_____

*Answer **all** questions in Part I (compulsory) and **six** questions from Part-II, choosing*
***two** questions from Section-A, **two** from Section-B and **two** from Section-C.*

PART I – 20 MARKS
*Answer **all** questions.*

While answering questions in this Part, indicate briefly your working and reasoning,
wherever required.

PART I (20 Marks)
Answer all questions.

Question 1   **[10X1=10]**

1.   The expression for Absorption law is given by

(a)   A + AB = A   (c)   AB + AA' = A
(b)   A + AB = B   (d)   A + B = B + A

2.   The complement of the expression A'B + CD'

(a)   (A+ B) (C' + D)   (c)   (A' + B)(C' + D)
(b)   (A + B')(C' + D)   (d)   (A + B')(C + D')

3.   The expression F1 = X.Y.Z' is in

(a)   Sum of products form   (c)   Product of sums form
(b)   Straight form   (d)   Parallel form

4.   The dual of the expression (B' + C).A

(a)   (B' . A) + C   (c)   (B' . A) + A
(b)   (B' . C) + A   (d)   (B' . C') + A

5.   The proposition (P => Q) ^ (Q => P)

(a)   Contradiction   (c)   Contingency
(b)   Negation   (d)   Tautology

6.   The device which converts an input into binary representation is _____.

7.   Exclusive OR gate is combination of ____&_____.

8.   Write the purpose of super keyword.

9.   The expression A'.B' + (A.B) can be implemented by _____gate

10. What is linked list?

Question 2

1. Convert the following infix notation to prefix notation: A * (B + C / D) — E/F   [2]

2. For an array of real numbers x[-6…8, -12…. 20], find the address of x[5][4] , if x[1][1] is
    stored in location 1200 in the column major order. Assume that each element requires 4
    bytes.   [2]

3. With reference to the program code given below, answer the questions that follow:

```
public static void array(int n[ ][ ])
{
int p=0;
for(int i=0;i<n.length;i++)
{
    for(int j=0;j<n[0].length;j++)
    {
        if(!(i==0 ||i==n.length-1 || j==0 || j==n[0].length-1))
        p=p+n[i][j];
    }
 System.out.print(p);
}
```

(i)What will be the output of the method array() when n[ ] [ ]={{5,2,3},{3,2,7},{2,5,1}}?   [2]

(ii)What is the method array() performing;   [1]

4. With reference to the program code given below, answer the questions that follow:

```
public void calculate(int n1,int n2)
{
        int Temp, res=0;
        while(n2 != 0)
        {
                Temp = n2;
                n2 = n1 % n2;
                n1 = Temp;
        }
        res = n1;
        System.out.println( res);
}
```

(i)What will be the output of the method calculate() when the value of n1=35,n2=56.   [2]

(ii)What is the method calculate() performing;   [1]

Part II- (50 marks)

Answer six questions in this part, choosing two questions from Section A, two from Section B and two from Section C.

Section A

Answer any two questions

Question 3.

(a) Given the Boolean function F (A, B, C, D) =∑(1, 3, 5, 7, 8, 9, 10, 11, 14, 15).

   (i) Reduce the above expression by using 4-variable Karnaugh map, showing the various

   groups (i.e. octal, quads and pairs).   [4]

   (ii) Draw the logic gate diagram for the reduced expression. Assume that the variables and their complements are available as inputs.   [1]

(b) Given the Boolean function: $F(P,Q,R,S) = \prod (4, 6, 7, 10, 11, 12, 14, 15)$
   (i) Reduce the above expression by using the 4-variable Karnaugh map, showing the Various groups (i.e, octal, quads and pairs). [4]
   (ii) Draw the logic gate diagram for the reduced expression. Assume that the variables and their complements are available as inputs. [1]

Question 4
   (a) How is a decoder different from a multiplexer? Write the truth table and draw the logic circuit diagram for a 3 to 8 decoder and explain its working. [5]
   (b) Simplify the following Boolean expression and draw the gate for the reduced expression:
   A'B + AB'C + A [3]
   (c) Define Universal gates. Give one example and show how it works as an OR gate. [2]

Question 5.
(a) The main safe in the nationalized bank can be opened by means of a unique password consisting of three parts. Different parts of the password are held by the chairman, Regional Manager, Bank Manager and Head Cashier of the bank, respectively.
In order to open the safe any one of the following conditions must be satisfied:
The password of the chairman, together with passwords of any two other officials, must be entered.

OR

The password of all three bank officials, excluding the chairman, must be entered.
The inputs are:

A	Denotes the chairman's password
B	Denotes the Regional Manager's password
C	Denotes the Bank Manager's password
D	Denotes the Head Cashier's password

Output

X   Denotes the safe can be opened [1 indicates YES ad 0 indicates NO in all cases]
Draw the truth table for the inputs and outputs given above and write the SOP expression for X(A,B,C,D). [5]

   (b) What do you understand by a multiplexer? Explain an 8 to 1 multiplexer with the truth table and Logic circuit. [5]

Section B
Answer any two questions
Each program should be written in such a way that it clearly depicts the logic of the problem. This can be achieved by using mnemonic names and comments in the program. (Flowcharts and algorithms are not required)
The programs must be written in Java.

Question 6.
A disarium number is a number in which the sum of the digits to the power of their respective position is equal to the number itself.

Example: $135 = 1^1 + 3^2 + 5^3$

Hence, 135 is a disarium number.

Design a class Disarium to check if a given number is a disarium number or not. Some of the members of the class are given below:

Class name : Disarium

Data members/instance variables:

        int num : stores the number

        int size : stores the size of the number

Methods/Member functions:

        Disarium(int nn) : parameterized constructor to initialize the data members n = nn and size = 0

        void countDigit( ) : counts the total number of digits and assigns it to size

        int sumofDigits(int n, int p) : returns the sum of the digits of the number(n) to the power of their respective positions(p) using **recursive technique**

        void check( ) : checks whether the number is a disarium number and displays the result with an appropriate message.

Specify the class Disarium giving the details of the constructor( ), void countDigit( ), int sumofDigits(int, int) and void check( ). Define the main( ) function to create an object and call the functions accordingly to enable the task.

Question 7

Money is a unit that has 2 parts, Rupees and Paise, where 100 Paise=1 Rupee.

Design a class named Money whose details are as follows:

Class Name : Money

Data member:

  int rs, ps : integer to store the value of Rupees and paise.

Member methods:

     Money(…..)   : Parameterized constructor to initialize member data

    void fnShow() : to show the member data as Money [Rs 819.75]

    Money fnAdd(Money m1, Money m2) : Add m1 and m2. Store the result in corresponding

                                      member data and return it.

Specify the class Money, giving the details of the above member data and methods. Also write the main() to create objects and call the other methods accordingly to enable the task of the adding 2 units on Money.

Question 8

Write a java program to input a sentence from user in lowercase and capitalize the first and last character of every word in it.

Sample Input-   java is case sensitive

Sample output -   JavA IS CasE SensitivE

Some of data members and member methods are given below:

class Name : Capitalize

Data members

        sent : to store the sentence

        cap : to store the new sentence.

size: to store size of sentence

Member Methods:

Capitalize()   : default constructor

void readSentence (): to accept the sentence

void CapFirs tLast () : Extract each word of the sentence and capitalize first and last character and store the new sentence in cap.

void display()   : to display original sentence and converted sentence.

Specify the class capitalize giving details of the constructor capitalize (), void readSentence() void CapFirstLast () and void display- Define the main function to create an object and call the function accordingly to enable the task.

SECTION — C
Answer any two questions

Question 9.

A linear data structure enables the user to add an address from rear end and remove address from front. Define a class Diary with the following details:

Class name: Diary

Data members/instance variables:

       Q[]: array to store the addresses

       size: stores the maximum capacity of the array

       start: to point the index of the front end

       end: to point the index of the rear end

Member functions:

Diary(int max): constructor to initialize the data member size = max, start=0 and end=0

void pushadd(String n): to add the address in the diary from the rear end if possible, otherwise display the message "NO SPACE"

String popadd(): removes and returns the address from the front end of the diary if any, else returns "?????"

void show (): displays all the addresses in the diary

(a) Specify the class Diary giving details of the functions void pushadd(String) and String popadd(). Assume that other functions have been defined. The main function need NOT be written.

Question 10.

A class Author contains details of the author and another class Book List contains details of the books written by him. The details of the two classes are given below:

Class name : Author

    Data members

    authorno : stores the author's number

    name : stores the author's name

    Member functions

Author ( ) : default constructor
Author (…): parameterised constructor to assign values to author number and name
void show( ):to display the author's details.

Class name: Booklist
Data members
bookno : Long type variable to the store book number
bookname : stores the book name
price : float variable to store the price
edition:integer type variable to store the edition number
Member functions
Booklist (…) : parameterized constructor to assign values to data members of both the classes
void show( ): to display all the details
Specify the class Author giving details of the constructors and member function void show( ). Using the concept of Inheritance, specify the class Booklist giving details of the constructor and the member function void show( ). Also define the main function to create an object and call methods accordingly to enable the task

Question 11.
(a) A linked list is formed from the objects of the class Node. The class structure of the Node is given below:

```
class Node
{
int num;
Node next;
}
```

Write an Algorithm OR a Method to insert a node at the endof an existing linked list. The method declaration is as follows:
void InsertNode(Node starPtr, int n)
(b) Answer the following questions from the diagram of a binary tree given below.   [3]

    i.   Root of the tree
    ii.   Preorder Traversal
    iii.   Postorder Traversal