Unique Paper Code : 32341201
Name of the Course : B.Sc.(H) Computer Science
Name of the Paper : Programming in Java (OC)
Semester : Semester-II
Year of Admission : 2015, 2016, 2017

Maximum Time : 2 Hours Maximum Marks: 75 Marks

Instructions for Candidates:
Attempt any four questions. All questions carry equal marks.

Q.1 Write a program to define an interface *Matrix* with following methods:

public void addsub(Matrix m1, Matrix m2);
public int calc_trace(Matrix m);

Define class *Myclass* to implement interface *Matrix* with appropriate code for *addsub()* method to add and subtract two matrices, and display the results.
Method *calc_trace()* should calculate the sum of all the diagonal elements for square matrix. In case the input matrix is not square, it should display the error message.

Q.2 Fill appropriate java code in place of blanks.

```
import java.awt.*;
import java.awt._____.*;
import java. _____.*;

/*<_____ code="ME" _____=300 _____=100>
</_____> */

public class ME extends Applet
implements _____, MouseMotionListener {
String msg = "";
int mouseX = 0, mouseY = 0;

public void init() {
  addMouseListener(this);
  _____(this);
  }

public void _____(MouseEvent me) {
  mouseX = 0;mouseY = 10;
```

```
  msg = "Mouse clicked.";
  repaint();
  }

public void mouseEntered(MouseEvent me) {
  mouseX = 0;
  mouseY = 10;
  msg = "_____";
  repaint(); }

public void _____(MouseEvent me) {
  mouseX = 0;
  mouseY = 10;
  msg = "Mouse exited.";
  repaint(); }

public void mousePressed(MouseEvent me) {
  mouseX = me.getX();
  mouseY = me.getY();
  msg = "Down";
  _____; }

public void _____(MouseEvent me) {
  mouseX = me.getX();
  mouseY = _____;
  msg = "up";
  repaint(); }

public void mouseDragged(MouseEvent me) {
  mouseX = me.getX();
  mouseY = me.getY();
  msg = "*";
  showStatus("Dragging mouse at " + _____ + ", " +
  _____);
  repaint(); }

public void mouseMoved(MouseEvent me) {
  }
public void paint(_____ g) {
  g._____(msg, mouseX, mouseY);
  }
}
```

Q.3 Write Java code to calculate total salary of employee *A* when *HRA*, *DA* and *BasicSalary* is given and calculate total salary of employee *B* when only *DA* and *BasicSalary* is given. Create an abstract class *Salary* with an abstract method *getTotalSalary()*. Class *Salary* is inherited in two classes *AA* and *BB*, each having *getTotalSalary()* as inherited method and returning the total salary of the employee. Pass appropriate values as parameters to the constructors. Create an object for each of the two classes and print the total salary of both the employees. Make use of dynamic method dispatch.

Q.4 Exact output of a multithreaded program cannot be predicted. Explain in detail the working of the following program which uses multithreading. Further, explain why the order of displayed messages differs on separate executions of program. How many threads are executing in the program?

```
public class DisplayMessage implements Runnable {
  private String message;
  public DisplayMessage(String message) {
    this.message = message;
  }
  public void run() {
    while(true) {
      System.out.println(message);
    } }
}
public class ThreadClassDemo {
  public static void main(String [] args) {
    Runnable hello = new DisplayMessage("Hello");
    Thread thread1 = new Thread(hello);
    System.out.println("Starting hello thread...");
    thread1.start();
    Runnable bye = new DisplayMessage("Goodbye");
    Thread thread2 = new Thread(bye);
    thread2.setPriority(Thread.MIN_PRIORITY);
    System.out.println("Starting goodbye thread...");
    thread2.start();
    System.out.println("main() is ending...");
  } }
```

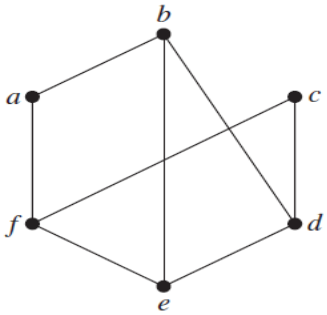
Q.5 Create a user defined exception class which is thrown when number entered by user is not within range of 60 to 90. Override *toString()* method to display error message as “Valid range of numbers to be entered is 60 to 90”. Use multi catch feature in the code to catch arithmetic exception also. Why arithmetic exception is an unchecked exception? How is it different from checked exceptions? How can the underlying exception be displayed in Java if required?

Q.6 Make an object of *StringBuffer* class. Initialize it with string “Hello Java”. Find length and capacity of this object. Explain the difference in output values. Insert a string “dear” in this object to get output as “Hello dear Java”. Make use of predefined methods to convert value of this *StringBuffer* object to “I like Java”. Explain how *StringBuffer* class accommodates dynamic strings.

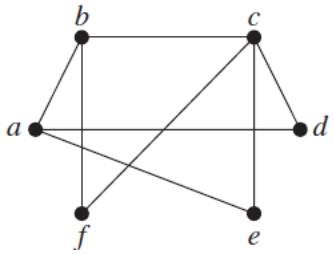
Unique Paper Code	: 32341202-OC
Name of the Course	: B. Sc. (Hons.) Computer Science (Old Course)
Name of the Paper	: Discrete Structure
Semester	: II
Duration	: 2 Hours
Maximum Marks	: 75
Year of Admission	: 2015-2017

Instructions for Candidates: Attempt Any Four questions. All Questions carry equal marks.

Q1. For the following given graphs G1 and G2, show whether G1 and G2 are bipartite? Find the incidence matrix for the given graphs G1 and G2. Determine whether G1 and G2 are planar, if yes, how many regions are there in each graph? Determine chromatic number of the given graphs?



G1



G2

For each of the following graph, give the value of n for which it is bipartite. K_n, C_n, W_n

Q2. Use Master method to find asymptotic bounds for the following recurrence relation:

$$T(n) = 2T\left(\frac{n}{4}\right) + \sqrt{n} + 24$$

Find S^6a and $S^{-3}a$ for the following numeric function a_r

$$a_r = \begin{cases} 1 & 0 \le r \le 10 \\ 2 & r \ge 11 \end{cases}$$

Q3. Show all the steps of Bubble Sort to put the following list of items in an increasing order:

3	1	5	9	2	6	4	7	11	5

The number of comparison in bubble sort is n (n – 1) / 2. Prove that it is $\Theta(n^2)$. Also find suitable values of C1, C2 and K.

Q4. For the following given matrix A_R, Show A_R is a Partial Ordering Relation. Draw the digraph and Hasse diagram for given relation.

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

Assume $f(x) = 2x^2 + 10$ and $g(x) = x + 6$. Find the composition f o g and g o f.

Q5. Find the total solution (homogeneous and particular solution) of the given recurrence relation:

$$a_r + 5\, a_{r-1} + 6\, a_{r-2} = 42 \cdot 4^r$$

with $a_2 = 278$, $a_3 = 962$

Q6. Convert the following statement in symbolic form:
S1: If a woman is married, she is happy.
S2: If a woman is happy, she lives longer.
Show that "Woman lives longer" is a valid conclusion. "If women is not married and either women is married or women is happy then women is happy." Prove that the given statement is a tautology. Also find inverse, converse and contra-positive for the given statement S1.

Consider the word "CORONAVIRUS". Calculate in how many ways these letters can be arranged. Calculate in how many ways the letters can be arranged such that the vowels should always come together.

Set	**:**	**B**
Unique Paper Code	**:**	**32341403**
Course	**:**	**B. Sc. (H) Computer Science**
Paper	**:**	**Database Management Systems**
Semester	**:**	**IV**
Duration	**:**	**2 Hours**
Maximum Marks	**:**	**75**

Attempt any FOUR questions

All questions carry equal marks

(For courses effective from Academic Year 2015-16)

Q1 Consider the following case study:

`BookMyEvent` is an online booking website which allows customers to book tickets for events, shows and artists' performances.

The site stores details about various performance artists that the customers might be interested in such as the artist's name, gender, date of birth, latest work. Artists are associated to an artist category, namely, comedy, tragedy, theatre, T.V. artist. Each category has a code, a title and a description and most categories have several artists, although some are not populated yet.

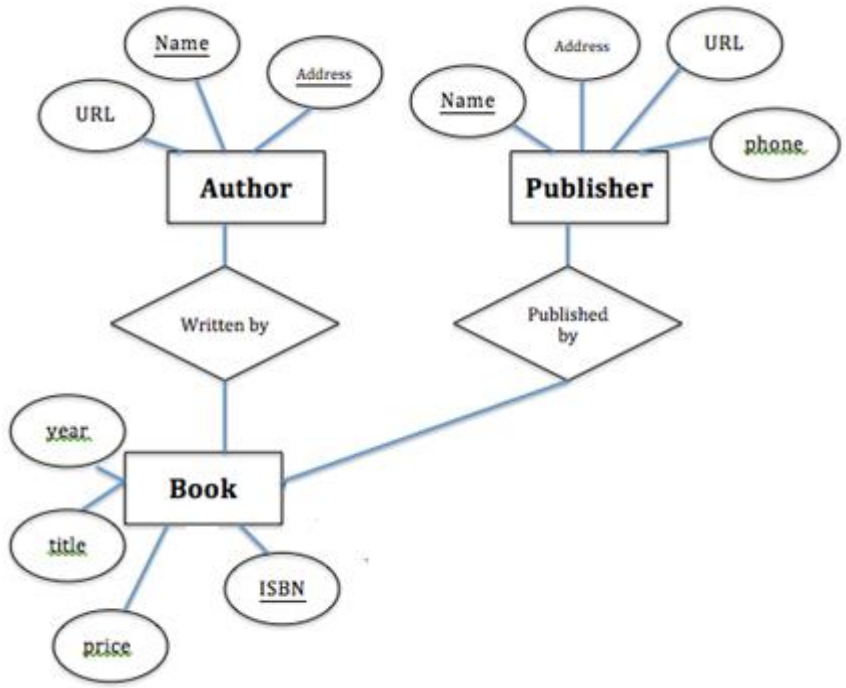
Artists may perform at many different events. All events have an id, a name, a description, start time, and duration. An event may have many news stories released about it, namely, 'new show in city' or 'successfully running for many weeks', to develop interest in the events. Event news has an id, title, author and date.

Events are held at a specific venue. Venues have a name, address, lead contact, seating capacity, star rating. Star ratings are stored with a number, **`1-5`**.

Many tickets are sold for each event. Tickets include a number, type, such as standard or VIP and a price. Each ticket is for one event only. Customers have to register on the system before they can reserve tickets. They must add standard information including name, address, email, and contact number. A customer can buy many tickets for an event though a ticket is for one event and one customer.

For the above given case study, identify the entities and relationships with their associated attributes, cardinality ratio, and participation constraints. Also, identify subclasses for entities, if they exist. Then, based on these, draw an Enhanced Entity-Relationship Diagram. Clearly state any assumptions you make.

Q2



Study the above ER diagram. For each of the relationships, find the cardinality ratio, and participation constraint values. Map the ER diagram to the relation schema. Clearly show all the steps. Mention all the primary and foreign keys for each relation. Clearly state any assumptions that are made.

Q3 You are hired as a database designer for an **animal adoption agency**. You designed the following relations.

Animal (AnimalID, Name, DateAdmitted, PreviousOwnerID)
Adopter (ID, Name, Address, OtherAnimals)
Adoption (AnimalID, AdoptDate, PrevOwnerID, CurrentAdopterID)
MedicalRecord (AnimalID, age, vaccine, prescription, dosage)

- The underlined attributes are the primary keys.
- The relation **Animal** stores the information about the animal. **DateAdmitted** is of **Date** data type. The **PreviousOwnerID** value should be **NULL** by default. It references the **ID** attribute in the relation **Adopter**.
- The **Adopter** relation stores information about the person who adopts the animal. The attribute **OtherAnimals** should allow values as **Yes** or **No** only.
- The **Adoption** relation depicts the relationship between the relations **Animal** and **Adopter**. **AdoptDate** should be of **Date** data type and should not be **NULL**. **PrevOwnerID** and **CurrentAdopterID** refer to the **ID** attribute of the relation **Adopter** and may or may not be the same.
- **AnimalID** attribute in the **MedicalRecord** relation references the **AnimalID** attribute in the **Animal** relation.

For the above relations, answer the following questions using SQL:

- Write **CREATE TABLE** command for each of the tables. You must use data types, **PRIMARY KEY** constraint, and **FOREIGN KEY** constraint, as applicable. Implement the other constraints mentioned above
- For each of the given relations, write a command to **INSERT** one row with appropriate values

Q4 Consider the relations in question **3**.

Design **four** queries in English language. The **first** query should involve a join and should display the results in a sorted fashion. The **second** query should involve an aggregation operator and the **group by** clause. The **third** query should update the data (based on a condition) in one of the tables. The **fourth** query should delete all the data in one of the tables.

Write the corresponding SQL queries for **any of the three** English queries.
Write relational algebra queries for **any one of the** English queries.

Example: If you were to write a query using **WHERE** clause, you might answer as follows:
English query: ***Find name of the animal whose AnimalID is 234567.***
SQL query:
```
SELECT Name
FROM Animal
WHERE AnimalID = 234567;
```

Q5 Consider a relation **R (A, B, C, D, E, F)** with the following set of functional dependencies

$$F = \{AB \rightarrow C,\ DC \rightarrow AE,\ E \rightarrow F\}$$

Find any two keys for the given relation? Is this relation in **2NF**? If not, state the reason and decompose this relation until each of the decomposed relations are in **2NF**.

Q6 Consider a disk with block size **B = 1024 bytes**. A block pointer is **P = 8 bytes** long and a record pointer is P_R **= 10 bytes** long. A file has **r = 102,000 Book** records of fixed length. Each record has the following fields: **BookID (6 bytes), Name (30 bytes), Author (30 bytes), Publisher (30 bytes), Year (2 bytes), PrintedCopies (2 bytes).** Assume that the file is ordered by the key field **BookID**.

- Calculate the record size **R** for the file in bytes.
- Assuming the un-spanned organization, calculate the blocking factor and the number of file blocks **b** required to store all the records.
- Calculate the number of block accesses required for searching a record in the data file using binary search.

Suppose that we construct a primary index on **BookID** for the above file.

- Calculate the size of an entry in the index R_i.
- Calculate the index blocking factor bfr_i
- Find the total number of index entries r_i and the number of index blocks, **bi**.
- Calculate the number of block accesses required for searching a record in the data file using this primary index.

Unique Paper Code : **32347611**
Name of the Paper : **Data Mining**
Name of the Course : **B.Sc. (H) Computer Science**
Semester : **Semester -VI**
Duration of Examination : **Two Hours**
Maximum Marks : **75 Marks**
Year of Admission : **2015, 2016, 2017**

Instructions for Candidates

Attempt Any Four questions. All Questions carry equal marks.

Q 1. Given the following table, classify all the attributes appearing in the table as *binary, discrete or continuous*. Also classify them as qualitative (*nominal or ordinal*) or quantitative (r*atio or interval*). Justify your answer in each case. Show the normalization (scaling data between 0 and 1) of values in the age attribute column. How can you handle missing values in Age column and Height column? Replace Y and N respectively by 1 and 0 in the first column. Replace M and F respectively by 0 and 1 in the second column. You will get one binay vector each for Smoker attribute and Gender attribute. Find out the similarity measure between these two vectors using Jaccard coefficient.

Smoker	Gender	Age	Height	Marital Status
Y	F	32	Tall	Married
Y	M	34	Medium	Marries
N	F	39	Medium	Single
Y	M	41	Tall	Single
Y	M	25	Tall	Divorcee
N	M	36	Tall	Single
Y	F	45	Short	Married
Y	M	31	Tall	Single
N	M	29	Medium	Divorcee
N	F	51	Tall	Single
Y	F	38	Short	Married

Q 2. Given the following binary classification problem :

Instance	A1	A2	Target Class
1	T	T	+
2	T	T	+
3	T	F	-
4	F	F	+
5	F	T	-
6	F	T	-
7	F	F	-
8	T	F	+
9	F	T	-
10	T	F	-

Calculate separately the information gain when splitting is done on A1 and on A2. Which attribute would the decision tree induction algorithm choose? Calculate separately the gain in the Gini index when splitting is done on A1 and A2. Which attribute would the decision tree induction algorithm choose? Is it possible that information gain and the gain in Gini index favour different attributes? Explain your answer.

Q 3. Consider the one dimensional labeled data set given below:

X:	0.5	3.0	4.5	4.6	4.9	5.2	5.3	5.5	7.0	9.5
Y:	-	-	+	+	-	-	+	+	-	-

Classify the data point x= 5.0 according to its 3- and 5- nearest neighbour using majority vote.

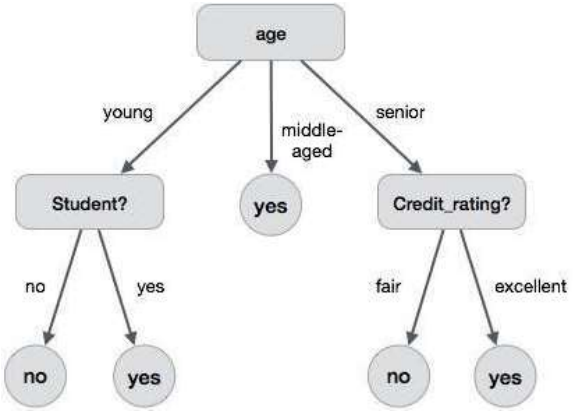
Suppose that there are a total of 60 data mining related documents in a library of 200 documents. Suppose that a search engine retrieves 20 documents after a user enters ‘data mining’ as a query, of which 5 are data mining related documents. What are the precision and recall?

Q 4. Consider the Market Basket dataset shown below:

Transaction ID	Items Bought
0001	{a,d,e}
0024	{a,b,c,e}
0012	{a,b,d,e}
0031	{a,c,d,e}
0015	{b,c,e}
0022	{b,d,e}
0029	{c,d}
0040	{a,b,c}
0033	{a,d,e}
0038	{a,b,e}

Compute support for item sets {e}, {b,d}, {b,d,e}, {a,b,c,e} and {a,b,c,d,e}. Find all association rules that can be generated from item set {b,d,e} along with the confidence of each rule. Is confidence a symmetric measure?

Q 5. Generate all the rules given the following decision tree:



Arrange the generated rule according to class based ordering and classify the following tuples:

Age = young	student = no	loan_approval=?
Age = senior	credit_rating = excellent	loan_approval=?

Consider a training set that contains 90 positive examples and 300 negative examples. For each of the following rules:

R1: A----->+ (Covers 30 positive and 10 negative examples)

R2:B---->+ (Covers 90 positive and 80 negative examples)

R3:C ---->+ (Covers 4 positive and 1 negative example)

Determine which is the best and which is the worst candidate rule according to rule Accuracy.

Q 6. Use K-means algorithm and Euclidean distance to cluster five data points (A4-A8) given below, into 3 clusters. The coordinates of the data points are:

A1(2,8), A2(2,5), A3(1,2), A4(5,8), A5(7,3), A6(6,4), A7(8,4), A8(4,7).

Use A1, A2, A3 as initial centroids. For which situations K-mean clustering will give good results and when will it fail to produce good results?

Unique Paper Code	**:**	**62341201**
Name of the Course	**:**	**B.A. (Prog.) Computer Applications (Old Course)**
Name of the Paper	**:**	**Database Management Systems**
Semester	**:**	**II**
Duration	**:**	**2 Hours**
Maximum Marks	**:**	**75**

Instructions for Candidates:

Attempt any four questions. All questions carry equal marks.

Q1. Consider the following table EMPLOYEE. Identify the types of problems that may occur while performing insert, delete or update operations in the table. Give suitable examples for each of the problem.

EMPLOYEE

Emp_id	Emp_Name	Emp_Address	Emp_Dept
101	Rick	Delhi	D001
101	Rick	Delhi	D002
123	Maggie	Agra	D890
166	Glenn	Chennai	D900
166	Glenn	Chennai	D004

Q2. Consider the following table BOOKS:

BOOKS

Bookid	Title	Author	Price
101	DBMS	Varuna	600
102	Computer Fundamentals	Brijesh	650
103	Python	Swati	450
104	C++	Vaani	500

Give the output that will be produced on execution of the following SQL Commands:

SELECT COUNT(*) FROM BOOKS;

SELECT Title , SUM(Price) FROM BOOKS GROUP BY Title;

UPDATE BOOKS SET PRICE=700 WHERE Author="Varuna",;

INSERT INTO BOOKS VALUES (105, "OS", "KELVIN",700);

ALTER TABLE BOOKS ADD Publisher;

SELECT Title, Author FROM BOOKS WHERE Price BETWEEN 400 AND 600;

Q3. Consider the following relation instances R1 and R2:

R1

Roll No.	Name
1001	Amit
1002	Sunil
2001	Ojas
2002	Radha

R2

Roll No.	Name
1004	Ankit
1005	Sunil
2002	Radha
1001	Amit

Display the result of following operations:

R1 UNION R2, R1 PRODUCT R2, R1 INTERSECTION R2, R1 DIFFERENCE R2, R1 JOIN R2, and R1 LEFT JOIN R2.

Q4. Consider the following table Work_Allocation:

Stud_id, Stud_Name, Collge, Project_id, Project_Name, Project_marks

Following are the functional dependencies for the above table:

Stud_id→ Stud_Name, College

Project_id→Project_Name

RollNo, Project_id→ Project_marks

Reduce the table Work_Allocationin the Ist normal form (1NF) into third normal form (3NF) and identify the primary key in each of the resulting tables.

Q5. Consider the following table STUDENT with following attributes:

Attribute	Data Type
Stud_id	INTEGER(6), UNIQUE, NOT NULL
Name	VARCHAR (12), NOT NULL
Address	VARCHAR (15)
Course_id	INTEGER (2), NOT NULL
University_rollno	INTEGER(6), UNIQUE, NOT NULL

Identify the candidate keys in the table STUDENT.

Give SQL command to create the table STUDENT using suitable data types and constraints, define a suitable primary key for the table.

Populate the table STUDENT with information of four students.

Display the names of students whose Course_id is “Computer Science” and name starts from “A”.

Add a column “Phone_no”.

Update “Phone_no” of all the students with suitable values in the table.

Q 6. A Company maintains the following tables for its Database :

Table	Attributes
Executive	E_Id, Name, Address, Salary, Date_of_Joining,
Product	P_Id, Name, Price
Customer	C_Id, Name
Order	Invoice_No, Date_of_Purchase, P_Id, E_Id, C_Id, Quantity

Construct an ER diagram where an invoice is given by the executive. Each executive can write many invoices but each invoice is written by only one executive. The invoice is written for a single customer but each customer can have many invoices.

Unique Paper Code	: 62344414
Name of the Paper	: Multimedia Systems and Applications
Name of the Course	: B.A. (Programme) Discipline Course
Semester	: IV
Duration of Examination	: Two Hours
Maximum Marks	: 75
Year of admission	: 2015, 2016, 2017

Instructions for Candidates:

Answer any FOUR questions out of SIX given in the question paper.

All questions carry equal marks.

Q1. Describe different environments in which multimedia can be used. Give three aspects of multimedia that make it superior over other forms of information presentation.

Q2. Describe primary multimedia delivery methods. You have been given the task of creating a new website for your college. What tools will you use to create the dynamic webpages?

Q3. Differentiate between animation and virtual reality. Describe the types of animation techniques.

Q4. Describe the terms anti-aliasing, rollovers, auto-tracing, dithering.

Q5. Describe hardware components that are used in multimedia projects. How do you evaluate the appropriateness of multimedia authoring systems for a given project?

Q6. Compare the use of MIDI and digitized audio in a multimedia production. List the important steps and considerations in recording and editing (any five) digital audio.

Unique Paper Code:	32345401
Name of the paper:	Information Security and Cyber Laws
Name of the Course:	Generic Elective (Computer Science)
Semester:	IV

Duration: 2 hours Maximum Marks: 75

Instructions for Candidates:

Attempt any four questions.
All questions carry equal marks

Q1. Suppose you receive an e-mail saying "someone tried to login into your Facebook account from a new device, if it wasn't you, please confirm your identity. Please Sign in by clicking on the following link." What form of attack is this e-mail attempting? How should you respond to such e-mails? List some other ways in which your system can be maliciously attacked through e-mail?

Q2. What are three important aspects related to information security. Explain each one in detail. List at least three kinds of damage a company could suffer when the integrity of a program or company data is compromised.

Q3. Assume that you have found a pen drive in your parking area. You just plug in the pen drive into your personal laptop to examine its content. What threats might this pose to your laptop? What steps can be taken to mitigate these threats? List different ways to safely determine the contents of the pen drive? What are the four broad categories of payloads that a malware may carry?

Q4. What is cryptanalysis? What are tasks performed by cryptanalysts? What are the differences between substitution ciphers and transpositions? Encrypt the message "hello, how are u" using the substitution cipher and Rail-fence techniques with key =3.

Q5. What is risk analysis? List various steps involved in risk analysis? Explain different strategies to deal with risk? Consider a situation where system failure occurs as a result of overheating in a server room. List the consequences of such failure. What are the assets which will be effected? Identify the risks involved and suggest the solution to mitigate the identified risks.

Q6. In e-commerce, safeguarding privacy of the customers is one of the characteristics of company's policies. List four other characteristics of such policies and explain them with the help of an example. Who are audiences of these policies apart from customers?