Register Indirect
 - (v) Index with R1 as the index register.

4. (a) What is a half adder ? Give its function table. Design a 4-bit binary incrementer using half-adders. 6
- (b) Convert as directed : 4
- (i) $(11000011.10101)_2 = (?)_{16}$
- (ii) $(736)_8 = (?)_{10}$
5. (a) The contents of Register A and Register B are 11001100 and 00110011 respectively. List the contents of Register A if the following operations are carried out on contents of A using contents of B : 6
- (i) Selective Complement
- (ii) Masking
- (iii) Selective Set.
- (b) Write the micro-operations performed to execute the following instructions : 4
- (i) BSA
- (ii) AND to AC.

6. (a) Explain the three different types of instruction formats.
Given the following instructions (in hexadecimal), identify the category to which they belong : 5

(i) 7800

(ii) F800.

- (b) Perform the following arithmetic operation using signed 2's complement representation for negative numbers : 3

$$(-38)_{10} - (+85)_{10}$$

- (c) How many address lines and input-output data lines are needed for a memory unit of 16M words \times 32 bits per word ? 2

7. (a) What is a multiplexer ? Explain the working of 4-to-1 MUX with a suitable diagram. 5
- (b) Find the hexadecimal equivalent of $(189.75)_{10}$. 2
- (c) List the micro-operations performed during fetch & decode phase of an instruction. 3

8. (a) Differentiate between : 4
- (i) Isolated I/O and memory mapped I/O
 - (ii) Synchronous and Asynchronous Data Transfer.
- (b) Design a combinatorial circuit with three inputs x, y, z and three outputs A, B, C. When the binary input is 0, 1, 2, or 3, the binary output is one greater than the input; otherwise the binary output is one less than the input. 6

Photo Copy Computer

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2309 IC
Unique Paper Code : 42347903
Name of the Paper : Internet Technology
Name of the Course : B.Sc. (P) / B.Sc. Math.
Sciences
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 **five** questions from **Section B**.

SECTION – A

1. (a) Write the HTML code to create a link to a page 'showPage.html'. The link text that appears should read 'Click Here for more information'.
(2)

P.T.O.

(b) Write the CSS code to :

(i) set the **size of the text** to 7 in element **H3**.

(ii) set the **color of the text** in element **P** to **blue**. (2)

(c) Write a function in **JavaScript** to accept a number as argument and return its **cube**. (2)

(d) What is the difference between **reset** and **submit** button? (2)

(e) When is '**onLoad**' event executed in **JavaScript**? Illustrate with an example. (2)

(f) What is the use of **abstract** class in Java? (2)

(g) Give one difference between **throw** and **throws** in Java. (2)

(h) Give the output for the following **JavaScript** code :

```
var day = "Sunday"  
(day == "Sunday") ? "Weekend" : "Weekday";  
document.write("<center>" + "day=" + day + "</center>");
```

 (2)

(i) What is the use of `DriverManager.getConnection()` in `JDBC`? (2)

(j) Find the error and make correction in the following `JSP` code: (2)

```
<%= int x = 15 %>
```

(k) What is the use of `isErrorPage` attribute of page? What is its default value as per the following code: (2)

```
<%@ pageisErrorPage = "true" %>
```

(l) Give three advantages of using `JSP` over `Servlets`. (2)

SECTION - B

2. (a) Give the **output** for the following `HTML` code:

```
<html>
```

```
<body>
```

```
<table border=1>
```

```
<tr><td rowspan=2>Desination</td><td colspan=2>Time</td></tr>
```

```
<tr><td>Arrival</td><td>Departure</td></tr>
```

```
<tr><td>Mumbai</td><td>7:30</td><td>08:45</td></tr>
<tr><td>Delhi</td><td>13:00</td><td>23:45</td></tr>
</table>
</body>
</html>
```

(5)

- (b) Give one advantage of using CSS with HTML. How do you create external CSS file? Give example. (5)

3. (a) List any two **properties** and **methods** of the **textbox** element in **Javascript**. What will be value stored in "a" in the following code :

```
var myStr = "Hello I am here";
```

```
var a=myStr.substring(2,8);
```

(5)

- (b) Explain the three types of **dialog** boxes (pop-up windows) available in **JavaScript**? (5)

4. (a) Explain **Exception Handling** in **Java**. Give the output of the following code :

```
class MyClass {
```

```
public static void main( String args[ ] )
```

```
{ try{  
int d[ ]={1};  
    d[22]=45;  
System.out.println("This is in try block");  
    }  
catch(ArrayIndexOutOfBoundsException e)  
    { System.out.println("This is in Catch  
    block"); }  
System.out.println("This is after catch block");  
    }  
}
```

(5)

(b) Differentiate between **overloading** and **overriding** in Java with example. (5)

5. (a) What is a **directive element** in **JSP**. Give the use of any three directive elements. (5)

(b) What is the use of **ResultSet** object in **JDBC**? What is its initial cursor position? (5)

6. (a) Illustrates **HTTP Request/Response Model** in **JSP** with the help of a diagram. (5)

(b) Give the output of the following

(i) `<%@ taglib uri="http://java.sun.com/jsp/jstl/core" prefix="c" %>`

`<html>`

`<body>`

`<c:set value="10" var="num"/>`

`<c:choose>`

`<c:when test="{num%2==0}">`

`<c:out value="{num} is even number">`

`</c:out></c:when><c:otherwise>`

`<c:out value="{num} is odd number"></c:out>`

`</c:otherwise>`

`</c:choose>`

`1 + 2 + 3 = <c:out value = "{1 + 2 + 3}" />`

`</body>`

`</html>`

(ii) `<%@ taglib prefix="c" uri="http://java.sun.com/jsp/jstl/core" %>`

`<html>`

`<body>`

`<%! String str = null; %>`

```

<%! String str1 = "Hello"; %>
<c:out value="\${str}" default="Nothing"/>
<br>
<c:out value="\${str1}" default="Nothing"/>
</body>
</html>

```

7. (a) What is **JSTL**? Explain the following functions with example

(i) **startsWith**(string, prefix)

(ii) **join**(array, separator)

(5)

(b) Write a note on **JSP** life cycle.

(5)

8. (a) Write a code to create a **HTML** form with the following elements -

(5)

<u>Label</u>	<u>Name</u>	<u>Type</u>
(i) Client Name	txtName	Textbox
(ii) Password	setPwd	Textbox for password
(iii) Country	ctry	Dropdown
(iv) OK	btnOK	Button
(v) Clear	btnClear	Reset Button

(b) Add a **JavaScript** code block to the above HTML form at the click of 'OK' Button -

(i) Client Name should not be left blank.

(ii) Password should not be less than 8 characters.

(iii) If the Client Name is not blank and password is greater than 8 characters, print <Client Name > lives in <Country> on next page

(5)

This question paper contains 7 printed pages]

Roll No.

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S. No. of Question Paper : 2780

Unique Paper Code : 32347611

IC

Name of the Paper : Data Mining

Name of the Course : B.Sc. (H) Computer Science : DSE-4

Semester : VI

Duration : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt All questions from Section A.

Attempt any four questions from Section B.

Section A

1. (a) Find the Euclidean distance between data points $X(0, -1, 0, 1)$ and $Y(1, 0, -1, 0)$. 2
- (b) If recall and precision are 0.5 and 0.6 respectively, compute the value of F_1 measure. 2
- (c) In a given dataset, it is found that an itemset $\{ab\}$ is infrequent. Will itemset $\{abc\}$ be infrequent or frequent? Explain why. 2

P.T.O.

(2)

- (d) What are the three strategies for handling missing values in a dataset ? 3
- (e) Differentiate between precision and bias on the basis of the quality of the measurement process. 3
- (f) What is meant by variable transformation ? What are its advantages ? 3
- (g) If support of an association rule $X \rightarrow Y$ is 80% and confidence is 75%, can we derive support and confidence of the rule $Y \rightarrow X$? If yes, list down the values. If no, state the reason. 3
- (h) List down *two* advantages and *two* disadvantages of leave-one-out approach used in cross-validation for evaluating the performance of the classifier ? 4
- (i) Differentiate between agglomerative and divisive methods of hierarchical clustering with the help of a diagram. 4
- (j) What are asymmetric attributes ? Give an example of each : 4
- (i) asymmetric binary attribute,
 - (ii) asymmetric discrete attribute,
 - (iii) asymmetric continuous attribute.

- (k) The confusion matrix for a 2-class problem is given below : 5

		Predicted Class	
		Class=1	Class=0
Actual Class	Class=1	400	100
	Class=0	200	300

Calculate the Accuracy, Sensitivity, Specificity, True Positive Rate, and False Positive rate.

Section B

2. (a) What are the differences between noise and outliers ?
Are noise objects always outliers ? Are outliers always noise objects ? 2+1+1
- (b) Let A and B be two sets of integers. A distance measure ' d ' is defined as follows : 4
 $d(A - B) = \text{size}(A - B) + \text{size}(B - A)$ where ' $-$ ' denotes set difference. Size denotes the number of elements in the set.
Prove that the distance measure ' d ' is a metric.
- (c) What is unsupervised learning ? Explain with the help of an example application. 2

3. (a) Consider the following dataset for a 2-class problem : 7

A	B	Class Label
T	F	+
T	T	+
T	T	+
T	F	-
T	T	+
F	F	-
F	F	-
F	F	-
T	T	-
T	F	-

- (i) Calculate the gain in the Gini Index when splitting on A and B.
- (ii) Which attribute would the decision tree induction algorithm choose ?
- (iii) Draw the decision tree after splitting showing the number of instances of each class.

(iv) How many instances are misclassified by the resulting decision tree ?

(b) Why is K-nearest neighbor classifier a lazy learner ? 3

4. (a) What is an exhaustive rule-sets in Rule based classification ? If the rule-set is not exhaustive, what problem arises ? How is it resolved ? 4

(b) What is progressive sampling ? What are its advantages ? 3

(c) State Bayes' theorem. What assumption is used by the Naïve Bayes classifier ? 3

5. (a) Consider the following set of frequent 3-itemsets :

{1, 2, 3}, {1, 2, 4}, {1, 2, 5}, {1, 3, 4}, {1, 3, 5}, {2, 3, 4},
{2, 3, 5}, {3, 4, 5}.

Assume that there are only five items in the dataset.

(i) List all candidate 4-itemsets obtained by a candidate generation procedure using the $F_{k-1} \times F_1$ merging strategy.

(ii) List all candidate 4-itemsets obtained by a candidate generation procedure in Apriori. 6

(b) Let X denotes the categorical attribute having values {awful, poor, OK, good}. What is the representation of each value when X is converted to binary form using :

(i) 2 bits

(ii) 4 bits ?

4

6. Consider the following transactional dataset :

8

Transaction ID	Items Bought
0001	{a, d, e}
0002	{a, b, c, e}
0003	{a, b, d, e}
0004	{a, c, d, e}
0005	{b, c, e}
0006	{b, d, e}
0007	{c, d}
0008	{a, b, c}
0009	{a, d, e}
0010	{a, b, e}

(7)

(i) Find out the support of itemsets $\{e\}$, $\{b, d\}$, $\{a, d\}$ and $\{b, d, e\}$. Are these itemsets frequent if minimum support threshold is 30%?

(ii) Find all the rules generated from the 3-itemset $\{b, d, e\}$. List down the strong rules among these rules if minimum confidence threshold is 60%.

(b) What is the difference between nominal attributes and ordinal attributes? Give an example of each. 2

7. (a) Explain the following terms with reference to the DBSCAN clustering algorithm :

(i) Core point

(ii) Noise point

(iii) Border point 6

(b) Given the following data points : 2, 4, 10, 12, 3, 20, 30, 11, 25. Assume $K = 3$ and initial means 2, 4, 6. Show the clusters obtained using K-means algorithm after two iterations and show the new means for the next iteration. 4

This question paper contains 4+2 printed pages]

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S. No. of Question Paper : 2645

Unique Paper Code : 32347607 IC

Name of the Paper : Machine Learning

Name of the Course : B.Sc. (Hons.) Computer Science : DSE-3

Semester : VI

Duration : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Section A is compulsory.

Attempt any 4 questions from Section B.

Use of scientific calculator is allowed.

Section A (Compulsory)

1. (a) For a classification problem to classify 250 training instances into two classes TRUE and FALSE, the prediction pattern of a classifier is shown below :

(1) 120 TRUE class instances classified as TRUE

P.T.O.

- (2) 85 TRUE class instances classified as FALSE
(3) 25 FALSE class instances classified as TRUE
(4) 20 FALSE class instances classified as FALSE

Find the accuracy of this classifier. 4

- (b) State Naïve Bayes theorem. 2
- (c) List and explain *three* applications of machine learning. 3
- (d) Why can't linear regression be used for classification ? Explain with the help of an example. 3
- (e) Write the expression for cost function of logistic regression and explain it. 3
- (f) What do you mean by polynomial regression ? Explain it with an example. 3
- (g) How does single layer perceptron function ? 3
- (h) Draw the diagram of a neural network required to handle five class problems. 3
- (i) What do you mean by reinforcement learning ? Give an example. 3

- (j) Give an expression of binary sigmoidal activation function and obtain first derivative of the function. 3
- (k) The sales of a company (in million rupees) for each year are shown in the table below : 5

x (year)	y (sales)
2005	12
2006	19
2007	29
2008	37
2009	45
2010	49

- (a) Find the least square regression line $y = ax + b$.
- (b) Use the least squares regression line as a model to estimate the sales of the company in 2013.

Section B

2. Using Naive Bayes classification rule for the following training data, predict whether an old student having high income and excellent credit rating will buy a computer or not. 10

Id	Age	Income	Student	Credit Rating	Buys Computer
1.	Young	High	No	Fair	No
2.	Young	High	No	Excellent	No
3.	Middle	High	No	Fair	Yes
4.	Old	Medium	No	Fair	Yes
5.	Old	Low	Yes	Fair	Yes
6.	Old	Low	Yes	Excellent	No
7.	Middle	Low	Yes	Excellent	Yes
8.	Young	Medium	No	Fair	No
9.	Young	Low	Yes	Fair	Yes
10.	Old	Medium	Yes	Fair	Yes
11.	Young	Medium	Yes	Excellent	Yes
12.	Middle	Medium	No	Excellent	Yes
13.	Middle	High	Yes	Fair	Yes
14.	Old	Medium	No	Excellent	No

3. (a) What is over-fitting in logistic regression ? How can this problem be resolved ? 6
- (b) Discuss the classification of Machine Learning algorithms. 4
4. (a) Find the linear regression coefficients using gradient descent method for the following dataset when learning rate = 0.1. Carry out the process for 2 iterations. 5

X	Y
0	2
1	3
2	5
3	4
4	6

- (b) Explain how can logistic regression be used for solving more than two class problems ? 5
5. (a) What is the cost function for linear regression ? Derive least square estimation of the coefficients ? 5
- (b) Explain *two* methods of updating weights for a single layer perceptron. 5

6. (a) Explain the gradient descent method for obtaining the parameters of Logistic regression. 6
- (b) Differentiate between Linear regression and Logistic regression. 4
7. (a) Explain Back-propagation algorithm for multilayer perceptron. 6
- (b) Write the truth table of OR operation and solve it using single layer perceptron. 4

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This question paper contains 2 printed pages]

Roll No.

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S. No. of Question Paper : 2303

Unique Paper Code : 42343408

IC

Name of the Paper : PHP Programming

Name of the Course : B.Sc. (P)/B.Sc. Math. Sciences : SEC

Semester : IV

Duration : 2 Hours

Maximum Marks : 25

(Write your Roll No. on the top immediately on receipt of this question paper.)

Question No. 1 is compulsory.

Attempt any *three* questions from Q. Nos. 2 to 6.

1. (a) Consider the statement :

PHP is a programming language that generates dynamic result for web pages.

Justify.

2

(b) List the main difference between echo and print commands.

2

(c) What is explicit casting ? Explain with the help of a suitable example.

2

(d) Explain, for each...as loop with the help of suitable example.

2

P.T.O.

(e) Give the statements in PHP for the following : 2

(i) To connect to MYSQL from PHP.

(ii) To select the database to be used.

Make your own assumptions for database name, username and password.

2 Explain the following functions giving suitable example of each : 5

(a) Explode()

(b) Strtok()

3. What is a regular expression ? Explain preg_match() and preg_replace() functions giving suitable examples of each. 1+4=5

4 (a) Write a PHP script to display a "Hello" message in three different languages selected in drop down list, using switch case statement. 3

(b) What is the scope of local and global variables in a function ? 2

5. (a) Write a function to swap two numbers *a* and *b*. Pass data to function by reference. 3

(b) Explain the purpose of mysql_fetch_array() function. 2

6. (a) Differentiate between while and do-while loop, giving suitable example of each. 3

(b) List the main differences between GET and POST methods. 2

This question paper contains 8 printed pages]

Roll No.

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S. No. of Question Paper : 2928

Unique Paper Code : 32345201

IC

Name of the Paper : Introduction to Database Systems

Name of the Course : General Elective for Honours :

Computer Science

Semester : II

Duration : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Q. No. 1 is compulsory. Attempt any four questions out of

Q. Nos. 2 to 7. Parts of a question must be answered together.

Marks are indicated against each question.

1. (a) Suggest appropriate data types for the following attributes : 3

(i) Marks in Examination

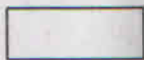
(ii) Name of an Employee

(iii) Date of Birth.

P.T.O.

- (b) What do the following geometrical shapes represent in an ER Diagram ? 3

(i)



(ii)



(iii)



- (c) In each case, draw the geometrical shape to be used in an ER Diagram : 3

(i) Multivalued attribute

(ii) Weak entity type

(iii) Key attribute.

- (d) For each of the following commands, indicate whether it belongs to DDL or DML : 4

(i) Create table

(ii) Update table

(iii) Drop table

(iv) Delete from table.

- (e) For the given binary relationships, suggest the cardinality ratio of the relationship based on the general context of entity types and state the context clearly : 5

	Entity Type	Relationship	Entity Type
(i)	EMPLOYEE	Has	DEPENDENT
(ii)	EMPLOYEE	Works_on	PROJECT
(iii)	TEACHER	Teaches	STUDENT
(iv)	COLLEGE	Offer	COURSE
(v)	BANK	Has	MANAGER

- (f) In the following relational database, point out the primary and foreign keys stating any assumptions that you make : 5

EMPLOYEE (ENumber, Ename, Email, Phone)

PROJECT (ProjectName, ProjectDescription, ProjectManager)

WORKS_ON (ENumber, ProjectName, Hours)

(g) Given the following relations :

EMPLOYEE

<u>Eid</u>	Ename	Salary	Dno
1	Amit	3000	101
2	Sumit	2000	102
3	Jaspal	1000	103
4	Rohit	4000	102
5	Vikas	3000	102

DEPARTMENT

<u>Dno</u>	Dname
101	Administration
102	Research
103	Accounts

What will be the output of the following queries ? 6

(i) select Dno, Count(*)

from Employee

group by Dno;

(ii) select E.Ename, D.Dname

from Employee E, Department D

where E.Dno=D.Dno;

(iii) select count (Dno)

from Employee;

- (h) Consider the following Relational database schema :

STUDENT

Rollno	Name	Department	Marks
1	Ramesh	CS	94
2	Narayan	CS	75
3	Murthy	MS	62
4	Priya	MS	89
5	Garima	CS	78

Write SQL queries for the following statements :

- (i) Insert a new student <7, 'Priyanka','CS',82> in the above database.
- (ii) Change the Department of 'Ramesh' to 'MS'.
- (iii) Delete the records where marks are less than 70.
2. (a) Consider the relation STUDENT (RollNo, Name, Dept, Marks)

Write the following queries into SQL form :

- (i) Display the total number of students in each department. 6
- (ii) Display minimum, average and maximum marks of the class.
- (iii) Display the details of the students whose name starts with 'J'. 6
- (b) Write two advantages of DBMS over traditional file processing. 4

3. (a) Draw ER diagrams for the following binary relationships. Specify at least *three* attributes for each entity and mention cardinality ratios also : 6

Entity Type	Relationship	Entity Type
(i) EMPLOYEE	Works_For	COMPANY
(ii) STUDENT	Enrols_For	COURSES

- (b) Illustrate each of the following with the help of an ER diagram :
- (i) One to many relationship, and
(ii) One to one relationship.
4. (a) Differentiate between the following :
- (i) Primary key and candidate key.
(ii) Physical data independence and logical data independence. 6
- (b) Is the relation given below in 1NF ? If yes, justify, otherwise convert it into 1NF : 4

Dno	Dname	Dlocation
101	Administration	{Spring, Houston}
102	Research	Stanford
103	Accounts	Houston

5. (a) Consider the universal relation $R = \{A, B, C, D, E, F, G, H, I, J\}$ and the set of functional dependencies $F = \{AB \rightarrow C, BD \rightarrow EF, AD \rightarrow GH, G \rightarrow I, H \rightarrow J\}$. What is the key for R ? Decompose R into 2NF and then 3NF relations. 6

- (b) Write SQL query for performing the following tasks on relation schema 4

EMPLOYEE (Eno, Ename, BDate, Address, Dno) :

- (i) For displaying employee names having two 'a's in their names.
- (ii) For sorting the data of the above table name-wise.

6. (a) EMP_DEPT 6

<u>Ename</u>	Id	Bdate	City	Dno	Dname	DmgrSsn
Kalpna	1	01-05-92	New Delhi	101	Research	3
Daksh	2	02-05-92	Hyderabad	101	Research	3
Nitin	3	11-05-95	Bangalore	102	Admin	4
Anita	4	04-07-92	Mumbai	102	Admin	5
Narayan	5	22-05-82	Hyderabad	105	Headquarter	5

Consider the above relational database schema and give an SQL query for each of the following :

- (i) a query that will result in Insertion Anomaly.
- (ii) a query that will result in Deletion Anomaly.
- (iii) a query that will result in Update Anomaly.
- (b) Differentiate between HAVING and WHERE clause with the help of an example. 4

P.T.O.

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

- Each movie is identified by title and year of release. Each movie has a length in minutes. Each has a production company, and each 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.
- Actors are identified by name and date of birth and appear in one or more movies. Each actor has a role in the movie.
- Directors are also identified by name and date of birth and direct one or more movies. It is possible for a director to act in a movie (including one that he or she may also direct).
- Production companies are identified by name and each has an address. A production company produces one or more movies.

Identify:

- (i) entities of interest.
- (ii) attributes for each entity.

Draw an ER diagram for the above database. Also specify clearly all constraints on the relationships in the diagram.

State clearly any assumptions that you make. 10

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 3051

IC

Unique Paper Code : 32345401

Name of the Paper : Information Security and
Cyber Laws

Name of the Course : Computer Science : Generic
Elective for Honours

Semester : IV

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

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

Section A

1. (a) Define Plain text, Cipher Text, key, encryption and decryption. (5)

P.T.O.

- (b) What is the need for Information Security? (3)
- (c) What are threats and vulnerabilities? (3)
- (d) What are substitution ciphers? Give an example. (3)
- (e) What do you mean by security policy? (3)
- (f) What do you understand by Hackers? Give the classification of hackers. (4)
- (g) What are viruses? Give any two names of viruses. (4)
- (h) What are the categories of attacks in networks? (4)
- (i) Differentiate : (6)
- (i) Trojans and Viruses
 - (ii) Symmetric and Asymmetric encryption

Section B

2. (a) Encrypt and decrypt the message "Meet me tonight at square point" using the additive cipher/ Caesar cipher with key size 7. (5)

(b) Encrypt the message "meet me after the college" using the columnar transposition technique. (5)

3. (a) What do you mean by security goals? (5)

(b) Explain the types of vulnerabilities. (5)

4. (a) What do you mean by Intrusion Detection System? Give types of IDS. (5)

(b) What is the process of TCP session hijacking? (5)

5. (a) What do you mean by password crackers? (5)

(b) Explain the concept of digital signatures. (5)

6. (a) Discuss the different types of Firewall systems. (5)

(b) What are computer criminals? What do you mean by cyber crime? (5)

7. (a) What is the punishment under section 65, 66, 66A, 66B, 66F ITAA 2008? (5)

(b) What do you mean by the scanning tools? (5)

- (1) Scanning tool is a device used to capture the image of a document or a page from a scanner.
- (2) Scanning tool is a device used to capture the image of a document or a page from a scanner.
- (3) Scanning tool is a device used to capture the image of a document or a page from a scanner.
- (4) Scanning tool is a device used to capture the image of a document or a page from a scanner.
- (5) Scanning tool is a device used to capture the image of a document or a page from a scanner.
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- (18) Scanning tool is a device used to capture the image of a document or a page from a scanner.
- (19) Scanning tool is a device used to capture the image of a document or a page from a scanner.
- (20) Scanning tool is a device used to capture the image of a document or a page from a scanner.