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INDEX

Sl.No.	Topic	Page No.
1.	Introduction	3
2.	Half-Yearly Assignments	4-27
3.	Annual Assignments	28-63
4.	Bibliography	64

Introduction

Java is a class-based, object-oriented programming language that is designed to have as few implementation dependencies as possible. It is a general-purpose programming language intended to let application developers write once, run anywhere (WORA), meaning that compiled Java code can run on all platforms that support Java without the need for recompilation. Java applications are typically compiled to *byte code* that can run on any Java virtual machine (JVM) regardless of the underlying computer architecture. The syntax of Java is similar to C and C++, but it has fewer low-level facilities than either of them.

Java was originally developed by James Gosling at Sun Microsystems (which has since been acquired by Oracle) and released in 1995 as a core component of Sun Microsystems' Java platform. The original and reference implementation Java compilers, virtual machines, and class libraries were originally released by Sun under proprietary licenses. As of May 2007, in compliance with the specifications of the Java Community Process, Sun had relicensed most of its Java technologies under the GNU General Public License. Oracle offers its own HotSpot Java Virtual Machine, however the official reference implementation is the OpenJDK JVM which is free open source software and used by most developers including the Eclipse IDE and is the default JVM for almost all Linux distributions.

HALF-YEARLY ASSIGNMENTS

Program: 1. Write a program to find the digital root of a number. [Digital root of a number is the single digit that results from the continuous summation of the digits of a

Number and the numbers resulting from each summation .E.g. consider the number 378,

```
Sum of its digits = 3+7+8=18, 1+8=9
So Digital root of 378 = 9
```

ALGORITHM:

{

{

n1=n;

int n1,s=0,d;

while(true)

while(n1!=0)

d=n1%10;

s=s+d;

break;

else

}

n1/=10;

```
Step 1 Start
  Step 2 Declare variables n, n1, s and d
  Step 3 Read n from user.
  Step 4 Initialize variables
                               s=0, n1=n
  Step 5 Repeat the following steps until false
       a. If n1 is not equal to 0, find the remainder of division of n1 by 10
        b. Add the remainders to s.
       c. If s<10, move to Step 6
       d. Else overwrite n1=s and s=0 and continue the steps.
  Step 6 Print s as the Digital Root of n.
  Step 7 End
Source Code:
import java.util.*;
class digital Root
int digitalRoot(int n)
```

//Finding the sum of the digits

if(s<10) //Digital root is a one digit no. thus s<10

```
{
n1=s;
s=0;
continue;
}
return s;//Returning s as Digital root
public static void main(String ars[])
int n,dr;
Scanner in=new Scanner(System.in);
System.out.println("Enter a no.");
n=in.nextInt();//Reading n from user
digital_Root ob=new digital_Root();//calling digital_Root()
dr=ob.digitalRoot(n);
System.out.println("The Digital Root of "+n+" is "+dr);
}
}
```

variable Description Table		
Variable	Data Type	Function
n	int	Accept value from user and a
		<pre>parameter for digital_Root()</pre>
n1	int	Temporary variable to store the
		value of n
S	int	Stores the sum of the digits of n1
d	int	Stores the digits of n1
dr	int	Calls digital_Root and stores the
		value returned

Input / Output Screen

```
CSAssignments>javac digital_Root.java

CSAssignments>java digital_Root

Enter a no.

378

The Digital Root of 378 is 9

CSAssignments>java digital_Root

Enter a no.

589

The Digital Root of 589 is 4

CSAssignments>
```

Program 2: Write a program to print all the Prime Palindrome numbers in the given range.

ALGORITHM:

```
Step 1 Start
  Step 2 Declare variables start, end, i, j and c.
  Step 3 Read start and end from user
  Step 4 Run loop from i=start till i=end.
  Step 5 Check for prime number
       a. Run a loop from j=1 to j=i
       b. If i%j=1 increment c by 1
       c. Outside the loop check if c=2, then return 1 and overwrite c=0
        d. Else return 0 and overwrite c=0
  Step 6 Check for palindrome.
        a. Declare variables n, r and d.
        b. Initialise n=i and r=0
       c. Repeat the following processes until n is 0.
             i. Find the remainder of the division of n by 10 and store in d
            ii. Multiply d by 10 and add it to r. store this in r
            iii. Store the quotient of the division of n by 10 in n
        d. If r is equal to i return 1
        e. Else return 0
  Step 7 If i is Prime as well as palindrome print ii.
  Step 8 End
Source code:
import java.util.*;
class primePalindrome
int start,end;
primePalindrome(int a,int b)
start=a;end=b;//Initialising data members by parameterised constructor
int isPrime(int i)//Checking Prime no.
int j,c=0;
for(j=1;j<=i;j++)
```

{

{

{

if(i%j==0)

```
C++;
}
if(c==2)
return 1;
else
return 0;
int isPalin(int i)// Checking for palindrome no.
int n, j, r=0, d;
n=i;
while(n!=0)
{
d=n%10;
r=r*10+d;
n/=10;
}
if(r==i)
return 1;
else
return 0;
void generate()//Printing Prime-palindrome no.s
{
int i;
System.out.println("The Prime palindrome no.s b/w "+start+"
and "+end+" are ");
for(i=start;i<=end;i++)</pre>
{
if(isPrime(i)==1&&isPalin(i)==1)
System.out.println(i+" ");
}
public static void main(String ars[])
{
int a,b;
System.out.println("Enter the start and end points");
```

```
Scanner in=new Scanner(System.in);
a=in.nextInt();
b=in.nextInt();
primePalindrome ob=new primePalindrome(a,b);
ob.generate();
}
}
```

variable Description Table		
Variable	Data Type	Function
start	int	To store the starting point
end	int	To store the ending point
i	int	Loop variable and parameter for
		isPalin() and isPrime()
j	int	Loop variable
a	int	Parameter for constructor
b	int	Parameter for constructor
r	int	Stores the reverse of the no.
d	int	Store the digits of
c	int	Counts the factors

Command Prompt

CSAssignments>javac primePalindrome.java

```
CSAssignments>java primePalindrome
Enter the start and end points
10
1000
The Prime palindrome no.s b/w 10 and 1000 are
11
101
131
151
181
191
313
353
373
383
727
757
787
797
919
929
```

CSAssignments>

Program 3: Write a program to take a binary number and convert it into Decimal number.

ALGORITHM:

Step 1 Start

```
Step 2 Declare variables dec_out, dec1, dec2, bin_s, bin_in, bin_frac, pi, i, p,
     ch
  Step 3 Initialise dec1=0.0 and dec2=0.0
  Step 4 Read bin s from user
  Step 5 Find the index of '.' In bin s and store in 'pi'
  Step 6 Separate the integral and the fractional part of bin s into bin in and
     bin frac respectively
  Step 7 Store the length of bin in in p
  Step 8 Declare a temporary variable k and initialise it to 0
  Step 9 Run a loop from i=(p-1) until i<=1 and repeat the following
       a. Store each character of bin in in ch
       b. Check if the integral value of ch is>1
       c. If true terminate the program
       d. Else declare a temporary variable temp to store the integral value of c
       e. Increment the value of dec1 by (temp*2^k)
       f. Increment k by 1
  Step 10 Repeat from Step 7 for bin_frac but in Step 9 e dec2 will be
     incremented
  Step 11 Concatenate dec1 and dec2 in dec out
  Step 12 Return dec out
  Step 13 End
Source Code:
import java.util.*;
class binarytodecimal
{
double converter(double bin)
double dec out, dec1=0.0, dec2=0.0; String
bin s, bin in, bin frac; int pi, i, p; char ch;
bin s=Double.toString(bin);
pi=bin s.indexOf(".");
bin_in=bin_s.substring(0,pi);
bin_frac=bin_s.substring(pi+1);
p=bin_in.length();
int k=0;
for(i=(p-1);i>=0;i--)
```

```
{
 ch=bin_in.charAt(i);
if(Integer.parseInt(String.valueOf(ch))>1)
{
System.out.println("Invalid Binary No.");
System.exit(0);
int temp=Integer.parseInt(String.valueOf(ch));
dec1=dec1+(temp*Math.pow(2,k));
k++;
p=bin frac.length();
for(i=0;i<p;i++)</pre>
{
ch=bin frac.charAt(i);
if(Integer.parseInt(String.valueOf(ch))>1)
{
System.out.println("Invalid Binary No.");
System.exit(0);
int temp=Integer.parseInt(String.valueOf(ch));
dec2=dec2+(temp*Math.pow(2,-(i+1)));
}
dec out=dec1+dec2;
return dec out;
public static void main(String ars[])
{
double bin;
Scanner in=new Scanner(System.in);
System.out.println("Enter a binary no. (fractions
included)");
bin=in.nextDouble();
binarytodecimal ob=new binarytodecimal();
System.out.println("The decimal equivalent of "+bin+" is
"+(ob.converter(bin)));
}
```

}

Variable Description Table

<u>Variable</u>	Data Type	<u>Function</u>
dec_out	double	Store the decimal
		equivalent
dec1	double	Store the integral
		decimal
dec2	double	Store the fractional
		decimal
bin_s	String	Input from user
bin_in	String	Integral part of bin_s
bin_frac	String	Fractional part of bin_s
pi	int	Index of '.' in bin_s
i	int	Loop variable
р	int	Stores the lengths of
		bin_in and bin_frac
k	int	Stores the power of 2
temp	int	Store the integral value
		of ch
ch	char	Store each of charac ter
		of bin_in and bin_frac

Input/Output Screen

```
CSAssignments>javac binarytodecimal.java

CSAssignments>java binarytodecimal

Enter a binary no. (fractions included)

1100.01

The decimal equivalent of 1100.01 is 12.25

CSAssignments>java binarytodecimal

Enter a binary no. (fractions included)

4

Invalid Binary No.

CSAssignments>
```

Program 4: Write a program to accept an Octal number and convert it into Decimal number.

ALGORITHM:

```
Step 1 Start
```

- Step 2 Declare variables dec_out, dec1, dec2, oct_s, oct_in, oct_frac, pi, i, p, ch
- Step 3 Initialise dec1=0.0 and dec2=0.0
- Step 4 Read oct s from user
- Step 5 Find the index of '.' In oct_s and store in 'pi'
- Step 6 Separate the integral and the fractional part of oct_s into oct_in and oct_frac respectively
- Step 7 Store the length of oct in in p
- Step 8 Declare a temporary variable k and initialise it to 0
- Step 9 Run a loop from i=(p-1) until $i \le 1$ and repeat the following
 - a. Store each character of oct in in ch
 - b. Check if the integral value of ch is>1
 - c. If true terminate the program
 - d. Else declare a temporary variable temp to store the integral value of c
 - e. Increment the value of dec1 by (temp*8^k)
 - f. Increment k by 1
- Step 10 Repeat from Step 7 for oct_frac but in Step 9 (e) dec2 will be incremented
- Step 11 Concatenate dec1 and dec2 in dec_out
- Step 12 Return dec_out

Source Code:

```
import java.util.*;
class OctToDec
{
  double converter(double oct)
  {
  double dec_out,dec1=0.0,dec2=0.0;String
  oct_s,oct_in,oct_frac;int pi,i,p;char ch;
  oct_s=Double.toString(oct);
  pi=oct_s.indexOf(".");
  oct_in=oct_s.substring(0,pi);
  oct_frac=oct_s.substring(pi+1);
  p=oct_in.length();
  int k=0;
```

```
for(i=(p-1);i>=0;i--)
{
 ch=oct in.charAt(i);
if(Integer.parseInt(String.valueOf(ch))>7)
{
System.out.println("Invalid Octal No.");
System.exit(0);
int temp=Integer.parseInt(String.valueOf(ch));
dec1=dec1+(temp*Math.pow(8,k));
k++;
}
p=oct frac.length();
for(i=0;i<p;i++)
{
ch=oct frac.charAt(i);
if(Integer.parseInt(String.valueOf(ch))>7)
{
System.out.println("Invalid Octal No.");
System.exit(0);
int temp=Integer.parseInt(String.valueOf(ch));
dec2=dec2+(temp*Math.pow(8,-(i+1)));
}
dec out=dec1+dec2;
return dec out;
}
public static void main(String ars[])
{
double oct;
Scanner in=new Scanner(System.in);
System.out.println("Enter a octal no. (fractions
included)");
oct=in.nextDouble();
OctToDec ob=new OctToDec();
System.out.println("The decimal equivalent of "+oct+" is
"+(ob.converter(oct)));
```

}
}

<u>Variable</u>	Data Type	Function
dec_out	double	Store the decimal
		equivalent
dec1	double	Store the integral
		decimal
dec2	double	Store the fractional
		decimal
oct_s	String	Input from user
oct_in	String	Integral part of oct_s
oct_frac	String	Fractional part of oct_s
pi	int	Index of '.' in oct_s
i	int	Loop variable
p	int	Stores the lengths of
		oct_in and oct_frac
k	int	Stores the power of 8
temp	int	Store the integral value
		of ch
ch	char	Store each of charac ter
		of oct_in and oct_frac

Command Prompt

CSAssignments>javac OctToDec.java

CSAssignments>java OctToDec Enter a octal no. (fractions included) 225.36 The decimal equivalent of 225.36 is 149.46875

CSAssignments>java OctToDec Enter a octal no. (fractions included) 5897.69 Invalid Octal No.

CSAssignments>

Program 5: Write a program to accept a decimal number and convert it into binary number.

ALGORITHM:

- Step 1 Declare variables dec, d, bin, dec_in, dec_frac and i
- Step 2 Initialise bin to null (i.e.,"")

- Step 3 Read dec from user
- Step 4 Store the integral value of dec in dec in
- Step 5 Store the fractional value of dec in dec frac
- Step 6 Execute the following steps until dec in=0
 - a. Store the remainder of the division of dec_in by 2 in d
 - b. Append d to bin
 - c. Divide dec in by 2
- Step 7 Execute the following steps from i=0 till i=5
 - a. Multiply dec frac by 2
 - b. Declare a variable frac_bit and store the integral part of dec frac(multiplied by 2) in frac bit
 - c. Check if frac bit is 1
 - d. If true append 1 to bin
 - i. Subtract ii from dec frac
 - ii. Append '1' to bin
 - e. Else append 0 to bin

Step 8 Return bin

Source Code:

```
import java.util.*;
class decToBin
{
String converter(double dec)
{
String bin=""; int dec in,d;double dec frac;
dec in=(int)dec;
dec_frac=dec-dec_in;
while(dec in!=0)
{
d=dec_in%2;
bin=Integer.toString(d)+bin;
dec_in/=2;
}
bin=bin+".";
for(int i=0;i<5;i++)
{
```

```
dec frac*=2;
int fract bit = (int) dec frac;
if (fract bit == 1)
{
dec frac -= fract bit;
bin+= (char)(1 + '0');
}
else
bin += (char)(0 + '0');
}
return bin;
}
public static void main(String ars[])
{
Scanner in=new Scanner (System.in);
double dec;String bin;
System.out.println("Enter the decimal no.");
dec=in.nextDouble();
decToBin ob=new decToBin();
bin=ob.converter(dec);
System.out.println("The binary equivalent of "+dec+" is
"+bin);
}
```

Variable	Data Type	Function
bin	String	Store the Binary
		equivalent

dec		Accept decimal number
		from User
d	int	Remainder of division of
		dec_in and dec_frac by 2
dec_in	int	Store the integral part of
		dec
dec_frac	double	Store the fractional part
		of dec
frac_bit	int	Store each bit of the
		fractional part of dec

Command Prompt

CSAssignments>javac decToBin.java

CSAssignments>java decToBin

Enter the decimal no.

45.23

The binary equivalent of 45.23 is 101101.00111

CSAssignments>

Program 6: Write a program to check whether a given number is fascinating number or not.

[A fascinating number is one which when multiplied by 2 and 3 and then the results are concatenated with the original number, the new number contains all the digits from 1 to 9 exactly once. E.g. -192

```
192 \times 2 = 384

192 \times 3 = 576
```

After concatenating, (192) + (384) + (576) = 192384576, contains all the digits 1 to 9 exactly once.

So 192 is a Fascinating number.]

ALGORITHM:

```
Step 1
        Start
Step 2 Declare variables n, n2, n3, i, j, f, N.
Step 3 Initialise f to 1.
Step 4 Read n from user.
Step 5 Check if n is a 3 digit number or not
Step 6 If true multiply n by 2 and store in n2
Step 7 Multiply n by 3 and store in n3.
Step 8 Concatenate n, n2 and n3 in N.
Step 9 Run a loop from i= '1' till i= '9'
     a. Initialise c to 0.
     b. Run another loop from j=0 till j=N.length().
           i. Store each character of N in ch
          ii. If ch=i increment c
     c. If c is greater than 1 or equal to 0 break the loop and overwrite f to 0
Step 10 Check if f is 1
Step 11 If true n is a fascinating number.
Step 12 End.
```

Source Code:

```
import java.util.*;
class Fascinating
{
void check(int n)
{
int n2,j,n3,f=1;String N;char i;
if(n>=100)
{
n2=n*2;
```

```
n3=n*3;
N=Integer.toString(n)+""+Integer.toString(n2)+""+Integer.
toString(n3);
for(i='1';i<='9';i++)
{
int c=0;
for(j=0;j<N.length();j++)</pre>
{
char ch=N.charAt(j);
if(ch==i)
C++;
}
if(c>1||c==0)
{
f=0; break;
}
if(f==1)
System.out.println(n+" is a Fascinating Number");
else
System.out.println(n+" is not a Fascinating Number");
else
System.out.println ("Invalid Input");
}
public static void main(String ars[])
{
int n;
Scanner in =new Scanner(System.in);
System.out.println("Enter a no. of 3 digits ");
n=in.nextInt();
Fascinating ob=new Fascinating();
ob.check(n);
}
}
```

Variable	Data Type	Function
n	int	Accepts number from
		user
n2	int	Store n*2
n3	int	Store n*3
N	String	Store the concatenation
		of n, n2, n3
i	char	Loop variable
j	int	Loop variable
f	int	Flag variable
ch	char	Store each character of N

Command Prompt

CSAssignments>javac Fascinating.java

CSAssignments>java Fascinating
Enter a no. of 3 digits
192

192 is a Fascinating Number

CSAssignments>java Fascinating Enter a no. of 3 digits 558 558 is not a Fascinating Number

CSAssignments>java Fascinating Enter a no. of 3 digits 45 Invalid Input

CSAssignments>

Annual Assignments

Program 7: Write a program to accept a Binary number and print its 1's complement and 2's complement.

ALGORITHM:

```
Step 1 Start
  Step 2 Declare variable bin
  Step 3 Read bin from User
  Step 4 Calculate 1's Complement
        a. Declare variables one, p, i, c,
        b. Initialise one to null ("")
        c. Initialise p to the length of bin
        d. Run a loop from i=0 till i=p
             i. Store each character of bin in c
             ii. If c is '1' append '0' to one
            iii. If c is '0' append '1' to one
        e. Return one as 1's complement
  Step 5 Calculate 2's Complement
        a. Declare variables two, p, i, last, c
        b. Initialise two to null("")
        c. Store the last index of '1' in last
        d. Store the length of bin in p
        e. Append the substring of bin from last to p in two
        f. Overwrite p to the length of the substring of bin till last
        g. Run a loop from i=p-1 till i=0
             i. Store each character of length of the substring of bin till last in c
             ii. If c is '1' append two to '0'
            iii. If c is '0' append two to '1'
        h. Return two as 2's Complement
  Step 6 Print the 1's and 2's Complement
  Step 7 End
Source Code:
import java.util.*;
class ones_twos
String ones(String bin)
String one="";int p,i;char c;
p=bin.length();
for(i=(p-1);i>=0;i--)
```

{

{

```
{
c=bin.charAt(i);
if(Integer.parseInt(String.valueOf(c))>1)
{
System.out.println("Invalid Binary No.");
System.exit(0);
}
        for(i=0;i<p;i++)
            c=bin.charAt(i);
            if(c=='1')
                one=one+"0";
            else
                one=one+"1";
return one;
String twos(String bin)
String two="";int p,i,last;char c;
 last=bin.lastIndexOf("1");
p=bin.length();
        two=two+bin.substring(last,p);
        p=(bin.substring(0,last)).length();
        for(i=p-1;i>=0;i--)
        {
            c=(bin.substring(0,last)).charAt(i);
            if(c=='1')
                two="0"+two;
            else
                two="1"+two;
        }
return two;
}
    public static void main(String ars[])
```

```
{
    String bin,one, two;
    Scanner in=new Scanner(System.in);
    System.out.println("Enter a Binary no.");
    bin=in.next();
    ones_twos ob=new ones_twos();
    one=ob.ones(bin);
    two=ob.twos(bin);
    System.out.println("One's="+one);
    System.out.println("Two's="+two);
}
```

Variable	Data Type	Function
bin	String	Accept binary number from user
р	int	Store the length of bin
i	int	Loop variable
one	String	Store the 1's complement
two	String	Store the 2's complement
c	char	Store each character of bin
last	int	Store the last index of 1 in bin

```
CSAssignments>javac ones_twos.java

CSAssignments>java ones_twos
Enter a Binary no.
110010101

One's=001101010

Two's=001101011

CSAssignments>java ones_twos
Enter a Binary no.
01101012

Invalid Binary No.

CSAssignments>
```

Program 8: Design a class with the following specification:

Class name: Mersenne

Data members : num (long type)

Member methods: -

int is Mersenne (): checks whether the number is Mersenne or not.

int is DoubleMersenne(): checks whether the number is double Mersenne or not. void genMersenne (): generates Mersenne numbers.

void genDoubleMersenne (): generates Double Mersenne numbers.

Design a constructor to initialize the data members with the value of parameter.

Define the main() also to execute the functions properly.

ALGORITHM:

- Step 1 Start
- Step 2 Declare variable num
- Step 3 Initialise num using a parameterised constructor
- Step 4 Check Mersenne number
 - a. Declare variable n, i, f
 - b. Initialise n and f to 0
 - c. Run an infinite loop from i=1
 - i. Overwrite n to $[(2^{i})-1]$
 - ii. If n=num overwrite f to 1 and break the loop
 - d. Return f
- Step 5 Check Double Mersenne number
 - a. Declare variable n, i, f, pwr
 - b. Initialise n, f, pwr to 0
 - c. Run an infinite loop from i=1
 - i. Overwrite pwr to $[(2^{i})-1]$
 - ii. Overwrite n to [(2^pwr)-1]
 - iii. If n=num overwrite f to 1 and break the loop
 - d. Return f
- Step 6 Generate Mersenne number
 - a. Initialise num to 0
 - b. Run a loop from i=1 to 10
 - i. Overwrite num to $[(2^{i})-1]$
 - ii. Print num
- Step 7 Generate double Mersenne
 - a. Initialise num to 0\
 - b. Declare variable pwr
 - c. Initialise pwr to 0
 - d. Run a loop from i=1 to 10

```
i. Overwrite pwr to [(2^{i})-1]
               ii. Overwrite num to [(2^pwr)-1]
               iii. Print num
      Step 8
             End
Source Code:
import java.util.*;
class Mersenne
long num;
Mersenne(long n)
{
num=n;
}
int isMersenne()
{
long n=0;int i,f=0;
for( i=1;;i++)
{
n=(long)(Math.pow(2,i)-1);
if(n==num){
f=1;
break;
}
return f;
}
int isDoubleMersenne()
{
long n=0, pwr=0;int f=0;
for(int i=1;;i++)
{
pwr=(long)Math.pow(2,i)-1;
n=(long)(Math.pow(2,pwr)-1);
if(n==num)
{
f=1;
```

```
break;
}
}
return f;
}
public void genMersenne(){
 num=0;
System.out.println("Generated Mersenne numbers are :");
for(int i=1;i<=10;i++)
{
num=(long)(Math.pow(2,i)-1);
System.out.print(num+" ");
}
System.out.println();
}
public void genDoubleMersenne()
{
 num=0;long pwr=0;
System.out.println("Generated double Mersenne Numbers
are:");
for(int i=1;i<=10;i++)
pwr=(long)Math.pow(2,i)-1;
num=(long)(Math.pow(2,pwr)-1);
System.out.print(num+"
}
System.out.println();
}
public static void main(String ars[])
{
int N;
System.out.println("Enter num");
Scanner in=new Scanner(System.in);
N=in.nextInt();
Mersenne ob=new Mersenne(N);
if (ob.isMersenne()==1)
System.out.println(N+" is a Mersenne");
```

```
else
System.out.println(N+" is not a Mersenne");
if (ob.isDoubleMersenne()==1)
System.out.println(N+" is a Double Mersenne");
else
System.out.println(N+" is not a Double Mersenne");
ob.genMersenne();ob.genDoubleMersenne();
}
}
```

Variable	Data type	Function
num	long	Accept number from user
pwr	long	Exponent for checking and generation
		of double Mersenne no.
i	int	Loop variable
f	int	Flag variable

```
Command Prompt
CSAssignments>java Mersenne
Enter num
7
7 is a Mersenne
7 is a Double Mersenne
Generated Mersenne numbers are :
1 3 7 15 31 63 127 255 511 1023
Generated double Mersenne Numbers are:
1 7 127 32767 2147483647 9223372036854775807
CSAssignments>java Mersenne
Enter num
5 is not a Mersenne
5 is not a Double Mersenne
Generated Mersenne numbers are :
1 3 7 15 31 63 127 255 511 1023
Generated double Mersenne Numbers are:
1 7 127 32767 2147483647 9223372036854775807
CSAssignments>java Mersenne
Enter num
3 is a Mersenne
3 is not a Double Mersenne
Generated Mersenne numbers are :
1 3 7 15 31 63 127 255 511 1023
Generated double Mersenne Numbers are:
1 7 127 32767 2147483647 9223372036854775807
CSAssignments>
```

Program 9: Write a program to accept a decimal number and convert it into Octal number.

ALGORITHM:

{

{

}

}

{

dec=in.nextInt();

```
Step 1 Start
  Step 2 Declare variable dec, r, n, oct
  Step 3 Accept dec from user
  Step 4 Initialise oct to null ("")
  Step 5 Run a loop till n is not equal to 0
       a. Store the remainder of the division of n by 8 in r
       b. Append the string value of r to oct
       c. Divide n by 8 and store in n
  Step 6 Return oct
  Step 7 End
Source Code:
import java.util.*;
class decToOct
String converter(int dec)
int r,n;
String oct="";
while(dec!=0)
r=dec%8;
oct=Integer.toString(r)+oct;
dec=dec/8;
return oct;
public static void main(String ars[])
decToOct ob=new decToOct();
Scanner in=new Scanner(System.in);
int dec;
String oct;
System.out.println("Enter the decimal");
```

```
oct=ob.converter(dec);
System.out.println("Octal="+oct);
}
```

Variable	Data Type	Function
dec	int	Accept decimal no from
		user
oct	String	Store the Octal
		equivalent of dec
r	int	Store the remainder of
		the division of dec by 8

CSAssignments>javac decToOct.java
CSAssignments>java decToOct
Enter the decimal
5878
Octal=13366
CSAssignments>

Program 10: Write a program to accept a decimal number and convert it into Hexadecimal number.

ALGORITHM:

{

{

}

{

```
Step 1 Start
  Step 2 Declare variable r, n, hex, dec
  Step 3 Accept dec from User
  Step 4 Initialise n to dec
  Step 5 Declare a character array dig[] and initialise it with {'0', '1', '2', '3',
     '4', '5', '6', '7', '8', '9', 'A', 'B', 'C', 'D', 'E', 'F'}.
  Step 6 Execute the following while n>0
       a. Store the remainder of division of n by 16
       b. Append hex to the element in dig[] of index r
       c. Divide n by 16 and store it in n
  Step 7 Return hex as the hexadecimal equivalent of n
Source Code:
import java.util.*;
class decToHex
String converter(int dec)
int r,n;
String hex="";
n=dec:
char
dig[]={'0','1','2','3','4','5','6','7','8','9','A','B','C',
'D', 'E', 'F'};
while(n!=0)
r=n%16;
hex=dig[r]+hex;
n=n/16;
return hex;
public static void main(String ars[])
decToHex ob=new decToHex();
Scanner in=new Scanner(System.in);
```

```
int dec;
String hex;
System.out.println("Enter the decimal");
dec=in.nextInt();
hex=ob.converter(dec);
System.out.println("Hexadecimal="+hex);
}
```

Variable	Data type	Function
n	int	Stores the number given by the user
r	int	Stores the remainder of the division
		of n by 16
hex	String	Stores the Hexadecimal equivalent
		of n
dec	int	Accept decimal value from User
dig	char	Character array to store the digits of
-		the hexadecimal number System

Command Prompt

CSAssignments>javac decToHex.java

CSAssignments>java decToHex Enter the decimal 789456 Hexadecimal=C0BD0

CSAssignments>

Program 11: Write a program to accept a Hexadecimal number and convert it into decimal number.

ALGORITHM:

{

{

{

{

```
Step 1
         Start
  Step 2 Declare variables hexin, hex, dec, p, i, n, k
  Step 3 Read hexin from User
  Step 4 Initialise hex to "0123456789ABCDEF" and dec to 0
  Step 5 Turn hexin to Uppercase
  Step 6 Store the length of hexin in p
  Step 7 Initialise k to (p-1)
  Step 8 Run a loop from i=0 till i<p and execute the following
       a. Declare a variable ch and store in it each character of hexin
       b. Store in n the index of ch in hex
       c. Increment dec by [n*(16^k)]
       d. Decrement k by 1
       e. If k<0 break the loop
  Step 9 Return dec
Source Code:
import java.util.*;
class HEXtoDEC2
int converter(String hexin)
String hex="0123456789ABCDEF";
int dec=0,i,p,n,k;
hexin=hexin.toUpperCase();
p=hexin.length();
k=p-1;
for(i=0;i<p;i++)
char ch=hexin.charAt(i);
if((int)ch>(int)('F'))
System.out.println("Invalid Hexadecimal no.");
System.exit(0);
n=hex.indexOf(ch);
```

```
dec=dec+(int)(n*(Math.pow(16,k)));
k--;
if(k<0)
break;
}
return dec;
public static void main(String ars[])
HEXtoDEC2 ob=new HEXtoDEC2();
String hexin;
int dec;
System.out.println("Enter the hex");
Scanner in=new Scanner(System.in);
hexin=in.next();
hexin=hexin.toUpperCase();
dec=ob.converter(hexin);
System.out.println ("The Decimal value is "+dec);
}
}
```

Variable	Data type	Function
hexin	String	Accept hexadecimal number from User
hex	String	Store the digits of hexadecimal number
		System
p	int	Stores the length of hexin
i	int	Loop variable
n	int	Store the index of each character of
		hexin wih respect to hex
k	int	Stores the power of 16
ch	char	Stores each character of hexin
dec	int	Reads decimal value from User

Input / Output Screen

```
C:\Windows\System32\cmd.exe

CSAssignments >javac HEXtoDEC2.java

CSAssignments >java HEXtoDEC2

Enter the hex
254AB

The Decimal value is 152747

CSAssignments >java HEXtoDEC2

Enter the hex
45GH

Invalid Hexadecimal no.

CSAssignments >
```

Program 12: Write a program to accept a square matrix of size N and find its Saddle point.

ALGORITHM:

{

```
Step 1
               Start
       Step 2 Declare variables rowmin, col, i, j, n, p, sp=1
       Step 3 Read the size of square matrix from user
       Step 4 Declare a 2d array of size n \times n
       Step 5 Store the length of arr in p
       Step 6 Enter the elements of matrix in arr from user
       Step 7 Print them in matrix form
       Step 8 Run a loop from i=0 till i<p and execute the following
             a. Store the element arr[i][0] in rowmin
            b. Initialise col to 0 and sp to 1
             c. Run a loop from j=1 till j<arr[i].length
                  i. Check if arr[i][j]<rowmin
                 ii. If true overwrite rowmin to arr[i][j] and col to j
            d. Run another loop from j=0 till j<p
                  i. Check if arr[j][col]>rowmin
                 ii. If true overwrite sp to 0 and terminate the loop
             e. Check if sp=1
            f. If true print rowmin as saddle point
       Step 9 If sp is 0 print there are no saddle point(s) in the matrix
       Step 10 End
Source code:
import java.util.*;
class Saddle_Point
void saddle()
int rowmin,col,i,j,n,p,sp=1;
Scanner in=new Scanner(System.in);
System.out.println("Enter the size of square matrix");
n=in.nextInt();
int arr[][]=new int[n][n];
p=arr.length;
System.out.println("Enter the matrix elements");
for(i=0;i<n;i++)
for(j=0;j<n;j++)
```

```
arr[i][j]=in.nextInt();
System.out.println("The Matrix entered");
for(i=0;i<n;i++)</pre>
{
for(j=0;j<n;j++)
System.out.print(arr[i][j]+" ");
System.out.println();
for(i=0;i<p;i++)
rowmin=arr[i][0];
col=0;sp=1;
for(j=1;j<arr[i].length;j++)</pre>
{
if(arr[i][j]<rowmin)</pre>
{
rowmin=arr[i][j];
col=j;
}
for(j=0;j<p;j++)
if(arr[j][col]>rowmin)
{
sp=0;
break;
}
if(sp==1)
System.out.println("The Saddle Point is "+rowmin);
if(sp==0)
System.out.println("No saddle point");
}
public static void main(String ars[])
Saddle Point ob=new Saddle Point();
```

```
ob.saddle();
}
}
```

Variable	Data Type	Function
rowmin	int	To store the minimum
		value of the row
col	int	To store the column
		number of the minimum
		value of the row
i, j	int	Loop variable
n	int	To store the size of the
		matrix
p	int	To store the length of the
		array
sp	int	Flag variable to find the
		saddle point
arr	int	2-D Array to store the
		matrix entered by the
		user

Input / Output Screen

```
CSAssignments>javac Saddle_Point.java

CSAssignments>java Saddle_Point
Enter the size of square matrix

Enter the matrix elements

1
2
3
4
5
6
7
8
9
The Matrix entered
1 2 3
4 5 6
7 8 9
The Saddle Point is 7

CSAssignments>java Saddle_Point
Enter the size of square matrix

Enter the matrix elements

1
2
3
4
5
6
7
8
9
The Saddle Point is 7

CSAssignments>java Saddle_Point
Enter the size of square matrix

3
Enter the matrix elements

1
2
3
4
5
6
10
18
4
No saddle point

CSAssignments>
```

Program 13: Write a program to accept a sentence which may be terminated by either '.' or '?' or '!' and convert it into

Upper case .Now form a new sentence by arranging words in ascending order of number of characters

Present in each word.

Sample input-1: It is a String program.

Sample output-1: IT IS A STRING PROGRAM.

Converted string: AN IT IS A STRING PROGRAM.

Sample input-2: it is amazing %

Sample output -2: INVALID INPUT

ALGORITHM:

- Step 1 Start
- Step 2 Declare variables i, j, k, l, m, w, temp, sin
- Step 3 Initialise k to 0, m to 0, w to null ("")
- Step 4 Read sin from User
- Step 5 Check if sin ends with '.' or '!' or '?'
- Step 6 If true execute the following
 - a. Change sin to uppercase
 - b. Print sin
 - c. Make a substring of sin till it reaches '.' or '!' or '?'
 - d. Add a white space at the end of sin
 - e. Store the length of sin in l
 - f. Run a loop from i=0 till i<1
 - i. Store each character in ch
 - ii. If ch is a white space increment k by 1
 - g. Declare a string array sar[] of length k
 - h. Run a loop from i=0 till i<1
 - i. Store each character of sin in ch
 - ii. If ch is not a white space append ch to w
 - iii. Else
 - 1. Add w to the mth element of sar
 - 2. Increment m by 1
 - 3. Overwrite w to null ("")
 - i. Run a loop from i=0 till i<(k-1)
 - i. Run another loop from j=0 till j<(k-1-i)
 - ii. If jth element of sar is a '.' or '!' or '?' skip the iteration
 - iii. If the length of the jth element of sar is greater than (j+1)th term of sar

```
1. Initialise temp to sar[i]
               2. Overwrite sar[j] to sar[j+1]
                3. Overwrite sar[j+1] to temp
      j. Print sar[] as the arranged sentence
  Step 7 Else Print "invalid input"
  Step 8 End
Source Code:
import java.util.*;
class Sentence
void Sent(String sin)
{
int i,j,k=0,1,m=0;
String w="",temp;
if(sin.endsWith(".")||sin.endsWith("!")||sin.endsWith("?"))
{
sin=sin.toUpperCase();
System.out.println(sin);
if(sin.endsWith("."))
sin=sin.substring(0,(sin.indexOf(".")));
else if(sin.endsWith("!"))
sin=sin.substring(0,(sin.indexOf("!")));
else
sin=sin.substring(0,(sin.indexOf("?")));
sin=sin+" ";
l=sin.length();
for(i=0;i<1;i++)
{
char ch=sin.charAt(i);
if(ch==' ')
k++;
}
String sar[]=new String[k];
for(i=0;i<1;i++)
{
char ch=sin.charAt(i);
if(ch!=' ')
```

```
w=w+ch;
else
{
sar[m]=w;
w="";
m++;
}
}
   for(i=0;i<(k-1);i++)
for(j=0;j<(k-1-i);j++)
if(sar[j].equals(" . ") || sar[j].equals(" ! ") ||
sar[j].equals(" ? "))
continue;
if(sar[j].length()>sar[j+1].length())
{
temp=sar[j];
sar[j]=sar[j+1];
sar[j+1]=temp;
}
System.out.println("The arranged sentence=");
for(i=0;i<k;i++)</pre>
 System.out.print(sar[i]+" ");
}
else
System.out.println("Invali dinput");
publicstaticvoidmain(Stringars[])
String sin;
Scanner in=new Scanner(System.in);
System.out.println("Enterasentence");
sin=in.nextLine();
Sentence ob=new Sentence();
```

```
ob.Sent(sin);
}
}
```

Variable	Data Type	Function
i,j	int	Loop variables
k	int	Counter for the size of
		array sar[]
1	int	Store the length of the
		sentence
m	int	Acts as index for the
		array sar[]
W	String	Stores each word of sin
temp	String	Temporary variable for
		swapping the words
sar	String	String array to store the
		words of sin and to
		arrange in ascending
		order
sin	String	Reads the sentence from
		user

Command Prompt

CSAssignments>javac Sentence.java

CSAssignments>java Sentence
Enter a sentence
This is my Computer Science Assignments .
THIS IS MY COMPUTER SCIENCE ASSIGNMENTS .
The arranged sentence=
IS MY THIS SCIENCE COMPUTER ASSIGNMENTS
CSAssignments>java Sentence
Enter a sentence
This is my Computer Science Assignments %
Invalid input

CSAssignments>

Program 14: Write a program to accept a sentence may be terminated by either '.' or '?'.

- a. Now find the words beginning and ending with a vowel.
- b. Place the words which begin end with vowel at the beginning followed by the remaining words as

they occur in the sentence.

Sample Input -1: YOU MUST AIM TO BE A BETTER PERSON TOMORROW THAN YOU ARE TODAY.

Sample output-1 : NUMBER OF WORDS BEGIN AND END WITH A VOWEL = 2

A ARE YOU MUST AIM TO BE BETTER PERSON TOMORROW THAN YOU TODAY .

Sample input -2: WHO YOU ARE @ Sample output-2: INVALID INPUT

ALGORITHM:

- Step 1 Start
- Step 2 Declare variables sa, w, i, l, k, m, s, ch
- Step 3 Read s from User
- Step 4 Initialise sa and w to null (""); and k to 0
- Step 5 If s ends with '.' or '!'
 - a. Append a white space at the end of s
 - b. Change s to uppercase
 - c. Make a substring of s till '.'
 - d. Store the length of s in l
 - e. Run a loop from i=0 till i<1 and execute the following
 - i. Store each character of s in ch
 - ii. If ch is not a white space append ch to w
 - iii. Else execute the following
 - 1. If w ends and starts with a vowel then increment k by 1 and append a white space and w to sa
 - 2. Overwrite w to null ("")
 - iv. Else append sa, a white space, w and another whitespace to sa
 - v. Overwrite w to null ("")
 - f. Print k as the number of words beginning and ending with vowels
- Step 6 Else print "Invalid Input"
- Step 7 Print sa as the arranged sentence
- Step 8 End

Source Code:

```
import java.util.*;
class Sentence_vowel
{
void Sent Vow(String s)
{
String sa="",w="";int i,l,k=0;
if(s.endsWith(".")|| s.endsWith("?")||s.endsWith("!"))
{
s=s+" ";
s=s.toUpperCase();
s=s.substring(0,(s.indexOf(".")));
l=s.length();
for(i=0;i<1;i++)</pre>
{
char ch=s.charAt(i);
if(ch!=' ')
w=w+ch;
else
{
if((w.startsWith("A")||w.startsWith("E")||w.startsWith("I")
||w.startsWith("O")||w.startsWith("U"))&&(w.endsWith("A")||
w.endsWith("E")||w.endsWith("I")||w.endsWith("O")||w.endsWi
th("U")))
{
k++;
sa=sa+" "+w;
w="";
}
else
sa=sa+" "+w+" ";
w="";
}
```

```
System.out.println("The no. of words which start and end
with a vowel are "+ k);
}
else
System.out.println("Invalid input");
System.out.println(sa);
}
public static void main(String ars[])
Scanner in=new Scanner(System.in);
System.out.println("Enter a Sentence or terminating with
'.' or '!' ");
String s;
s=in.nextLine();
Sentence vowel ob=new Sentence vowel();
ob.Sent_Vow(s);
}
}
```

variable Description Table		
Variable	Data type	Function
S	String	Accept sentence from
		User
sa	String	Stores the Arranged
		sentence
W	String	Hold each word of s
i	int	Loop variable
1	int	Stores the length of s
k	int	Store the number of
		words beginning and
		ending with vowels
ch	char	Stores each character of s

C:\Windows\System32\cmd.exe

CSAssignment>javac Sentence_vowel.java

CSAssignment>java Sentence_vowel
Enter a Sentence or terminating with '.' or '!'
India is the biggest producer and consumer of bananas .
The no. of words which start and end with a vowel are 1
INDIA IS THE BIGGEST PRODUCER AND CONSUMER OF BANANAS

CSAssignment>

Program 15: Write a program to declare a square matrix of size M X M (M must be greater than 2 and less than 7). Rotate the matrix 90° anti clockwise. Display both the original and converted matrix.

ALGORITHM:

{

```
Step 1 Declare variables len ,n, n2, i, j, N
  Step 2 Read the size of matrix from the User in N
  Step 3 Declare a 2-D array mat[][] of size N×N
  Step 4 Read mat from User
  Step 5 Print mat in matrix form
  Step 6 Store the length of mat in len
  Step 7 Run a loop from i=0 till i<len
       a. Run another loop from j=0till j<i
            i. Initialise n to mat[i][j]
            ii. Overwrite mat[i][i] to mat[j][i]
           iii. Overwrite m[j][i] to n
  Step 8 Run a loop from i=0 till i<(len/2)
       a. Run a loop from j=0 till j<len
            i. Initialise n2 to mat[i][j]
            ii. Overwrite mat[i][j] to mat[len-i-1][j]
           iii. Overwrite mat[len-i-1][j] to n2
  Step 9 Print the rotated matrix
  Step 10 End
Source Code:
import java.util.Scanner;
class Rotate
     public static void rotate(int mat[][]) {
           int len = mat.length;
          for (int i = 0; i < len; i++) {
               for (int j = 0; j < i; j++) {
                    int n = mat[i][j];
                    mat[i][j] = mat[j][i];
                    mat[j][i] = n;
               }
          for (int i = 0; i < len / 2; i++) {
```

```
for (int j = 0; j < len; j++) {
                 int n2 = mat[i][j];
                mat[i][j] = mat[len - i - 1][j];
                mat[len - i - 1][j] = n2;
            }
        for (int i = 0; i < len; i++) {
            for (int j = 0; j < len; i++) {
                System.out.print( mat[i][j]+" ");
            System.out.println();
        }
    }
    public static void main(String ars[]) {
        System.out.println("Enter the size of the square
matrix");
        Scanner in = new Scanner(System.in);
        int N=in.nextInt();
         int mat[][] = new int[N][N];
        System.out.println("Enter the Matrix");
        for (int i = 0; i < N; ++i) {
            for (int j = 0; j < N; ++j) {
                mat[i][j] = in.nextInt();
            }
        System.out.println("The entered matrix is");
        for (int i = 0; i < N; i++) {
            for (int j = 0; j < N; j++) {
                System.out.print( mat[i][j]+" ");
            System.out.println();
        System.out.println("The rotated matrix");
        rotate(mat);
    }
}
```

Variable	Data Type	Function
i, j	int	Loop variable
n	int	Temporary variable for
		swapping
n2	int	Temporary variable for
		swapping
mat	int	Store the matrix entered
		by the User
N	int	The size of the square
		matrix

Input / Output Screen

```
CSAssignments>javac Rotate.java

CSAssignments>java Rotate
Enter the size of the square matrix

4
Enter the Matrix
1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 16
The entered matrix is
1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 16
The rotated matrix
4 8 12 16
3 7 11 15
2 6 10 14
1 5 9 13

CSAssignments>
```

BIBLIOGRAPHY

I have done this assignment with the help of the book:

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Author: **SUMITA ARORA**

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