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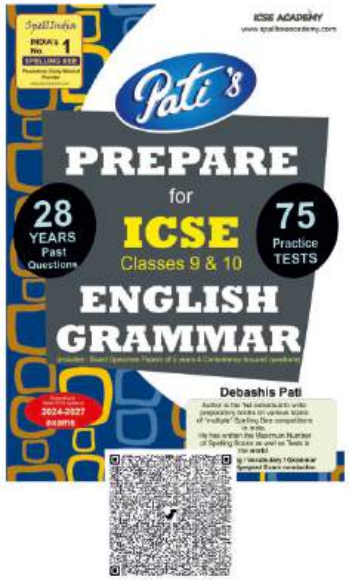

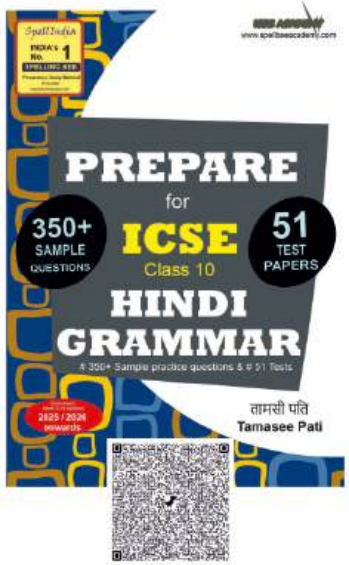

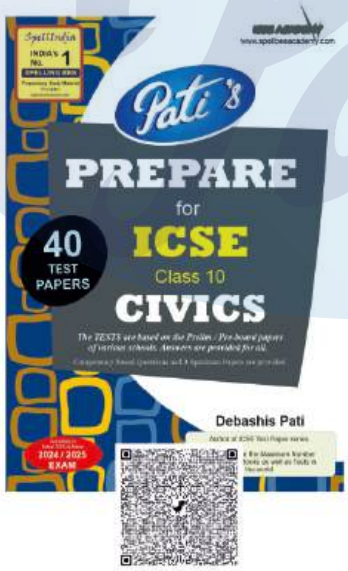

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ICSE ACADEMY

COMPUTER APPLICATIONS

(Theory)

(Two Hours)

Answers to this Paper must be written on the paper provided separately.

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This Paper is divided into two Sections.

*Attempt **all** questions from **Section A** and **any four** questions from **Section B**.*

The intended marks for questions or parts of questions are given in brackets[].

SECTION A (40 Marks)

*Attempt **all** questions*

Question 1.

(a) What are the default values of the primitive data type ***int*** and **float**? [2]

(b) Name any two OOP's principles. [2]

(c) What are identifiers? [2]

(d) Identify the literals listed below: [2]

(i) 0.5 (ii) 'A' (iii) false (iv) "a".

(e) Name the wrapper classes of **char** type and **boolean** type. [2]

Question 2.

(a) Evaluate the value of **n** if value of p= 5, q=19

int n = (q-p)>(p-q) ? (q-p) : (p-q); [2]

(b) Arrange the following primitive data types in an ascending order of their size:

(i) char (ii) byte (iii)double (iv) int. [2]

(c) What is the value stored in variable **res** given below:

double res = Math.pow ("345".indexOf('5'), 3); [2]

(d) Name the two types of constructors. [2]

This Paper consists of 5 printed pages and 1 blank page.

(e) Find the errors in the given program segment and re-write the statements correctly to assign values to an integer array.

```
int a = new int( 5 );
for( int i=0; i<=5; i++ )  a[i]=i;
```
[2]

Question 2.

(a) Operators with higher precedence are evaluated before operators with relatively lower precedence. Arrange the operators given below in order of higher precedence to lower precedence.

(i) && (ii) % (iii) >= (iv) ++ [2]

(b) Identify the statements listed below as assignment, increment, method invocation or object creation statements.

(i) System.out.println("Java");

(ii) costPrice = 457.50;

(iii) Car hybrid = new Car();

(iv) petrolPrice++; [2]

(c) Give two differences between ***switch*** statement and ***if-else*** statement. [2]

(d) What is an infinite loop? Write an infinite loop statement. [2]

(e) What is a constructor? When is it invoked? [2]

Question 3.

(a) List the variables from those given below that are composite data types.

(i) static int x; (iv) boolean b;

(ii) arr[i]=10; (v) private char chr;

(iii) obj.display(); (vi) String str; [2]

(b) State the output of the following program segment:

```
String str1 = "great";  String str2 = "minds";
System.out.println(strl.substring(0,2).concat(str2.substring(l)));
System.out.println(("WH" + (strl.substring(2).toUpperCase())));
```
[2]

(c) What are the final values stored in variables x and y below?

```
double a = − 6.35;
double b = 14.74;
double x = Math.abs(Math.ceil(a));
double y = Math.rint(Math.max(a,b));
```
[2]

(d) Rewrite the following program segment using the ***if-else*** statements instead of the ternary operator.

```
String grade = (mark>=90) ? "A" : (mark>=80) ? "B" : "C";
```
[2]

(e) Give output of the following method:

```
public static void main(String[] args) {
int a = 5;
a++;
System.out.println(a);
a − = (a− −) − (− −a);
System.out.println(a); }
```
[2]

(f) What is the data type returned by the library functions:

(i) compareTo()
(ii) equals()
[2]

(g) State the value of **characteristic** and **mantissa** when the following code is executed.

```
String s = "4.3756";
int n = s.indexOf('.');
int characteristic = Integer.parseInt(s.substring(0,n));
int mantissa = Integer.valueOf(s.substring(n+1));
```
[2]

(h) Study the method and answer the given questions.

```
public void sampleMethod()
{       for( int i=0; i<3; i++ )
                {       for( int j=0; j<2; j++)
                                { int number = (int)(Math.random() * 10);
                                  System.out.println(number);    } } }
```

(i) How many times does the loop execute?

(ii) What is the range of possible values stored in the variable *number*? [2]

(i) Consider the following class:

```
public class myClass  {
public static int x = 3, y = 4;
public int a = 2, b = 3;  }
```

(i) Name the variables for which each object of the class will have its own distinct copy.

(ii) Name the variables that are common to all objects of the class. [2]

(j) What will be the output when the following code segments are executed?

(i)
```
String s = "1001";
int x = Integer.valueOf(s);
double y = Double.valueOf(s);
System.out.println("x=" +x);
System.out.println("y=" +y);
```

(ii)
```
System.out.println("The King said \"Begin at the beginning!\" to me.");
```
[2]

SECTION B (60 Marks)

Attempt ***any four*** questions from this Section.

The answers in this Section should consist of the ***Programs in either Blue J environment or any program environment with Java as the base.***

Each program should be written using ***Variable descriptions/Mnemonic Codes*** *such that the logic of the program is clearly depicted.*

Flow-Charts and Algorithms ***are not required.***

Question 4.

Define a class named **movieMagic** with the following description:

Instance variables/data members:

int year	-	to store the year of release of a movie
String title	-	to store the title of the movie.
float rating	-	to store the popularity rating of the movie. (minimum rating = 0.0 and maximum rating = 5.0)

Member Methods:

(i) movieMagic() Default constructor to initialize numeric data members to 0 and String data member to "".

(ii) void accept() To input and store year, title and rating.

(iii) void display() To display the title of a movie and a message based on the rating as per the table below.

Rating	Message to be displayed
0.0 to 2.0	Flop
2.1 to 3.4	Semi-hit
3.5 to 4.5	Hit
4.6 to 5.0	Super Hit

Write a main method to create an object of the class and call the above member methods. [15]

Question 5.

A special two-digit number is such that when the sum of its digits is added to the product of its digits, the result is equal to the original two-digit number.

Example: Consider the number 59.
Sum of digits = 5 + 9 = 14
Product of its digits = 5 x 9 = 45
Sum of the sum of digits and product of digits= 14 + 45 = 59

Write a program to accept a two-digit number. Add the sum of its digits to the product of its digits. If the value is equal to the number input, output the message "Special 2-digit number" otherwise, output the message "Not a Special 2-digit number". [15]

Question 6.

Write a program to assign a full path and file name as given below. Using library functions, extract and output the file path, file name and file extension separately as shown.

Input C:\Users\admin\Pictures\flower.jpg
Output Path: C:\Users\admin\Pictures\
File name: flower
Extension: jpg [15]

Question 7.

Design a class to overload a function area() as follows:

(i) double area(double *a*, double *b*, double *c*) with three double arguments, returns the area of a scalene triangle using the formula:

$\text{area} = \sqrt{s(s-a)(s-b)(s-c)}$

where $s = \frac{a+b+c}{2}$

(ii) double area(int *a*, int *b*, int *height*) with three integer arguments, returns the area of a trapezium using the formula:

$\text{area} = \frac{1}{2} height\ (a+b)$

(iii) double area(double *diagonal1*, double *diagonal2*) with two double arguments, returns the area of a rhombus using the formula:

$\text{area} = \frac{1}{2} (diagonal1 \times diagonal2)$ [15]

Question 8.

Using the switch statement, write a menu driven program to calculate the maturity amount of a Bank Deposit.

The user is given the following options:

(i) Term Deposit
(ii) Recurring Deposit

For option (i) accept principal(P), rate of interest(*r*) and time period in years(*n*). Calculate and output the maturity amount (A) receivable using the formula $A = P\left[1 + \frac{r}{100}\right]^n$

For option (ii) accept Monthly Installment (P), rate of interest(*r*) and time period in months (*n*). Calculate and output the maturity amount(A) receivable using the formula

$A = P \times n + P \times \frac{n(n+1)}{2} \times \frac{r}{100} \times \frac{1}{12}$

For an incorrect option, an appropriate error message should be displayed. [15]

Question 9.

Write a program to accept the year of graduation from school as an integer value from the user. Using the Binary search technique on the sorted array of Integers given below, output the message "Record exists" if the value input is located in the array. If not, output the message "Record does not exist".

{1982, 1987, 1993, 1996, 1999, 2003, 2006, 2007, 2009, 2010} [15]

COMPUTER APPLICATIONS

(Theory)

(Two hours)

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SECTION A (40 Marks)

*Attempt **all** questions.*

Question 1.

(a) Which of the following are valid comments?

(i) /* comment */

(ii) /* comment

(iii) // comment

(iv) */ comment */ [2]

(b) What is meant by a package? Name any two Java Application Programming Interface packages. [2]

(c) Name the primitive data type in Java that is:

(i) a 64-bit integer and is used when you need a range of values wider than those provided by *int*.

(ii) a single 16-bit Unicode character whose default value is '\u0000' [2]

(d) State one difference between floating point literals ***float*** and ***double***. [2]

(e) What are the values of **a** and **b** after the following function is executed, if the values passed are 30 and 50:

```
void paws( int a, int b)
        { a= a+b;
          b=a-b;
          a=a-b;
          System.out.println( a+ ", "+b);
        }
```
[2]

Question 3.

(a) State the data type and value of **y** after the following is executed:

```
char x='7';
y=Character.isLetter(x);
```
[2]

(b) What is the function of **catch** block in exception handling? Where does it appear in a program? [2]

(c) State the output when the following program segment is executed:

```
String a ="Smartphone", b="Graphic Art";
        String h=a.substring(2,5);
        String k= b.substring(8).toUpperCase();
        System.out.println(h);
        System.out.println(k.equalsIgnoreCase(h));
```
[2]

(d) The access specifier that gives the most accessibility is _____ and the least accessibility is_____. [2]

(e) (i) Name the mathematical function which is used to find **sine** of an angle given in radians.

(ii) Name a string function which removes the blank spaces provided in the prefix and suffix of a string. [2]

(f) (i) What will this code print?

```
int arr[] =new int [5];
System.out.println(arr);
```

(i) 0 . (ii) value stored in arr[0] (iii) 0000 (iv)garbage value

(ii) Name the keyword which is used to resolve the conflict between method parameter and instance variables/fields. [2]

(g) State the package that contains the class:

(i) BufferedReader

(ii) Scanner. [2]

(h) Write the output of the following program code:

```
char ch;
int x=97;
        do
        {
         ch= (char) x;
         System.out.print(ch + " ");
          if( x%10==0)
           break;
           ++x;
        }while(x<= 100);
```
[2]

(i) Write the Java expressions for:

$\frac{a^2+b^2}{2ab}$ [2]

(j) If int y=10 then find int z = (++y *(y++ +5)); [2]

SECTION B (60 Marks)

Attempt ***any four*** questions from this Section.

The answers in this Section should consist of the ***Programs in either Blue J environment or any program environment with Java as the base.***

Each program should be written using ***Variable descriptions/Mnemonic Codes*** *so that the logic of the program is clearly depicted.*

Flow-Charts and Algorithms ***are not required.***

Question 4.

Define a class called **ParkingLot** with the following description :

Instance variables /data members :

int vno - To store the vehicle number

int hours - To store the number of hours the vehicle is parked in the parking lot

double bill : To store the bill amount

Member methods :

void input() – To input and store the vno and hours.

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void calculate() – To compute the parking charge at the rate of ₹3 for the first hour or part thereof, and ₹1.50 for each additional hour or part thereof.

void display() – To display the detail

Write a main method to create an object of the class and call the above methods. [15]

Question 5.

Write two separate programs to generate the following patterns using iteration (loop) statements:

(a)
```
*
*#
*#*
*#*#
*#*#*
```

(b)
```
5 4 3 2 1
5 4 3 2
5 4 3
5 4
5
```

[15]

Question 6.

Write a program to input and store roll numbers, names and marks in 3 subjects of *n* number students in five single dimensional array and display the remark based on average marks as given below: (The maximum marks in the subject are 100)

Average marks = $\frac{\text{Total Marks}}{3}$

Average marks	Remark
85 – 100	EXCELLENT
75 – 84	DISTINCTION
60 – 74	FIRST CLASS
40 – 59	PASS
Less than 40	POOR

[15]

Question 7.

Design a class to overload a function Joystring() as follows:

(i) void Joystring (String s, char ch1, char ch2) with one string argument and two character arguments that replaces the character argument **ch1** with the character argument **ch2** in the given string **s** and prints the new string.

Example:

Input value of s ="TECHNALAGY"

ch1='A',

ch2='O'

Output : "TECHNOLOGY"

(ii) void Joystring (String s) with one string argument that prints the position of the first space and the last space of the given string **s.**

Example:

Input value of ="Cloud computing means Internet based computing"

Output : First index : 5

Last index : 36

(iii)void Joystring (String s1, String s2) with two string arguments that combines the two strings with a space between them and prints the resultant string.

Example:

Input value of s1 ="COMMON WEALTH "

Input value of s2="GAMES "

Output : COMMON WEALTH GAMES

(use library functions)

[15]

Question 8.

Write a program to input twenty names in an array. Arrange these names in descending order of alphabets, using the bubble sort technique. [15]

Question 9.

Using the switch statement, write a menu driven program to:

(i) To find and display all the **factors** of a number input by the user (including 1 and excluding number itself).

Example:

Sample Input : n =15

Sample Output : 1,3, 5

(ii) To find and display the **factorial** of a number input by the user (the factorial of a non–negative integer ***n***, denoted by n!, is the product of all integers less than or equal to **n**.

Example:

Sample Input : n =5

Sample Output : 5! = 1×2×3×4×5 =120.

For an incorrect choice, an appropriate error message should be displayed. [15]

COMPUTER APPLICATIONS

(Theory)

(Two Hours)

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SECTION A (40 Marks)

*Attempt **all** questions*

Question 1.

(a) Define Encapsulation. [2]

(b) What are keywords? Give an example. [2]

(c) Name any two library packages. [2]

(d) Name the type of error (syntax, runtime or logical error) in each case given below: [2]

(i) Math.sqrt (36 – 45)

(ii) int a;b;c;

(e) If int x [ ] = { 4, 3 , 7, 8, 9, 10}; what are the values of **p** and **q**? [2]

(i) p = x.length

(ii) q= x[2] + x[5] * x[1]

This Paper consists of 6 printed pages.

Question 2.

(a) State the difference between == *operator* and *equals ( )* method . [2]

(b) What are the types of casting shown by the following examples: [2]

(i) char c = (char)120;

(ii) int x = 't';

(c) Differentiate between *formal* parameter and *actual* parameter. [2]

(d) Write a function prototype of the following : [2]

A function **PosChar** which takes a string argument and a character argument and returns an integer value.

(e) Name any two types of access specifiers. [2]

Question 3.

(a) Give the output of the following string functions : [2]

(i) "MISSISSIPPI".indexOf('S')+ "MISSISSIPPI".lastIndexOf('I')

(ii) "CABLE".compareTo("CADET")

(b) Give the output of the following Math functions : [2]

(i) Math.ceil(4.2)

(ii) Math.abs(-4)

(c) What is a parameterized constructor? [2]

(d) Write down java expression for : [2]

$T = \sqrt{A^2 + B^2 + C^2}$

(e) Rewrite the following using ternary operator: [2]

```
if (x%2 == 0)
System.out.print("EVEN");
else
System.out.print("ODD");
```

(f) Convert the following while loop to the corresponding for loop: [2]

```
int m = 5, n = 10;
while (n>=1)
{
    System.out.println(m*n);
    n-- ;
}
```

(g) Write one difference between primitive data types and composite data types [2]

(h) Analyze the given program segment and answer the following questions: [2]

(i) Write the output of the program segment

(ii) How many times does the body of the loop gets executed?

```
for (int m=5; m<=20; m+=5)
{   if (m%3==0)
        break;
    else
    if (m%5==0)
    System.out.println(m);
        continue;
    }
```

(i) Give the output of the following expression : [2]

a+= a++ + ++a + --a + a-- ; when a = 7

(j) Write the return type of the following library functions : [2]

(i) isLetterOrDigit(char)

(ii) replace(char, char)

SECTION B (60 Marks)

Attempt ***any four*** questions from this Section.

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*Flow-Charts and Algorithms **are not required.***

Question 4.

Define a class named **BookFair** with the following description : [15]

Instance variables /Data members :

String Bname - stores the name of the book

double price - stores the price of the book

Member methods :

(i) BookFair() - Default constructor to initialize data members

(ii) void Input() - To input and store the name and the price of the book.

(iii) void calculate() - To calculate the price after discount. Discount is calculated based on the following criteria

Price	Discount
Less than or equal to ₹1000	2% of price
More than ₹ 1000 and less than or equal to ₹ 3000	10% of price
More than ₹ 3000	15% of price

(iv) void display() - To display the name and price of the book after discount.

Write a main method to create an object of the class and call the above member methods.

Question 5.

Using the switch statement , write a menu driven program for the following: [15]

(i) To print the Floyd's triangle [Given below]

```
1
2  3
4  5  6
7  8  9  10
11 12 13 14 15
```

(ii) To display the following pattern

```
I
IC
ICS
ICSE
```

For an incorrect option, an appropriate error message should be displayed.

Question 6.

Special words are those words which starts and ends with the same letter. [15]

Examples :

EXISTENCE

COMIC

WINDOW

Palindrome words are those words which read the same from left to right and vice-versa

Examples :

MALAYALAM

MADAM

LEVEL

ROTATOR

CIVIC

All *palindromes* are *special words*, but all special words are not *palindromes*.

Write a program to accept a word check and print whether the word is a *palindrome* or only *special word*.

Question 7.

Design a class to overload a function SumSeries() as follows : [15]

(i) void SumSeries(int n, double x) – with one integer argument and one double argument to find and display the sum of the series given below :

$$s = \frac{x}{1} - \frac{x}{2} + \frac{x}{3} - \frac{x}{4} + \frac{x}{5} \ldots\ldots\ldots \text{ to n terms}$$

(ii) void SumSeries() – To find and display the sum of the following series :

$$s = 1 + (1 \times 2) + (1 \times 2 \times 3) + \ldots\ldots\ldots + (1 \times 2 \times 3 \times 4 \ldots\ldots\ldots\ldots \times 20)$$

Write a program to accept a number and check and display whether it is a **Niven** number or not. [15]

(Niven number is that number which is divisible by its sum of digits).

Example :

Consider the number 126.

Sum of its digits is 1+2+6 = 9 and 126 is divisible by 9.

Question 9.

Write a program to initialize the seven Wonders of the World along with their locations in two different arrays. Search for a name of the country input by the user. If found, display the name of the country along with its Wonder, otherwise display "Sorry Not Found!". [15]

Seven wonders -	CHICHEN ITZA, CHRIST THE REDEEMER, TAJMAHAL, GREAT WALL OF CHINA, MACHU PICCHU, PETRA, COLOSSEUM	
Locations -	MEXICO, BRAZIL, INDIA, CHINA, PERU, JORDAN, ITALY	
Example -	Country Name : INDIA	Output : INDIA - TAJMAHAL
	Country Name : USA	Output : Sorry Not Found!

ICSE ACADEMY

COMPUTER APPLICATIONS

(Theory)

(Two Hours)

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SECTION A (40 Marks)

*Attempt **all** questions*

Question 1.

(a) What is inheritance? [2]

(b) Name the operators listed below: [2]

(i) <

(ii) ++

(iii) **&&**

(iv) **? :**

(c) State the number of bytes occupied by **char** and **int** data types. [2]

(d) Write one difference between / and **%** operator. [2]

(e) String x[] = {"SAMSUNG", "NOKIA", "SONY", "MICROMAX", "BLACKBERRY"}; [2]

Give the output of the following statements:

(i) System.out.println(x[1]);

(ii) System.out.println(x[3].length ( ));

This Paper consists of 5 printed pages and 1 blank page.

Question 2.

(a) Name the following: [2]

(i) A keyword used to call a package in the program.

(ii) Any one reference data type.

(b) What are the two ways of invoking functions? [2]

(c) State the data type and value of **res** after the following is executed: [2]

```
char ch='t';
res= Character.toUpperCase(ch);
```

(d) Give the output of the following program segment and also mention the number of times the loop is executed: [2]

```
int a,b;
for (a = 6, b = 4; a <= 24; a = a + 6)
{
    if (a%b ==0)
    break;
}
System.out.println(a);
```

(e) Write the output: [2]

```
char ch = 'F';
int m = ch;
m=m+5;
System.out.println(m + " " + ch);
```

Question 3.

(a) Write a Java expression for the following: [2]

$ax^5 + bx^3 + c$

(b) What is the value of ***x*1** if $x=5$? [2]

$x1 = ++x \quad x++ \quad + --x$

(c) Why is an object called an instance of a class ? [2]

ICSE ACADEMY

(d) Convert following *do-while* loop into *for* loop. [2]

```
int i = 1;
int  d=5;
do   {
     d=d*2;
     System.out.println(d);
     i++  ;      } while ( i<=5);
```

(e) Differentiate between constructor and function. [2]

(f) Write the output for the following: [2]

```
String s="Today  is Test" ;
System.out.println(s.indexOf('T'));
System.out.println(s.substring(0,7) + " " +"Holiday");
```

(g) What are the values stored in variables r_1 and r_2: [2]

(i) double r_1 = Math.abs(Math.min(-2.83, -5.83));

(ii) double r_2 = Math.sqrt(Math.floor(16.3));

(h) Give the output of the following code: [2]

```
String   A ="26",  B="100";
String   D=A+B+"200";
int  x=  Integer.parseInt(A);
int  y = Integer.parseInt(B);
int  d = x+y;
System.out.println("Result 1 = "+D);
System.out.println("Result 2 = " +d);
```

(i) Analyze the given program segment and answer the following questions: [2]

```
for(int i=3;i<=4;i++ )          {
for(int j=2;j<i;j++ )          {
System.out.print("" );        }
System.out.println("WIN" );    }
```

(i) How many times does the inner loop execute?

(ii) Write the output of the program segment.

(j) What is the difference between the Scanner class functions *next()* and *nextLine()*? [2]

SECTION B (60 Marks)

Attempt ***any four*** questions from this Section.

The answers in this Section should consist of the ***Programs in either Blue J environment or any program environment with Java as the base.***

Each program should be written using ***Variable descriptions/Mnemonic Codes*** *so that the logic of the program is clearly depicted.*

Flow-Charts and Algorithms ***are not required.***

Question 4.

Define a class **ElectricBill** with the following specifications: [15]

class : ElectricBill

Instance variables / data member:

String n . to store the name of the customer

int units . to store the number of units consumed

double bill . to store the amount to be paid

Member methods:

void accept( ) . to accept the name of the customer and number of units consumed

void calculate( ) . to calculate the bill as per the following tariff:

Number of units	Rate per unit
First 100 units	Rs.2.00
Next 200 units	Rs.3.00
Above 300 units	Rs.5.00

A surcharge of 2.5% charged if the number of units consumed is above 300 units.

void print ( ) - To print the details as follows:

Name of the customer:

Number of units consumed:

Bill amount:

Write a main method to create an object of the class and call the above member methods.

Question 5.

Write a program to accept a number and check and display whether it is a **spy number** or not. (A number is spy if the sum of its digits equals the product of its digits.) [15]

Example: consider the number 1124, Sum of the digits = 1 + 1 + 2 + 4 = 8

Product of the digits = 1 1 2 4 = 8

Question 6.

Using *switch* statement, write a menu driven program for the following: [15]

(i) To find and display the sum of the series given below:

$$x + \frac{x^2}{2} + \frac{x^3}{3} + \frac{x^4}{4} + \frac{x^5}{5}$$

(where $x = 2$)

(ii) To display the following series:

1 11 111 1111 11111

For an incorrect option, an appropriate error message should be displayed.

Question 7.

Write a program to input integer elements into an array of size **20** and perform the following operations: [15]

(i) Display largest number from the array.

(ii) Display smallest number from the array.

(iii) Display sum of all the elements of the array.

Question 8.

Design a class to overload a function check( ) as follows: [15]

(i) void check (String str , char ch) - to find and print the frequency of a character in a string.

Example :

Input: Output:

str = "success" number of **s** present is =3

ch = 's'

(ii) void check(String s1) - to display only vowels from string s1, after converting it to lower case.

Example :

Input:

s1 ="computer" Output : o u e

Question 9.

Write a program to input **forty** words in an array. Arrange these words in descending order of alphabets, using **selection** sort technique. Print the sorted array. [15]

ICSE ACADEMY

COMPUTER APPLICATIONS

(Theory)

(Two Hours)

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The intended marks for questions or parts of questions are given in brackets[].

SECTION A (40 Marks)

*Attempt **all** questions*

Question 1.

(a) Define abstraction. [2]

(b) Differentiate between searching and sorting. [2]

(c) Write a difference between the functions isUpperCase( ) and toUpperCase( ). [2]

(d) How are private members of a class different from public members? [2]

(e) Classify the following as primitive or non-primitive datatypes: [2]

(i) char

(ii) arrays

(iii) int

(iv) classes

Question 2.

(a) (i) int res = 'A'; [2]

What is the value of **res**?

(ii) Name the package that contains wrapper classes.

(b) State the difference between **while** and **do while** loop. [2]

(c) System.out.print("BEST "); [2]

System.out.println("OF LUCK");

Choose the correct option for the output of the above statements

(i) BEST OF LUCK

(ii) BEST

OF LUCK

(d) Write the prototype of a function **check** which takes an integer as an argument and returns a character. [2]

(e) Write the return data type of the following function. [2]

(i) endsWith()

(ii) log()

Question 3.

(a) Write a Java expression for the following: [2]

(b) What is the value of **y** after evaluating the expression given below? [2]

y+= ++y + y-- + -- y; when int y=8

(c) Give the output of the following: [2]

(i) Math.floor (-4.7)

(ii) Math.ceil(3.4) + Math.pow(2, 3)

(d) Write two characteristics of a constructor. [2]

ICSE ACADEMY

(e) Write the output for the following: [2]

```
System.out.println("Incredible"+"\n"+"world");
```

(f) Convert the following **if else if** construct into **switch case** [2]

```
if( var==1)
System.out.println("good");
else if(var==2)
    System.out.println("better");
else if(var==3)
    System.out.println("best");
else
    System.out.println("invalid");
```

(g) Give the output of the following string functions: [2]

(i) "ACHIEVEMENT".replace('E', 'A')

(ii) "DEDICATE".compareTo("DEVOTE")

(h) Consider the following String array and give the output [2]

```
String arr[]= {"DELHI", "CHENNAI", "MUMBAI", "LUCKNOW",
"JAIPUR"};
System.out.println(arr[0].length()> arr[3].length());
System.out.print(arr[4].substring(0,3));
```

(i) Rewrite the following using ternary operator: [2]

```
if (bill >10000 )
discount = bill * 10.0/100;
else
discount = bill * 5.0/100;
```

(j) Give the output of the following program segment and also mention how many times the loop is executed: [2]

```
int i;
for ( i = 5 ; i > 10; i ++ )
System.out.println( i );
System.out.println( i * 4 );
```


SECTION B (60 Marks)

Attempt ***any four*** questions from this Section.

The answers in this Section should consist of the ***Programs in either Blue J environment or any program environment with Java as the base.***

Each program should be written using ***Variable descriptions/Mnemonic Codes*** *so that the logic of the program is clearly depicted.*

Flow-Charts and Algorithms ***are not required.***

Question 4.

Design a class **RailwayTicket** with following description: [15]

Instance variables/data members :

String name : To store the name of the customer

String coach : To store the type of coach customer wants to travel

long mobno : To number

int amt : To store basic amount of ticket

int totalamt : To store the amount to be paid after updating the original amount

Member methods :

void accept () To take input for name, coach, mobile number and amount.

void update() To update the amount as per the coach selected

(extra amount to be added in the amount as follows)

Type of Coaches	Amount
First_AC	700
Second_AC	500
Third_AC	250
sleeper	None

void display() To display all details of a customer such as name, coach, total amount and mobile number.

Write a main method to create an object of the class and call the above member methods.

Question 5.

Write a program to input a number and check and print whether it is a **Pronic** number or not. (Pronic number is the number which is the product of two consecutive integers) [15]

Examples: 12 = 3 4

20 = 4 5

42 = 6 7

Question 6.

Write a program in Java to accept a string in lower case and change the first letter of every word to upper case. Display the new string. [15]

Sample input: we are in cyber world

Sample output: We Are In Cyber World

Question 7.

Design a class to overload a function volume() as follows: [15]

(i) double volume (double R) . with radius (R) as an argument, returns the volume of sphere using the formula.

V = 4/3 22/7 R^3

(ii) double volume (double H, double R) . with height(H) and radius(R) as the arguments, returns the volume of a cylinder using the formula.

V = 22/7 R^2 H

(iii) double volume (double L, double B, double H) . with length(L), breadth(B) and Height(H) as the arguments, returns the volume of a cuboid using the formula.

V = L B H

Question 8.

[15]

Pattern 1	Pattern 2
ABCDE	B
ABCD	LL
ABC	UUU
AB	EEEE
A	

For an incorrect option, an appropriate error message should be displayed.

Question 9.

Write a program to accept name and total marks of **N** number of students in two single subscript array **name[ ]** and **totalmarks[ ]**. [15]

Calculate and print:

(i) The average of the total marks obtained by **N** number of students.
[average = (sum of total marks of all the students)/N]

(ii)

[deviation = total marks of a student . average]

ICSE ACADEMY

COMPUTER APPLICATIONS

(Theory)

(Two Hours)

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SECTION A (40 Marks)

*Attempt **all** questions*

Question 1.

(a) Name any two basic principles of Object-oriented Programming. [2]

(b) Write a difference between **unary** and **binary** operator. [2]

(c) Name the keyword which: [2]

(i) indicates that a method has no return type.

(ii) makes the variable as a class variable.

(d) Write the memory capacity (storage size) of **short** and **float** data type in bytes. [2]

(e) Identify and name the following tokens: [2]

(i) public

(ii) 'a'

(iii) ==

(iv) { }

This Paper consists of 6 printed pages.

Question 2.

(a) Differentiate between **if else if** and **switch-case** statements. [2]

(b) Give the output of the following code: [2]

```
String  P = "20",  Q ="19";
int  a =  Integer.parseInt(P);
int  b = Integer.valueOf(Q);
System.out.println(a+""+b);
```

(c) What are the various types of errors in Java? [2]

(d) State the data type and value of **res** after the following is executed: [2]

```
char ch = '9';
res= Character.isDigit(ch);
```

(e) What is the difference between the **linear** search and the **binary** search technique? [2]

Question 3.

(a) Write a Java expression for the following: [2]

$| x^2+2xy |$

(b) Write the return data type of the following functions: [2]

(i) startsWith( )

(ii) random( )

(c) If the value of **basic**=1500, what will be the value of **tax** after the following statement is executed? [2]

```
tax = basic>1200 ? 200 :100;
```

(d) Give the output of following code and mention how many times the loop will execute? [2]

```
int i;
for( i=5 ; i>=1 ;i--)
{
    if(i%2 ==1)
 continue;
 System.out.print( i+ " ");
}
```


ICSE ACADEMY

(e) State a difference between call by value and call by reference. [2]

(f) Give the output of the following: [2]

Math.sqrt(Math.max(9,16))

(g) Write the output for the following: [2]

```
String s1 = "phoenix"; String s2 ="island" ;
System.out.println (s1.substring(0).concat (s2.substring(2) ) );
System.out.println(s2.toUpperCase());
```

(h) Evaluate the following expression if the value of x=2, y=3 and z=1. [2]

v=x+ --z+ y++ +y

(i) String x[] = {"Artificial intelligence", "IOT", "Machine learning", "Big data"}; [2]

Give the output of the following statements:

(i) System.out.println(x[3]);

(ii) System.out.println(x.length);

(j) What is meant by a package? Give an example. [2]

SECTION B (60 Marks)

Attempt ***any four*** questions from this Section.

*The answers in this Section should consist of the **Programs in either Blue J environment or any program environment with Java as the base.***

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*Flow-Charts and Algorithms **are not required.***

Question 4.

Design a class name **ShowRoom** with the following description: [15]

Instance variables / Data members:

String name - To store the name of the customer

long mobno - To store the mobile number of the customer

double cost - To store the cost of the items purchased

double dis - To store the discount amount

double amount - To store the amount to be paid after discount

Member methods:

ShowRoom( ) - default constructor to initialize data members

void input( ) - To input customer name, mobile number, cost

void calculate( ) - To calculate **discount** on the **cost** of purchased items, based on following criteria

Cost	Discount (in percentage)
Less than or equal to ₹ 10000	5%
More than ₹ 10000 and less than or equal to ₹ 20000	10%
More than ₹ 20000 and less than or equal to ₹ 35000	15%
More than ₹ 35000	20%

void display( ) - To display customer name , mobile number , amount to be paid after discount.

Write a main method to create an object of the class and call the above member methods.

Question 5.

Using the **switch-case** statement, write a menu driven program to do the following: [15]

(a) To **generate** and print Letters from A to Z and their Unicode

Letters	Unicode
A	65
B	66
.	.
.	.
.	.
Z	90

(b) Display the following pattern using **iteration** (looping) statement:

1

1 2

1 2 3

1 2 3 4

1 2 3 4 5

Question 6.

Write a program to input **15** integer elements in an array and sort them in **ascending** order using the **bubble** sort technique. [15]

Question 7.

Design a class to overload a function **series( )** as follows: [15]

(a) void series (int x, int n) . To display the sum of the series given below:

$x^1 + x^2 + x^3$ ..... ^{n} terms

(b) void series (int p) . To display the following series:

0, 7, 26, 63 ..... p terms

(c) void series ( ) . To display the sum of the series given below:

$\frac{}{} - \frac{}{} - \frac{}{} \ldots\ldots \frac{}{}$

Question 8.

Write a program to input a **sentence** and convert it into uppercase and count and display the total number of words starting with a letter **'A'**. [15]

Example:

Sample Input: ADVANCEMENT AND APPLICATION OF INFORMATION TECHNOLOGY ARE EVER CHANGING.

Sample Output: Total number of words starting with letter 'A' = 4.

Question 9.

A ***tech number*** has even number of digits. If the number is split in two equal halves, then the square of sum of these halves is equal to the number itself. Write a program to generate and print all *four digits tech numbers.* [15]

Example:

Consider the number 3025

Square of sum of the halves of 3025 $= (30+25)^2$

$= (55)^2$

= 3025 is a tech number.

COMPUTER APPLICATIONS

(Theory)

(Two Hours)

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The intended marks for questions or parts of questions are given in brackets [ ].

SECTION A (40 Marks)

*Attempt **all** questions*

Question 1.

(a) Define Java byte code. [2]

(b) Write a difference between *class* and an *object*. [2]

(c) Name the following: [2]

(i) The keyword which converts variable into constant.

(ii) The method which terminates the entire program from any stage.

(d) Which of the following are primitive data types? [2]

(i) double

(ii) String

(iii) char

(iv) Integer

(e) What is an operator? Name any two types of operators used in Java. [2]

Question 2.

(a) What is autoboxing in Java? Give an example. [2]

(b) State the difference between length and length() in Java. [2]

(c) What is constructor overloading? [2]

(d) What is the use of *import* statement in Java? [2]

(e) What is an infinite loop? Give an example. [2]

Question 3.

(a) Write a Java expression for the following: [2]

(b) Evaluate the following if the value of x=7, y=5 [2]

x+=x++ + x + ++y

(c) Write the output for the following: [2]

```
String s1 = "Life is Beautiful";
System.out.println ("Earth" + s1.substring(4));
System.out.println( s1.endsWith("L") );
```

(d) Write the output of the following statement: [2]

```
System.out.println("A picture is worth \t \"A thousand words.\" ");
```

(e) Give the output of the following program segment and mention how many times the loop will execute: [2]

```
int k;
for ( k = 5 ; k < = 20 ; k + = 7 )
if ( k% 6==0 )
continue;
System.out.println ( k );
```

(f) What is the data type returned by the following library methods? [2]

(i) isWhitespace()

(ii) compareToIgnoreCase()

(g) Rewrite the following program segment using logical operators: [2]

```
if ( x > 5 )
if ( x > y )
System.out.println (x+y);
```

(h) Convert the following **if else if** construct into **switch case**: [2]

```
if (ch== 'c' || ch=='C')
System.out . print("COMPUTER");
else  if (ch== 'h' || ch=='H')
System.out . print("HINDI");
else
System.out . print("PHYSICAL EDUCATION");
```

(i) Give the output of the following: [2]

(i) Math.pow (36,0.5) + Math.cbrt (125)

(ii) Math.ceil (4.2) + Math.floor (7.9)

(j) Rewrite the following using **ternary** operator: [2]

```
if(n1>n2)
r = true;
else
r = false;
```


SECTION B (60 Marks)

Attempt ***any four*** questions from this Section.

The answers in this Section should consist of the ***Programs in either Blue J environment or any program environment with Java as the base.***

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Flow-Charts and Algorithms ***are not required.***

Question 4.

A private Cab service company provides service within the city at the following rates: [15]

	AC CAR	NON AC CAR
UPTO 5 KM	150 /-	120 /-
BEYOND 5 KM	10/-PER KM	08/- PER KM

Design a class **CabService** with the following description:

Member variables /data members:

String car_type - To store the type of car (AC or NON AC)

double km - To store the kilometer travelled

double bill - To calculate and store the bill amount

Member methods :

CabService() - Default constructor to initialize data members. String data members to " " and double data members to 0.0.

void accept () - To accept car_type and km (using Scanner class only).

void calculate () - To calculate the bill as per the rules given above.

void display() - To display the bill as per the following format

CAR TYPE:

KILOMETER TRAVELLED:

TOTAL BILL:

Create an object of the class in the main method and invoke the member methods.

Question 5.

Write a program to search for an integer value input by the user in the sorted list given below using **binary** search technique. If found display "Search Successful" and print the element, otherwise display "Search Unsuccessful" [15]

{31, 36, 45, 50, 60, 75, 86, 90}

Question 6.

Write a program to input a **sentence** and convert it into uppercase and display each word in a separate line. [15]

Example: Input : India is my country

Output : INDIA

IS

MY

COUNTRY

Question 7.

Design a class to overload a method Number( ) as follows: [15]

(i) void Number (int num , int d) - To count and display the frequency of a digit in a number.

Example:

num = 2565685

d = 5

Frequency of digit 5 = 3

(ii) void Number (int n1) - To find and display the sum of even digits of a number.

Example:

n1 = 29865

Sum of even digits = 16

Write a main method to create an object and invoke the above methods.

Question 8.

Write a menu driven program to perform the following operations : [15]

(i) To print the value of $c=a^2+2ab$, where **a** varies from **1.0** to **20.0** with increment of **2.0** and **b=3.0** is a constant.

(ii) To display the following pattern using **for** loop:

A
AB
ABC
ABCD
ABCDE

Display proper message for an invalid choice.

Question 9.

Write a program to input and store integer elements in a double dimensional array of size **3 x 3** and find the **sum** of elements in the left diagonal. [15]

Example:

1 3 5

4 6 8

9 2 4

Output: Sum of the left diagonal elements = (1 + 6 +4) = 11

COMPUTER APPLICATIONS

Maximum Marks: 100

Time allowed: Two hours

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SECTION A (40 Marks)

*(Attempt **all** questions from this **Section**.)*

Question 1 [20]

Choose the correct answers to the questions from the given options.

(Do not copy the questions, write the correct answers only.)

(i) A mechanism where one class acquires the properties of another class:

(a) Polymorphism

(b) Inheritance

(c) Encapsulation

(d) Abstraction

(ii) Identify the type of operator **&&**:

(a) ternary

(b) unary

(c) logical

(d) relational

(iii) The Scanner class method used to accept words with space:

(a) next()

(b) nextLine()

(c) Next()

(d) nextString()

(iv) The keyword used to call *package* in the program:

(a) extends

(b) export

(c) import

(d) package

(v) What value will Math.sqrt (Math.ceil (15.3)) return?

(a) 16.0

(b) 16

(c) 4.0

(d) 5.0

(vi) The absence of which statement leads to *fall through* situation in switch case statement?

(a) continue

(b) break

(c) return

(d) System.exit(0)

(vii) State the type of loop in the given program segment:

```
for (int i = 5; i ! = 0; i - = 2)
System.out.println(i);
```

(a) finite

(b) infinite

(c) null

(d) fixed

(viii) Write a method prototype name **check**() which takes an integer argument and returns a char:

(a) char check()

(b) void check (int *x*)

(c) check (int *x*)

(d) char check (int *x*)

(ix) The number of values that a method can **return** is:

(a) 1

(b) 2

(c) 3

(d) 4

(x) Predict the output of the following code snippet: String P = "20", Q ="22";

```
int a = Integer.parseInt(P);
int b = Integer.valueOf(Q);
System.out.println(a+""+b);
```

(a) 20

(b) 20 22

(c) 2220

(d) 22

(xi) The String class method to **join** two strings is:

(a) concat(String)

(b) <string>.joint(string)

(c) concat(char)

(d) Concat()

(xii) The output of the function "COMPOSITION".substring(3, 6):

(a) POSI

(b) POS

(c) MPO

(d) MPOS

(xiii) int *x* = (int) 32.8; is an example of _____ typecasting.

(a) implicit

(b) automatic

(c) explicit

(d) coercion

(xiv) The code obtained after *compilation* is known as:

(a) source code

(b) object code

(c) machine code

(d) java byte code

(xv) Missing a semicolon in a statement is what type of error?

(a) Logical

(b) Syntax

(c) Runtime

(d) No error

(xvi) Consider the following program segment and select the output of the same when n = 10 :

```
switch(n)
{case 10 : System.out.println(n*2);
case 4 : System.out.println(n*4); break;
default : System.out.println(n);
}
```

(a) 20
40

(b) 10
4

(c) 20, 40

(d) 10
10

(xvii) A method which does not *modify* the value of variables is termed as:

(a) Impure method

(b) Pure method

(c) Primitive method

(d) User defined method

(xviii) When an object of a Wrapper class is converted to its corresponding primitive data type, it is called as _____.

(a) Boxing

(b) Explicit type conversion

(c) Unboxing

(d) Implicit type conversion

(xix) The number of *bits* occupied by the value 'a' are:

(a) 1 bit

(b) 2 bits

(c) 4 bits

(d) 16 bits

(xx) Method which is a part of a *class* rather than an instance of the class is termed as:

(a) Static method

(b) Non static method

(c) Wrapper class

(d) String method

Question 2

(i) Write the Java expression for $(a + b)^x$. [2]

(ii) Evaluate the expression when the value of $x = 4$: [2]

$x * = - - x + x++ + x$

(iii) Convert the following do…while loop to for loop: [2]

```
int x=10;
do
{x– –;
System.out.print(x);
}while (x>=1);
```

(iv) Give the output of the following Character class methods: [2]

(a) Character.toUpperCase ('a')

(b) Character.isLetterOrDigit('#')

(v) Rewrite the following code using the if-else statement: [2]

```
int m= 400;
double ch = (m>300) ? (m / 10.0) * 2: (m / 20.0) - 2;
```

(vi) Give the output of the following program segment: [2]

```
int n = 4279; int d;
while(n>0)
{d=n%10;
System.out.println(d);
n=n/100;
}
```

(vii) Give the output of the following String class methods: [2]

(a) "COMMENCEMENT" . lastIndexOf('M')

(b) "devote" . compareTo("DEVOTE")

(viii) Consider the given array and answer the questions given below: [2]

```
int x[ ]={4,7,9,66,72,0,16};
```

(a) What is the length of the array?

(b) What is the value in x[4]?

(ix) Name the following: [2]

(a) What is an instance of the class called?

(b) The method which has same name as that of the class name.

(x) Write the value of *n* after execution: [2]

```
char ch ='d';
int n = ch + 5;
```

SECTION B (60 Marks)

*(Answer **any four** questions from this **Section**.)*

The answers in this section should consist of the programs in either BlueJ environment or any program environment with java as the base.

Each program should be written using variable description / mnemonic codes so that the logic of the program is clearly depicted.

Flowcharts and algorithms are not required.

Question 3 [15]

Design a class with the following specifications:

Class name: **Student**

Member variables:
name – name of student
age – age of student
mks –marks obtained
stream – stream allocated
(Declare the variables using appropriate data types)

Member methods:

void **accept()** – Accept name, age and marks using methods of Scanner class.

void **allocation**() – Allocate the stream as per following criteria:

mks	stream
> = 300	Science and Computer
> = 200 and < 300	Commerce and Computer
> = 75 and 200	Arts and Animation
< 75	Try Again

void **print**() – Display student name, age, mks and stream allocated.

Call all the above methods in main method using an object.

Question 4 [15]

Define a class to accept 10 characters from a user. Using **bubble sort** technique arrange them in ascending order. Display the sorted array and original array.

Question 5 [15]

Define a class to overload the function **print** as follows:

void **print**() to print the following format

```
1 1 1 1
2 2 2 2
3 3 3 3
4 4 4 4
5 5 5 5
```

void **print**(int n) To check whether the number is a lead number. A lead number is the one whose sum of even digits are equal to sum of odd digits.

e.g. 3669 odd digits sum = 3 + 9 = 12
even digits sum = 6 + 6 = 12
3669 is a lead number.

Question 6 [15]

Define a class to accept a String and print the number of digits, alphabets and special characters in the string.

Example: S = "KAPILDEV@83"

Output: Number of digits – 2
Number of Alphabets – 8
Number of Special characters – 1

Question 7 [15]

Define a class to accept values into an array of double data type of size 20. Accept a double value from user and search in the array using **linear search** method. If value is found display message "Found" with its position where it is present in the array. Otherwise display message "not found".

Question 8 [15]

Define a class to accept values in integer array of size 10. Find sum of *one digit* number and sum of *two digit* numbers entered. Display them separately.

Example: Input: a[ ] = {2, 12, 4, 9, 18, 25, 3, 32, 20, 1}
Output: Sum of one digit numbers : 2 + 4 + 9 + 3 + 1 = 19
Sum of two digit numbers : 12 + 18 + 25 + 32 + 20 = 107

Pati's
ICSE ACADEMY

COMPUTER SCIENCE
PAPER 1
(THEORY)

Maximum Marks: 70
Time Allowed: Three Hours
*(Candidates are allowed **additional 15 minutes** for **only** reading the paper.*
*They must **NOT** start writing during this time.)*

*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.*
All working, including rough work, should be done on the same sheet as the rest of the answer.
The intended marks for questions or parts of questions are given in brackets [ ].

PART I – 20 MARKS

*Answer **all** questions.*

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

Question 1

(i) According to the *Principle of duality*, the Boolean equation $(A + B') \cdot (A + 1) = A + B'$ will be equivalent to: [1]

(a) $(A' + B) \cdot (A' + 1) = A' + B$

(b) $(A \cdot B') + (A \cdot 0) = A \cdot B'$

(c) $(A' \cdot B) + (A' \cdot 1) = A' \cdot B$

(d) $(A' \cdot B) + (A' \cdot 0) = A' \cdot B$

(ii) When a sequence of OR, NOT, NOR are connected in series, the logic gate obtained is: [1]

(a) AND

(b) NOT

(c) OR

(d) XOR

(iii) Idempotence Law states that: [1]

(a) $X + X = X$

(b) $X + X' = 0$

(c) $X + X = 1$

(d) $X + X' = X$

(iv) **Assertion:** For proposition $\sim A \Rightarrow B$, its contrapositive is $B \Rightarrow \sim A$ [1]

Reason: Contrapositive is the converse of inverse for any proposition.

(a) Both Assertion and Reason are true, and Reason is the correct explanation for the Assertion.

(b) Both Assertion and Reason are true, but Reason is not the correct explanation for the Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

(v) The complement of the Boolean expression $(P' \cdot Q) + (R \cdot S')$ is: [1]

(a) $(P' + Q) \cdot (R' + S)$

(b) $(P + Q') \cdot (R' + S)$

(c) $(P' + Q) \cdot (R + S')$

(d) $(P + Q') \cdot (R + S')$

(vi) **Assertion:** Recursive data structure follows the **LIFO** principle. [1]
Reason: Execution of recursive code follows the concepts of data structure **Queue**.

(a) Both Assertion and Reason are true, and Reason is the correct explanation for the Assertion.

(b) Both Assertion and Reason are true, but Reason is not the correct explanation for the Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

(vii) State *any one* use of *interfaces* in Java. [1]

(viii) Write the cardinal form of the maxterm $X + Y' + Z$ [1]

(ix) Write the *canonical* SOP expression for $F(A, B) = A \Leftrightarrow B$ [1]

(x) State *any one* difference between **instance variable** and **class variable**. [1]

Question 2

(i) Convert the following infix notation to postfix form. [2]

(P + Q * R − S) / T * U

(ii) An array ARR [−5 …..15, 10…..20] stores elements in **Row Major Wise** with each element requiring 2 bytes of storage. Find the address of ARR [10] [15] when the base address is 2500. [2]

(iii) The following function is a part of some class:

```
int jolly(int[ ] x, int n, int m)
{
 if (n < 0)
        return m;
 else if(n<x.length)
        m = (x[n] > m)? x[n] : m;
 return jolly(x, --n, m);
}
```

(a) What will be the output of **jolly( )** when the value of **x[ ]={6,3,4,7,1}** , **n=4** and **m=0**? [2]

(b) What function does **jolly( )** perform, apart from recursion? [1]

(iv) The following function is a part of some class which is used to find the smallest digit present in a number. There are some places in the code marked by **?1?, ?2?, ?3?** which must be replaced by an expression / a statement so that the function works correctly.

```
int small_dig(int n)
{   int min = ?1? ;
     while (n != 0)
     {
       int q=n/10;
       int r = ?2? * 10;
       min = r > min ?  ?3?  : r;
       n=q;
     }
     return min;
}
```

(a) What is the expression or statement at **?1?** [1]

(b) What is the expression or statement at **?2?** [1]

(c) What is the expression or statement at **?3?** [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

(i) To be recruited as the Principal in a renowned College, a candidate must satisfy any one of the following criteria: [5]

- The candidate must be a Postgraduate and should either possess a B.Ed. degree or a teaching experience of more than 15 years.

OR

- The candidate must be an employee of the same college with a teaching experience of more than 15 years.

OR

- The candidate must be a Postgraduate but not an employee of the same college and should have a teaching experience of more than 15 years.

The inputs are:

INPUTS	
P	Candidate is a Postgraduate
S	Candidate is an employee of the same College
E	Candidate has a teaching experience of more than 15 years
B	Candidate possesses a B.Ed. degree

(In all the above cases, 1 indicates yes and 0 indicates no)

Output: X - Denotes eligibility of a candidate [1 indicates eligibility and 0 indicates ineligibility in all cases]

Draw the truth table for the inputs and outputs given above and write the **SOP** expression for **X (P, S, E, B)**.

(ii) Reduce the above expression **X (P, S, E, B)** by using 4-variable Karnaugh map, showing the various groups (i.e., octal, quads and pairs). [5]
Draw the logic gate diagram for the reduced expression. Assume that the variables and their complements are available as inputs.

Question 4

(i) (a) Reduce the Boolean function **F (A,B,C,D) = π (0, 2, 4, 6, 8, 9, 10, 11, 14)** by using 4-variable Karnaugh map, showing the various groups (i.e., octal, quads and pairs). **[4]**

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

(ii) Verify if the following proposition is a Tautology, Contradiction or a Contingency, using a truth table. **[3]**

$$((A \Rightarrow B) \wedge (B \Rightarrow C)) \Rightarrow (A \Rightarrow C)$$

(iii) Find the complement of the following expression and reduce it by using Boolean laws. **[2]**

$$P \cdot (P + Q) \cdot Q \cdot (Q + R')$$

Question 5

(i) How is a *decoder* different from a *multiplexer*? Draw the logic circuit for 3:8 decoder (Octal decoder). Which multiplexer can be derived from the Octal decoder? **[5]**

(ii) Draw the logic gate diagram for 2-input OR gate using NAND gates only. Show the expression at each step. **[3]**

(iii) Write the *canonical* form of the cardinal terms, m_3 and M_5 for F (A, B, C, D). **[2]**

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 **[10]**

Design a class **DeciHex** to accept a positive integer in decimal number system from the user and display its hexadecimal equivalent.

Example 1: Decimal number = 25 Hexadecimal equivalent = 19
Example 2: Decimal number = 28 Hexadecimal equivalent = 1C

Some of the members of the class are given below.

Class name	:	**DeciHex**
Data members/instance variables:		
num	:	stores the positive integer
hexa	:	string to store the hexadecimal equivalent of num
Methods / Member functions:		
DeciHex( )	:	constructor to initialise the data members with legal initial values
void getNum( )	:	to accept a positive integer
void convert(int n)	:	to find the hexadecimal equivalent of the formal parameter 'n' using the **recursive technique**
void display( )	:	to display the decimal number and its hexadecimal equivalent by invoking the function convert( )

Specify the class **DeciHex** giving details of the **constructor( ), void getNum( ), void convert(int) and void display( )**. Define a **main( )** function to create an object and call all the functions accordingly to enable the task.

Question 7 **[10]**

A class **InsSort** contains an array of integers which sorts the elements in a particular order.

Some of the members of the class are given below.

Class name	:	**InsSort**
Data members/instance variables:		
arr[ ]	:	stores the array elements
size	:	stores the number of elements in the array
Methods / Member functions:		
InsSort(int s)	:	constructor to initialise size = s
void getArray( )	:	accepts the array elements
void insertionSort( )	:	sorts the elements of the array in descending order using the **Insertion Sort technique**
double find( )	:	calculates and returns the average of all the odd numbers in the array
void display( )	:	displays the elements of the array in a sorted order along with the average of all the odd numbers in the array by invoking the function find( ) with an appropriate message

Specify the class **InsSort** giving details of the **constructor( ), void getArray( ), void insertionSort( ), double find( ) and void display( )**. Define a **main( )** function to create an object and call all the functions accordingly to enable the task.

Question 8 **[10]**

Design a class **Coding** to perform some string related operations on a word containing alphabets only.

Example: Input: "Java"
Output: Original word: Java
J = 74
a = 97
v = 118
a = 97

Lowest ASCII code: 74
Highest ASCII code: 118

Some of the members of the class are given below.

Class name	:	**Coding**
Data members/instance variables:		
wrd	:	stores the word
len	:	stores the length of the word
Methods / Member functions:		
Coding( )	:	constructor to initialise the data members with legal initial values
void accept( )	:	to accept a word
void find( )	:	to display all the characters of 'wrd' along with their ASCII codes. Also display the lowest ASCII code and the highest ASCII code, in 'wrd'
void show( )	:	to display the original word and all the characters of 'wrd' along with their ASCII codes. Also display the lowest ASCII code and the highest ASCII code in 'wrd', by invoking the function find( )

Specify the class **Coding** giving details of the **constructor( ), void accept( ), void find( )** and **void show( )**. Define a **main( )** function to create an object and call all the functions accordingly to enable the task.

SECTION – C

*Answer **any two** questions.*

Each program should be written in such a way that it clearly depicts the logic of the problem stepwise.
This can be achieved by using comments in the program and mnemonic names or pseudo codes for algorithms. The programs must be written in Java and the algorithms must be written in general / standard form, wherever required / specified.
(Flowcharts are **not** required.)

Question 9

CardGame is a game of mental skill, built on the simple premise of adding and removing the cards from the top of the card pile.

The details of the class **CardGame** are given below.

Class name : **CardGame**

Data members/ instance variables:

cards[ ]	:	array to store integers as cards
cap	:	to store the maximum capacity of array
top	:	to store the index of the topmost element of the array

Methods / Member functions:

CardGame(int cc)	:	constructor to initialise cap=cc and top= –1
void addCard(int v)	:	to add the card at the top index if possible, otherwise display the message "CARD PILE IS FULL"
int drawCard( )	:	to remove and return the card from the top index of the card pile, if any, else return the value –9999
void display( )	:	to display all the cards of card pile

(i) Specify the class **CardGame** giving details of the functions **void addCard(int)** and **int drawCard( )**. *Assume that the other functions have been defined.* **The main( ) function and algorithm need NOT be written.** [4]

(ii) Name the entity described above and state its principle. [1]

Question 10 [5]

A super class **EmpSal** has been defined to store the details of an employee. Define a subclass **Overtime** to compute the total salary of the employee, after adding the overtime amount based on the following criteria.

- If hours are more than 40, then ₹ 5000 are added to salary as an overtime amount
- If hours are between 30 and 40 (both inclusive), then ₹ 3000 are added to salary as an overtime amount
- If hours are less than 30, then the salary remains unchanged

The details of the members of both the classes are given below.

Class name : **EmpSal**

Data members/instance variables:

empnum	:	to store the name of the employee
empcode	:	integer to store the employee code
salary	:	to store the salary of the employee in decimal

Methods / Member functions:

EmpSal(…)	:	parameterised constructor to assign values to data members
void show( )	:	to display the details of the employee

Class name **Overtime**

Data members/instance variables:

hours	:	integer to store overtime in hours
totsal	:	to store the total salary in decimal

Methods / Member functions:

Overtime(…)	:	parameterised constructor to assign values to data members of both the classes
void calSal( )	:	calculates the total salary by adding the overtime amount to salary as per the criteria given above
void show( )	:	to display the employee details along with the total salary (salary + overtime amount)

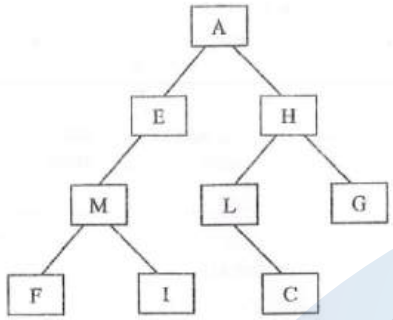
*Assume that the super class **EmpSal** has been defined.* Using the **concept of inheritance**, specify the class **Overtime** giving the details of the **constructor (...)**, **void calSal( )** and **void show( )**.

The super class, main function and algorithm need NOT be written.

Question 11

(i) With the help of an example, briefly explain the *dominant term* in complexity. [2]

(ii) Answer the following questions based on the diagram of a Binary Tree given below:



(a) Name the external nodes of the tree. [1]

(b) State the degree of node M and node L. [1]

(c) Write the *post-order* traversal of the above tree structure. [1]

COMPUTER APPLICATIONS

SECTION A (40 Marks)

*(Attempt **all** questions from this **Section**.)*

Question 1 [20]

Choose the correct answers to the questions from the given options.

(Do not copy the questions, write only the correct answers.)

(i) Character class methods are found in the ***package*** called:

(a) java.util

(b) java.lang

(c) java.awt

(d) java.io

(ii) System.out.println(**'Z'+32**); will display:

(a) z

(b) Z

(c) 122

(d) 154

(iii) ***double x [ ]={2.5,4.5,5.5,6.4};*** occupies _____ bytes.

(a) 16

(b) 4

(c) 8

(d) 32

(iv) The output of ***42/6%2*** is:

(a) 1

(b) 10

(c) 2

(d) 0

(v)

 Mouse	 Keyboard	 Printer
 Scanner	 Barcode Scanner	 Microphone

Consider the ***Two dimensional array P[2][3]***, of peripherals (input / output devices) given above, state the index of the device ***Barcode Scanner***.

(a) P[1][1]

(b) P[0][1]

(c) P[1][2]

(d) P[0][0]

(vi) Which of the following is ***user defined data type***?

1. array	3. class
2. double	4. boolean

(a) only 1

(b) 1 and 3

(c) only 2

(d) only 4

(vii) Select the ***infinite*** loop:

(a) for(int i=1;i<=10;i++)

(b) for(int i=2; i!=0 ;i-=3)

(c) for(int i=5 ;i<=5;i++)

(d) for(int i =1;i>=1; i - -)

(viii) The output of ***Math.max(-7, Math.min(-5 ,-4))*** is:

(a) –5

(b) –4

(c) –7

(d) error

(ix) Which of the following ***is true*** for the given object creation statement?

Game cricket = new Game( );

(a) Game is an object of cricket class

(b) New keyword creates object Game

(c) Game is a class and cricket is an object

(d) Game and cricket are objects

(x) ***Post office*** is an example for _____ access specifier.

(a) public

(b) local

(c) protected

(d) private

(xi) **Assertion (A):** In switch case ***break*** statement avoids fall through.

Reason (R): ***break*** statement helps to execute only one case at a time.

(a) Both (A) and (R) are true and (R) is a correct explanation of (A).

(b) Both (A) and (R) are true and (R) is not a correct explanation of (A).

(c) (A) is true and (R) is false.

(d) (A) is false and (R) is true.

(xii) A physical education teacher asks the students to do the ***side stretch*** as shown below, 10 times. Which ***programming construct*** the teacher uses?

(a) if

(b) switch

(c) for

(d) if else if

(xiii) The ***index (subscript)*** of the last element of an array ***ar[ ]*** is:

(a) ar.length( )

(b) ar[ ].length

(c) ar.length()-1

(d) ar.length-1

(xiv) **Assertion (A):** A clock is a real-life example of ***nested loops***.

Reason (R): The hour hand moves through 12 positions, while the minute hand moves through 60 positions within each hour.

(a) Both (A) and (R) are true and (R) is a correct explanation of (A).

(b) Both (A) and (R) are true and (R) is not a correct explanation of (A).

(c) (A) is true and (R) is false.

(d) (A) is false and (R) is true.

(xv) Which of the following ***pairs of methods*** will cause a ***compile-time error*** due to incorrect method ***overloading***?

(a) void test(int a, int b) and void test(double a, double b)

(b) void test(int a, double b) and void test(double a, int b)

(c) void test(int a, double b) and void test(int a)

(d) void test(int a) and int test(int a)

(xvi) Which of the following converts ***"25"*** to ***25.0***?

(a) Double.Parsedouble("25")

(b) Double.parse("25")

(c) Double.parseDouble("25")

(d) Double.parseDouble(25)

(xvii) Consider the program segment:

```
int p=0;
for(p=4 ; p>0 ; p- =2);
System.out.print(p);
System.out.println(p);
```

The above statements will display:

(a) 42

(b) 4200

(c) 0
0

(d) 00

(xviii) ***System.out.println("I said,\"It\'s wise to obey elders.\"");***

The ***output*** of the above statement is:

(a) I said,'It is wise to obey elders.'

(b) I said, "It's wise to obey elders."

(c) I said,It's wise to elders.

(d) "'It's wise to obey elders.'"

(xix) What is the ***output*** of the statement given below?

"ANGER".compareTo("ANGEL")

(a) 3

(b) –6

(c) 6

(d) 0

(xx) Consider the following program segment in which the statements are ***jumbled***. Choose the ***correct order*** of statements to calculate and return the ***factorial of 4***.

for (k=1; k<=4; k++) ⟶ 1

return fa; ⟶ 2

long fa = 1, k; ⟶ 3

fa*=k; ⟶ 4

(a) 1, 2, 3, 4

(b) 3, 1, 4, 2

(c) 3, 1, 2, 4

(d) 1, 3, 2, 4

Question 2

(i) Write the ***java expression*** to find the product of square root of **P** and the square root of **Q** using the methods of ***Math class***. [2]

(ii) Write the ***output*** of the following String method: [2]

```
String x= " talent" ;   String y="matrix" ;
System.out.print(x.substring(3).concat(y.substring(3))) ;
```

(iii) Write the Java statement for creating an object named ***'sifra'*** of the class ***'Robot'***, which takes ***three double parameters***. [2]

(iv) Convert the given loop into **exit controlled loop.** [2]

```
int a,b;
for ( a=10 ,b=1; a>=1 ;a-=2)
{
b+=a;
b++;
}
System.out.print(b);
```

(v) Consider and give the ***output*** of the following program: [2]

```
class report
{   int a,b;
    report()
    {  a=10;
       b=15;
    }
    report(int x, int y)
    {  a=x;
       b=y;
    }
    void print()
    {  System.out.println(a*b);
    }
    static void main()
    {  report r = new report();
       r.print();
       report p = new report(4, 5);
       p.print();
    }
}
```

(vi) (a) Name one ***String method*** which results in ***positive integer only***. [2]

(b) Name one ***String method*** which results in a ***character***.

(vii) John was asked to write a Java code to calculate the ***surface area of a cone***, the following code was written by him: [2]

Surface area of cone is A=πrl $l = \sqrt{r^2 + h^2}$

```
class area
{    double area (double r, double h)
  {  double l, a;
     a=22.0/7*r*l;
     l=Math.sqrt(r*r+h*h);
     return a;
  }
}
```

Specify the ***type of the error*** in the above program, correct and writethe program to be error free.

(viii) Consider the following array and answer the questions given below: [2]

int a[ ] = {12,10,8,4,6,2,3,5,7}

(a) What is the ***output*** of System.out.print***(a[0]+a[5])***;?

(b) What is the ***index (subscript)*** of the ***largest*** element of the array ***a[ ]***?

(ix) (a) Write the Java statement to initialise the ***first 6 odd numbers*** in a ***3 × 2*** array. [2]

(b) What is the result of ***x[0][1] + x[2][1]*** of the above array?

(x) Give the ***output*** of the following program segment and specify ***how many times*** the loop is executed. [2]

```
String s = "JAVA";
for(i=0;i<s.length();i+=2)
System.out.println(s.substring(i));
```


SECTION B (60 Marks)

*(Answer **any four** questions from this **Section**.)*

The answers in this section should consist of the programs in either BlueJ environment or any program environment with Java as the base.

Each program should be written using variable description / mnemonic codes so that the logic of the program is clearly depicted.

Flowcharts and algorithms are not required.

Question 3 [15]

Define a ***class*** named ***CloudStorage*** with the following specifications:

- ***Member Variables:***
  - int acno - stores the user's account number.
  - int space - stores the amount of storage space in GB purchased by the user.
  - double bill - stores the total price to be paid by the user.
- ***Member Methods:***
  - void accept() - prompts the user to input their account number and storage space using Scanner class methods only.
  - void calculate() - calculates the bill total price based on the storage space purchased using the pricing table provided:

Storage range	Price per GB (Rs)
First 15 GB	15
Next 15 GB	13
Above 30 GB	11

  - void display() - displays the account number, storage space and bill to be paid.

Write a ***main method*** to create an ***object*** of the class and ***invoke*** the methods of the class with respect to the object.

Question 4 [15]

Define a ***class*** to accept values into a 4 x 4 integer array. Calculate and print the ***NORM*** of the array.

NORM is the square root of sum of squares of all elements.

1	2	1	3
5	2	1	6
3	6	1	2
3	4	6	3

Sum of squares of elements = 1+4+1+9+25+4+1+36+9+36+1+4+9+16+36+9 = 201

NORM = Squareroot of 201 = 14.177446878757825

Question 5 [15]

Define a ***class*** to accept a String and Print if it is a ***Super string*** or not. A ***String is Super*** if the ***number of uppercase letters*** are equal to the ***number of lower case letters***.

[Use Character & String methods only]

Example : "COmmITmeNt"

Number of Uppercase letters – 5

Number of Lowercase letters – 5

String is a Super String

Question 6 [15]

Define a ***class*** to initialise the following data in an array.

Search for a given character input by the user, using the ***Binary Search technique***.

Print ***"Search Successful"*** if the character is found otherwise print ***"Search is not Successful"***.

'A', 'H', 'N', 'P', 'S', 'U', 'W', 'Y', 'Z', 'b', 'd'

Question 7 [15]

Define a ***class*** to overload the method ***print( )*** as follows:

void print ( ) – To print the given format using nested loops.

@#@#@

@#@#@

@#@#@

@#@#@

double print(double *a*, double *b*) – To display the sum of numbers between ***a*** and ***b*** with difference of 0.5.

e.g. if *a* = 1.0, *b* = 4.0

output is: 1.0 + 1.5 + 2.0 + 2.5 + ……. + 4.0

int print(char ch1, char ch2) – compare the two characters and return the ASCII code of the largest character.

Question 8 [15]

Define a ***class*** to accept a number. Check if the sum of the ***largest digit*** and the ***smallest digit*** is an even number or an odd number. ***Print appropriate messages.***

Sample Input:	6425	3748
Largest digit:	6	8
Smallest digit:	2	3
Sample Output:	Sum is even	Sum is odd

PART I – 20 MARKS

*Answer **all** questions.*

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

Question 1

(i) The complement of the Boolean expression (P + Q') • (R' + P) is: **[1]**

(a) (P • Q') + (R' • P)

(b) (P' • Q) + (R • P')

(c) (P' • Q) • (R • P')

(d) (P + Q') • (R' + P)

(ii) Given below are two statements marked Assertion and Reason. Read the two statements carefully and choose the correct option. **[1]**

Assertion: For overloaded method, signature matching happens at compile time.

Reason: The overloaded method must have a unique signature for its every prototype.

(a) Both Assertion and Reason are true and Reason is the correct explanation for Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation for Assertion.

(c) Assertion is true and Reason is false.

(d) Both Assertion and Reason are false.

(iii) According to the Principle of Duality, the Boolean equation (X' + Y • 0) • X = 0 will be equivalent to: **[1]**

(a) (X + Y' • 1) • X' = 1

(b) (X • Y' + 1) + X' = 1

(c) (X' • Y + 1) + X = 1

(d) (X' • Y + 0) + X = 0

(iv) Commutative law states that: **[1]**

(a) A • (A + B) = A

(b) (A • B) • C = A • (B • C)

(c) A+ (B + C) = (A+ B) + C

(d) (A + B) = (B + A)

(v) The canonical expression for F(x, y, z) = ∑(1, 3, 6) is: **[1]**

(a) (x • y • z') + (x • y' • z') + (x' • y' • z)

(b) (x + y + z') • (x + y' + z') • (x' + y' + z)

(c) (x' + y' + z) • (x' + y + z) • (x + y + z')

(d) (x' • y' • z) + (x' • y • z) + (x • y • z')

(vi) Given below are two statements marked Assertion and Reason. Read the two statements carefully and choose the correct option. **[1]**

Assertion: An abstract class can contain abstract as well as non-abstract methods.

Reason: Abstract classes are meant to provide complete implementation of all types of methods in its sub class.

(a) Both Assertion and Reason are true and Reason is the correct explanation for Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation for Assertion.

(c) Assertion is true and Reason is false.

(d) Both Assertion and Reason are false.

(vii) Study the given propositions and the statements marked Assertion and Reason that follow it. Choose the correct option on the basis of your analysis. [1]

X – Sujata is a topper

Y – Sujata is in the merit list

Assertion: If Sujata is in the merit list, then she is a topper (Y => X).

Reason: Inverse is formed when both antecedent and consequent are negated.

(a) Both Assertion and Reason are true and Reason is the correct explanation for Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation for Assertion.

(c) Assertion is true and Reason is false.

(d) Both Assertion and Reason are false.

(viii) Consider the following code segment. [1]

```
class Car extends Vehicle implements Fourwheeler
{.....}
```

Which of the following statements are valid for the given code?

I *Vehicle* is a super class and *Fourwheeler* is an interface.

II Interface cannot have abstract methods.

III Keyword *extends* applies to class and keyword *implements* applies to interface.

(a) Only I and II

(b) Only II and III

(c) Only I and III

(d) Only II

(ix) Differentiate between Tautology and Contradiction. [1]

(x) For the given code segment, write Big O notation for worst case complexity. [1]

```
int i=1, j=1, k=1, p;
while (i <= p)
{
    statements
}
while (j<= p)
{
    while (k<= p)
    {
    statements
    }
}
```

Question 2

(i) Convert the following *infix* notation to *postfix* form. [2]

(A*B^C) + (D*E) where B^C = B^C

(ii) A matrix P[−10....10, 1...10] is stored in the memory with each element requiring 2 bytes of storage. If the base address is 2000, find the address of P[5][6] when the matrix is stored **Row Major wise**. [2]

(iii) The following function *think( )* is part of some class. Assume *f* is the lower bound and *l* is the upper bound of *arr[ ]*.

Answer the questions given below along with the dry run / working.

```
int think(int arr[ ], int f, int l)
{
  if (f > l)
    return 0;
  else
  {
  int current = (arr[f] % 2 == 0) ? arr[f] : 0;
  return current + think (arr, f + 1, l);
  }
}
```

(a) What will the function **think( )** return, if **arr[ ] = {9,7,12,16,19,25}, f = 0** and **l = 5** ? **[2]**

(b) What is the function **think( )** performing apart from recursion? **[1]**

(iv) The following function **getPart( )** is a part of some class which is used to extract **h** number of characters starting from index **b** of a string **str**. There are some places in the code marked by **?1?,?2?,?3?** which must be replaced by an expression / statement so that the function works correctly.

```
String getPart(String str, int b, int h)
{
  int beg= ?1?;
  int end =b+h-1;
  String g="";
  while(beg<=?2? && beg>=0 && end<str.length() )
  {
    g+=str.charAt(beg);
    ?3?;
  }
  return g;
}
```


(a) What is the expression or statement at **?1?** **[1]**

(b) What is the expression or statement at **?2?** **[1]**

(c) What is the expression or statement at **?3?** **[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

(i) A food delivery app offers free home delivery to its customers who meet any of the following criteria. **[5]**

- The order is above ₹ 1000 and payment is made through UPI

OR

- Food is ordered from a partner restaurant and payment is made through UPI

OR

- The customer uses the app for the first time and places order above ₹ 1000

The inputs are:

INPUTS	
A	Order is above ₹ 1000
U	Payment is done through UPI
P	Food is ordered from a partner restaurant
F	Customer uses the app for the first time

(In all the above cases, 1 indicates YES, 0 indicates NO)

Output: **D** - Denotes free home delivery [1 indicates YES and 0 indicates NO in all cases]

Draw a truth table for the inputs and the outputs given above. Write the **SOP** expression for **D(A, U, P, F).**

(ii) Reduce the above expression **D(A, U, P, F)** by using 4-variable Karnaugh map, showing the various groups (i.e., octal, quads and pairs). **[5]**

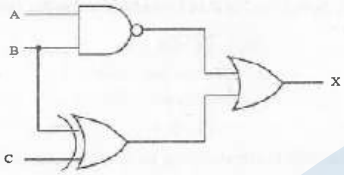
Draw the logic gate diagram for the reduced expression using NAND gates only. Assume that the variables and their complements are available as inputs.

Question 4

(i) (a) Reduce the Boolean function **F(X, Y, Z, W)** = π(0,1,2,3,4,6,8,9,11,12) by using 4-variable Karnaugh map, showing the various groups (i.e., octal, quads and pairs). **[4]**

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

(ii) From the logic gate diagram given below:



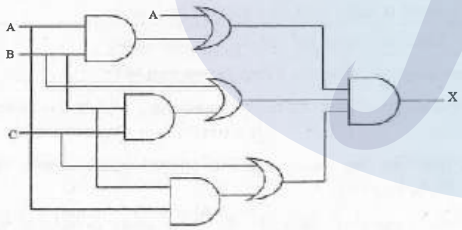
(a) Derive Boolean expression for X(A, B, C) and draw the truth table. **[4]**

(b) Write the canonical expression for SUM and CARRY of a half adder. **[1]**

Question 5

(i) Draw the logic gate diagram for an octal to binary encoder. State how multiplexer can be derived from a decoder. Mention *one* application of multiplexer. **[5]**

(ii) From the logic gate diagram given below, derive the Boolean expression for X(A, B, C) and reduce it using Boolean laws. **[3]**



(iii) Verify if the following compound proposition is **valid or not** using the **truth table.** **[2]**

$(A \wedge B) \wedge C \Rightarrow (A \wedge B \wedge C) = (A \wedge B) \Leftrightarrow (A \wedge B \wedge C)$

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 **[10]**

A class **Mighty** has been defined to create m1 and m2 as mighty numbers from integers n1 and n2. m1 will become mighty by placing the eventual sum of digits of n2 at the end of n1. m2 will become mighty by placing the eventual sum of digits of n1 at the end of n2.

Example: If

n1 = 235, the eventual sum of digits of n1 = 1

n2 =106, the eventual sum of digits of n2 = 7

then, m1= 2357

m2 = 1061

The details of the members of the class are given below:

Class name	**Mighty**
Data members/instance variables:	
n1	to store first integer
n2	to store second integer
m1	to store the first mighty number
m2	to store the second mighty number
Methods/Member functions:	
Mighty( )	constructor to initialise data members with legal initial values
void accept( )	to accept values for n1 and n2
int sumofdigits(int x)	to return the eventual sum of digits of x using **recursive technique**
void calMighty( )	to calculate mighty numbers m1 and m2 by invoking **sumofdigits()**
void display( )	to display mighty numbers m1 and m2

Specify the class **Mighty** giving details of the **constructor( ),void accept( ), int sumofdigits(int), void calMighty( )** and **void display( )**. Define the **main( )** function to create an object and call the functions accordingly to enable the task.

Question 7 **[10]**

A class **JoinArray** contains an array of integer elements. Form a new array which will contain elements of the second array from last index to first index followed by elements of the first array from last index to first index.

Example:

Array1

9	7	6	4

Array2

8	3	2	1

Resultant Array

1	2	3	8	4	6	7	9

The details of the members of the class are given below:

Class name	:	**JoinArray**
Data members/instance variables:		
arr[ ]	:	integer array
size	:	integer to store the size of the array
Member functions/methods:		
JoinArray(int s)	:	parameterised constructor to initialise size = s
void accept( )	:	to input the elements of the array
JoinArray attach(JoinArray P, JoinArray Q)	:	to return the resultant array after combining arrays of objects P and Q as per the description given above
void display( )	:	to display the array elements

Specify the class **JoinArray** giving details of the **constructor(int)**, **void accept( )**, **JoinArray attach(JoinArray, JoinArray)** and **void display( )**. Define the **main( )** function to create objects and call the functions accordingly to enable the task.

Question 8 **[10]**

A class **Palprime** has been defined to display **Palprime** words from a sentence. Palprime is a palindrome word and its length is a prime number.
Example:

Input: MY MOM POSSESSES A GOOD LEVEL OF KNOWLEDGE IN MALAYALAM

Output: MOM, LEVEL

The details of the members of the class are given below:

Class name	:	**Palprime**
Data member/instance variable:		
line	:	to store a sentence
Methods/Member functions:		
Palprime( )	:	constructor to initialise data member
void input( )	:	to accept the sentence in UPPER CASE
boolean isPalin(String n)	:	to check whether the string n is a palindrome word and return true, otherwise return false
boolean primelen(String n)		to find the length of the string and to check for prime and return true if the length is a prime number otherwise return false
void display( )	:	to display the palprime word(s) from the sentence by invoking isPalin() and primelen()

Specify the class **Palprime** giving details of the **constructor( )**, **void input( )**, **boolean isPalin(String)**, **boolean primelen(String)** and **void display( )**. Define a **main( )** function to create an object and call the member functions accordingly to enable the task.

SECTION – C

*Answer **any two** questions.*

Each program should be written in such a way that it clearly depicts the logic of the problem stepwise.
This can be achieved by using comments in the program and mnemonic names or pseudo codes for algorithms. The programs must be written in Java and the algorithms must be written in general / standard form, wherever required / specified.
(Flowcharts are **not** required.)

Question 9

A circular queue is a linear data structure that allows data insertion at the rear and removal from the front, with the rear end connected to the front end forming a circular arrangement.

Given below are the details of class **MerryGoRound**

Class name	:	**MerryGoRound**
Data members/instance variables:		
q[ ]	:	an array to hold integers
cap	:	to store the maximum capacity of the array
front	:	to point the index of the front end
rear	:	to point the index of the rear end
Methods/Member functions:		
MerryGoRound(int n)	:	parameterised constructor to initialise cap = n, front = rear = 0
void add(int val)	:	to add integers from the rear index if possible, else display the message "QUEUE IS FULL"
int remove( )	:	to remove and return the integer from front if any, else return –999
void display()	:	to display the elements of the circular queue in the order of front to rear

(i) Specify the class **MerryGoRound** giving details of the functions **void add(int)** and **int remove( )**. Assume that the other functions have been defined. **[4]**

The main() function and algorithm need NOT be written.

(ii) State the principle on which the entity works. **[1]**

Question 10 **[5]**

A superclass **Train** has been defined to store the details of a train for booking tickets. Define a subclass **Booking** to compute the total cost of the tickets based on the number of passengers and any discount for group bookings.
The details of the members of both the classes are given below:

Class name	:	**Train**
Data members/instance variables:		
trainName	:	to store the name of the train
trainNumber	:	to store the train number
ticketPrice	:	to store the price of a single ticket in decimal
Methods/Member functions:		
Train(…)	:	parameterised constructor to assign values to data members
void displayDetails( )	:	to display the train details
Class name	:	**Booking**
Data members/instance variables:		
numPassengers	:	to store the number of passengers for booking
groupDiscount	:	to store the group discount percentage
totalCost	:	to store the total cost after applying the group discount in decimal
Methods/Member functions:		
Booking(...)	:	parameterised constructor to assign values to data members of both the classes
void calCost( )	:	to calculate the cost as per the formula (ticket price * numPassengers), apply a group discount of 10% if numPassengers is greater than 5 and calculate the total cost with discount, if any
void displayDetails( )	:	to display the train details, number of passengers, group discount and the total cost with discount, if any

*Assume that the superclass **Train** has been defined.* Using the **concept of Inheritance**, specify the class **Booking** giving the details of the **constructor(…), void calCost( )** and **void displayDetails( )**.
The superclass, main function and algorithm need NOT be written.

Question 11

(i) A linked list is formed from the objects of class **VotersList**. The class structure is given below. [2]

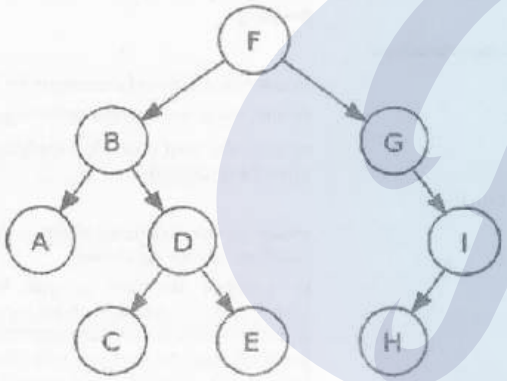
```
class VotersList
{
    int age;
    VotersList link;
}
```

Write an *Algorithm* **OR** a *Method* to count and return total number of nodes whose age > = 60.

The method prototype is as follows:

int countNodes(VotersList start)

(ii) Refer to the Binary Tree given below and answer the questions that follow:



(a) Write the post-order traversal of the above tree structure. [1]

(b) Name the internal nodes of the right subtree and the external nodes of the left subtree [1]

(c) Write the size of the tree and the degree of node D. [1]

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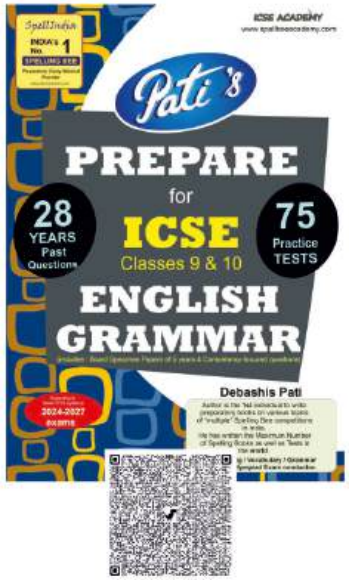

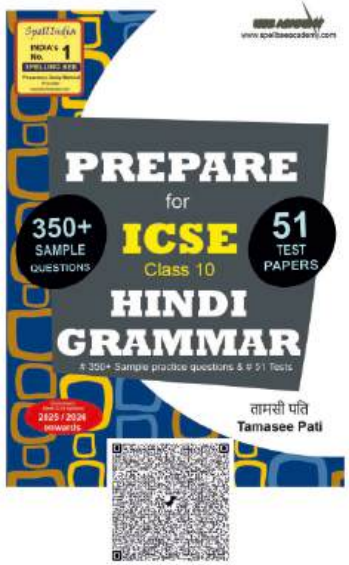

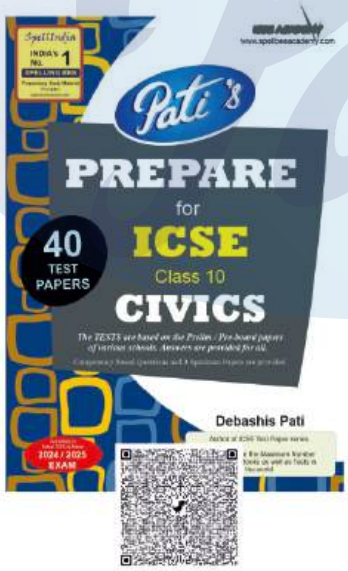

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