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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.

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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:

```
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
```

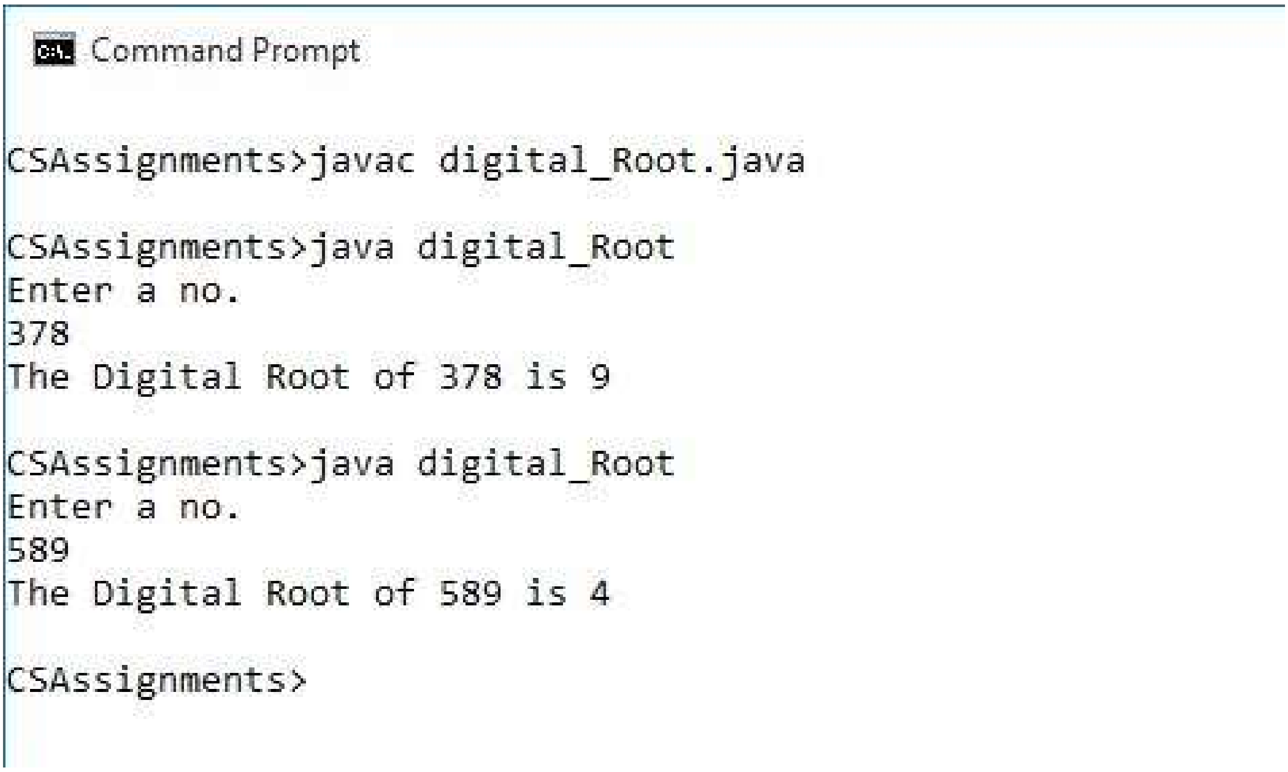
Source Code:

```
import java.util.*;
class digital_Root
{
int digitalRoot(int n)
{
int n1,s=0,d;
n1=n;
while(true)
{
while(n1!=0)
{
d=n1%10;
s=s+d;  //Finding the sum of the digits
n1/=10;
}
if(s<10) //Digital root is a one digit no. thus s<10
break;
else
{
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 parameter for digital_Root()
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.
{
```

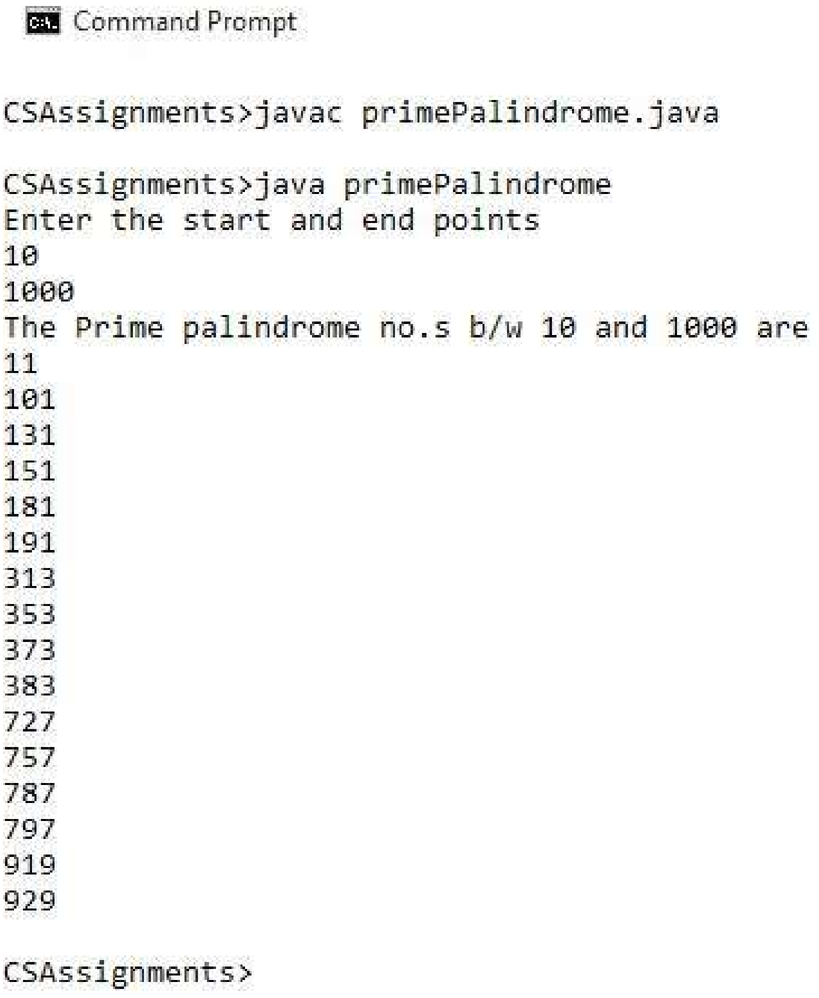
```
int j,c=0;
for(j=1;j<=i;j++)
{
if(i%j==0)
c++;
}
if(c==2)
return 1;
else
return 0;
}
int isPalin(int i)// Checking for palindrome no.
{
int n,j,r=0,d;
n=i;
while(n!=0)
{
d=n%10;
r=r*10+d;
n/=10;
}
if(r==i)
return 1;
else
return 0;
}
void generate()//Printing Prime-palindrome no.s
{
int i;
System.out.println("The Prime palindrome no.s b/w "+start+"
and "+end+" are ");
for(i=start;i<=end;i++)
{
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

Input / Output Screen



```
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(".");
```

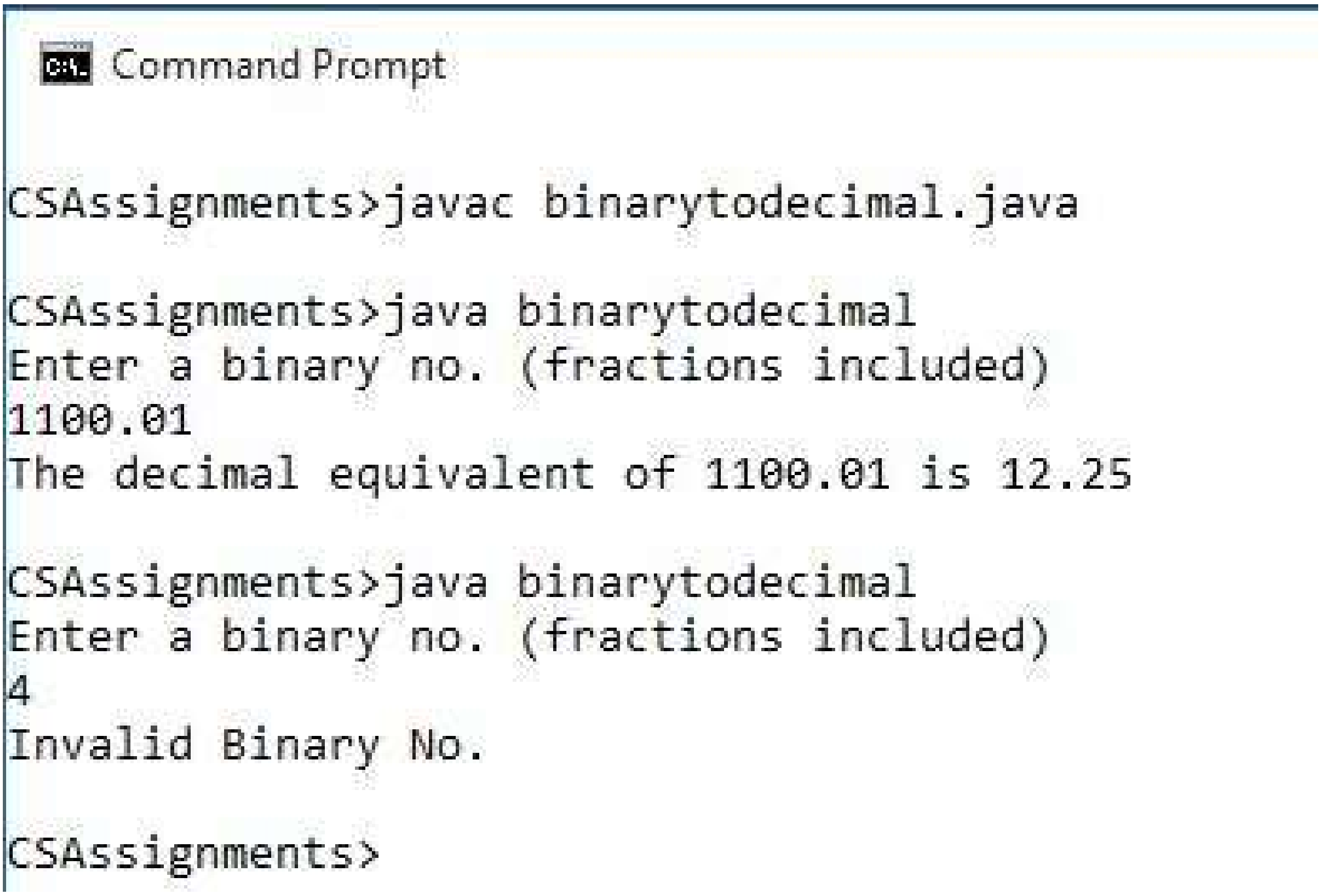
```
bin_in=bin_s.substring(0,pi);
bin_frac=bin_s.substring(pi+1);
p=bin_in.length();
int k=0;
for(i=(p-1);i>=0;i--)
{
 ch=bin_in.charAt(i);
if(Integer.parseInt(String.valueOf(ch))>1)
{
System.out.println("Invalid Binary No.");
System.exit(0);
}
int temp=Integer.parseInt(String.valueOf(ch));
dec1=dec1+(temp*Math.pow(2,k));
k++;
}
p=bin_frac.length();
for(i=0;i<p;i++)
{
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

Variable	Data Type	Function
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
p	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<=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);
```

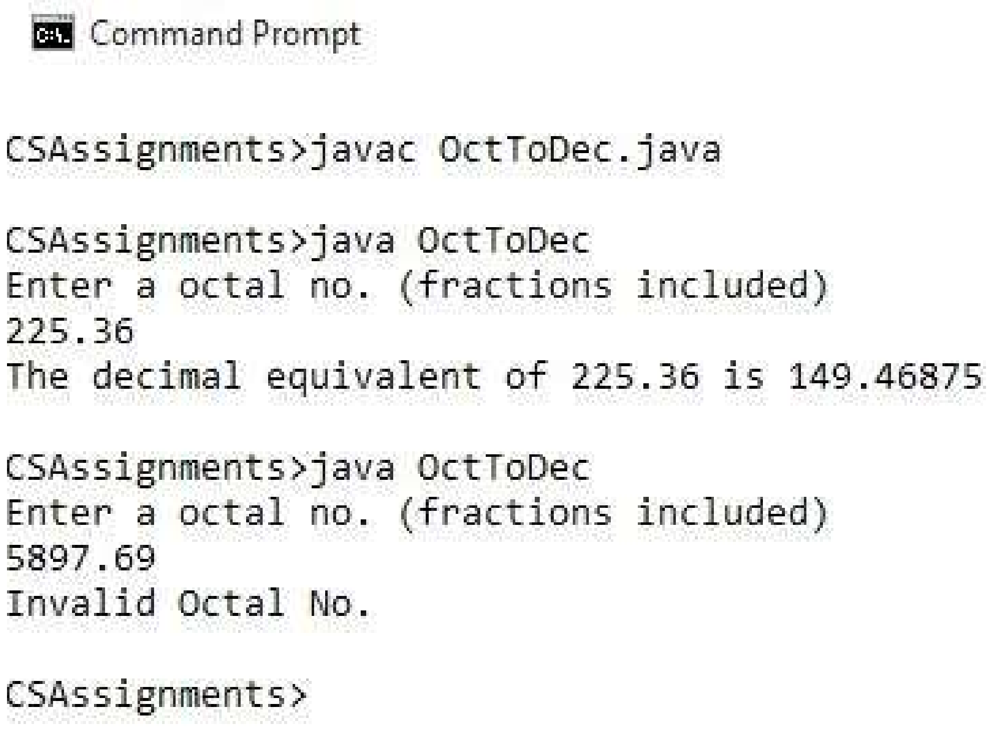
```
pi=oct_s.indexOf(".");
oct_in=oct_s.substring(0,pi);
oct_frac=oct_s.substring(pi+1);
p=oct_in.length();
int k=0;
for(i=(p-1);i>=0;i--)
{
 ch=oct_in.charAt(i);
if(Integer.parseInt(String.valueOf(ch))>7)
{
System.out.println("Invalid Octal No.");
System.exit(0);
}
int temp=Integer.parseInt(String.valueOf(ch));
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)));
}
}
```

Variable Description Table

Variable	**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

Input/ Output Screen



```
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
```

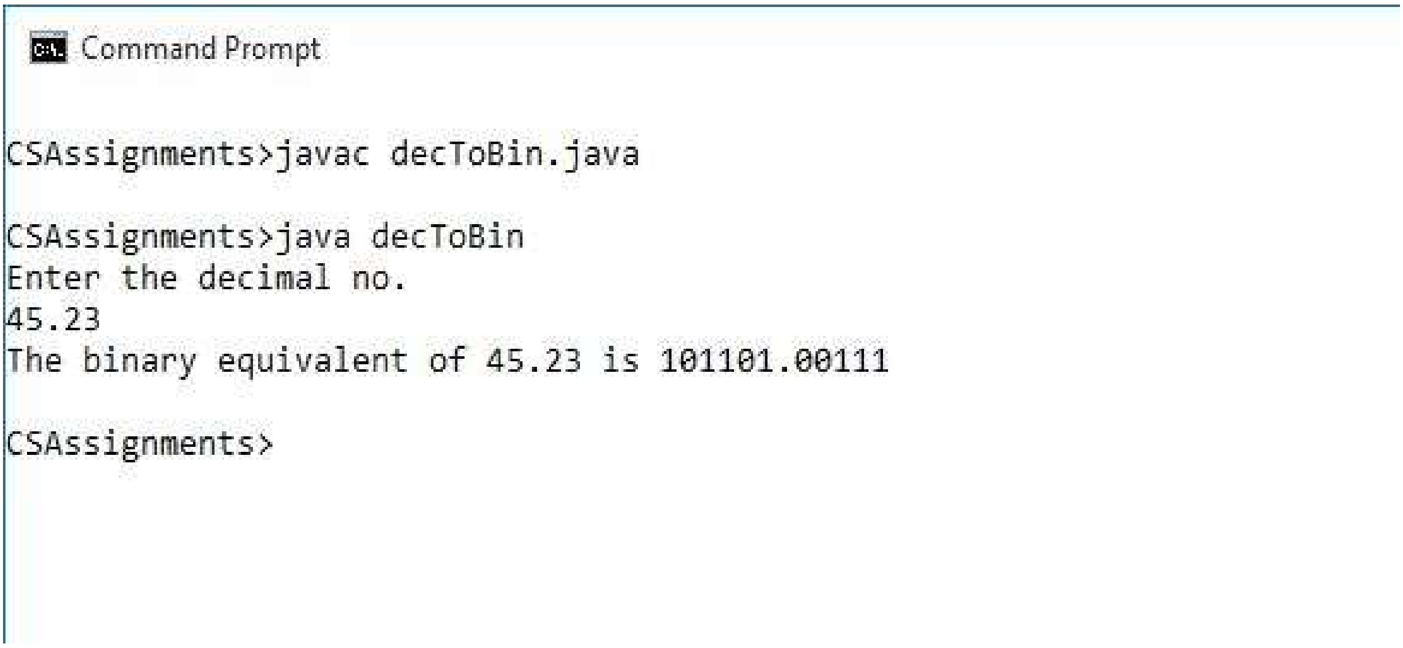
Source Code:

```
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 Description Table

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

Input/ Output Screen



```
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 × 2 = 384

192 × 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)
{
```

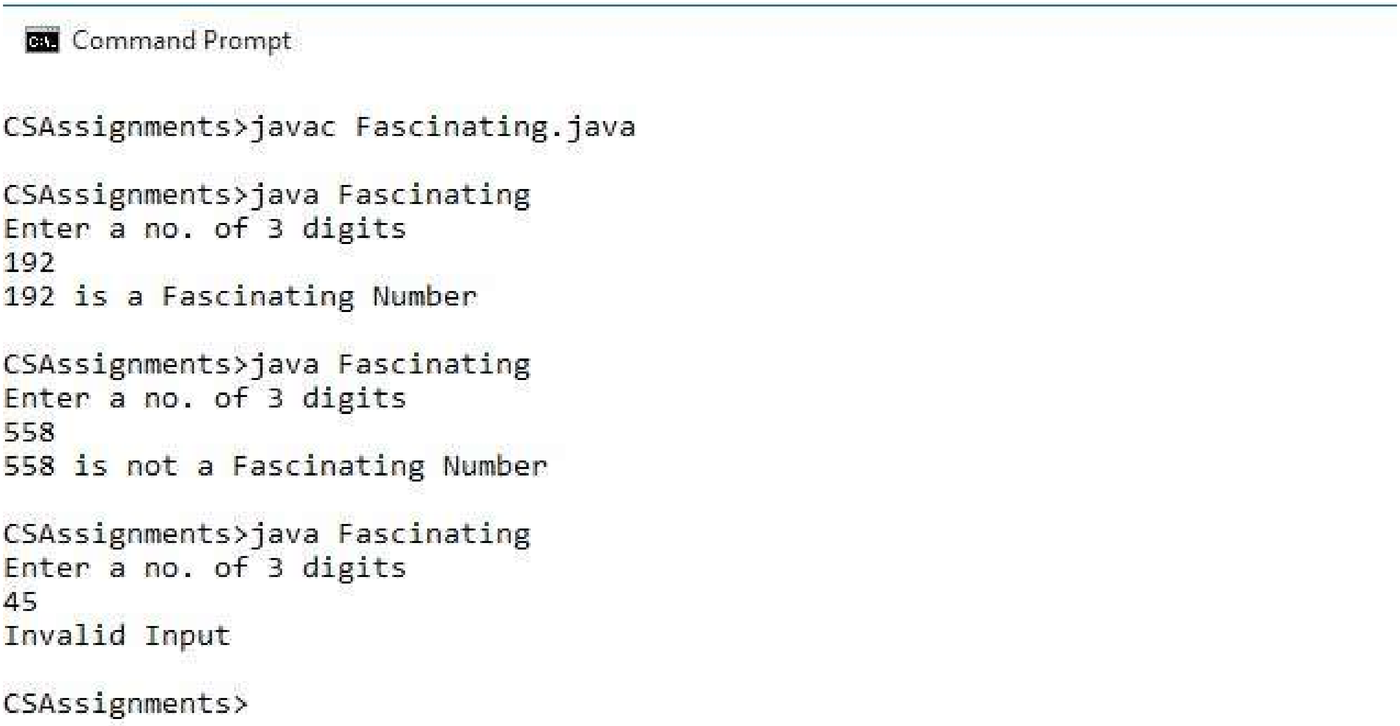
```
int n2,j,n3,f=1;String N;char i;
if(n>=100)
{
n2=n*2;
n3=n*3;
N=Integer.toString(n)+""+Integer.toString(n2)+""+Integer.
toString(n3);
for(i='1';i<='9';i++)
{
int c=0;
for(j=0;j<N.length();j++)
{
char ch=N.charAt(j);
if(ch==i)
c++;
}
if(c>1||c==0)
{
f=0;break;
}
}
if(f==1)
System.out.println(n+" is 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 Description Table

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

Input/ Output Screen



```
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)
{
```

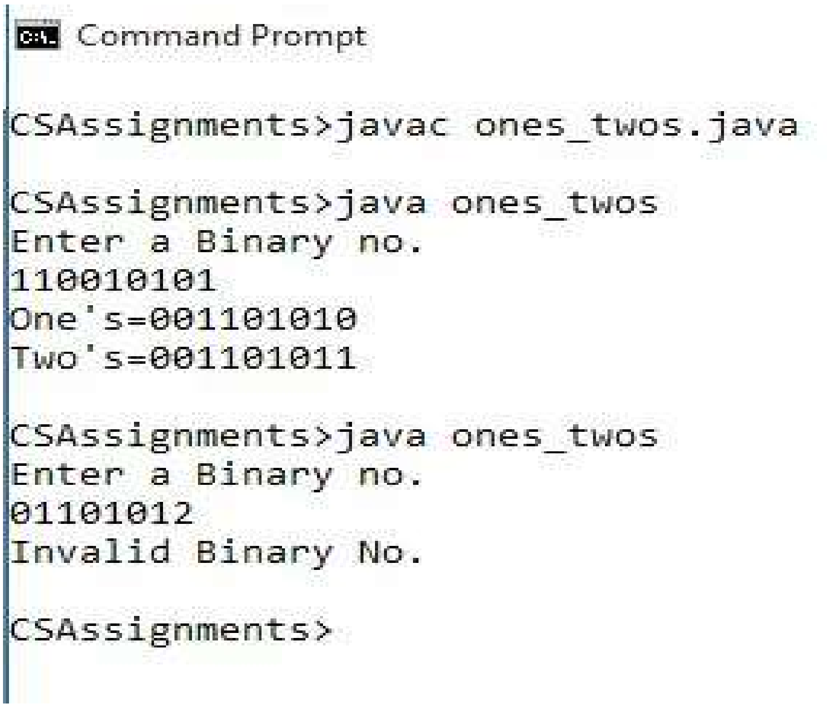
```
String one="";int p,i;char c;
p=bin.length();
for(i=(p-1);i>=0;i--)
{
 c=bin.charAt(i);
if(Integer.parseInt(String.valueOf(c))>1)
{
System.out.println("Invalid Binary No.");
System.exit(0);
}
}

        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 Description Table

Variable	Data Type	Function
bin	String	Accept binary number from user
p	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

Input/ Output Screen



```
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:

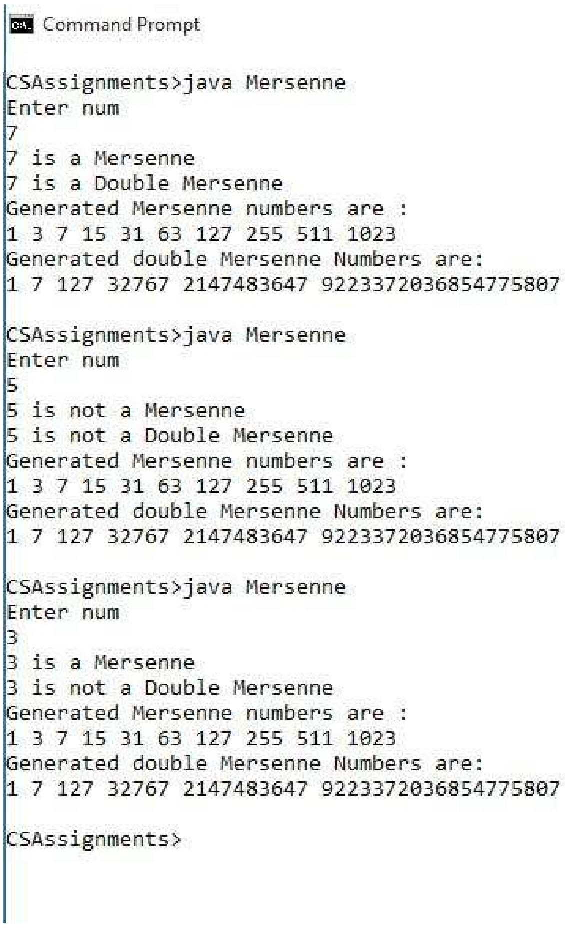
```
import java.util.*;
class Mersenne
{
long num;
Mersenne(long n)
{
num=n;
}
int isMersenne()
{
long n=0;int i,f=0;
for( i=1;;i++)
{
n=(long)(Math.pow(2,i)-1);
if(n==num){
f=1;
break;
}
}
return f;
}
int isDoubleMersenne()
{
long n=0, pwr=0;int f=0;
for(int i=1;;i++)
{
pwr=(long)Math.pow(2,i)-1;
n=(long)(Math.pow(2,pwr)-1);
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 Description Table

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

Input/ Output Screen



```
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
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
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:

```
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
```

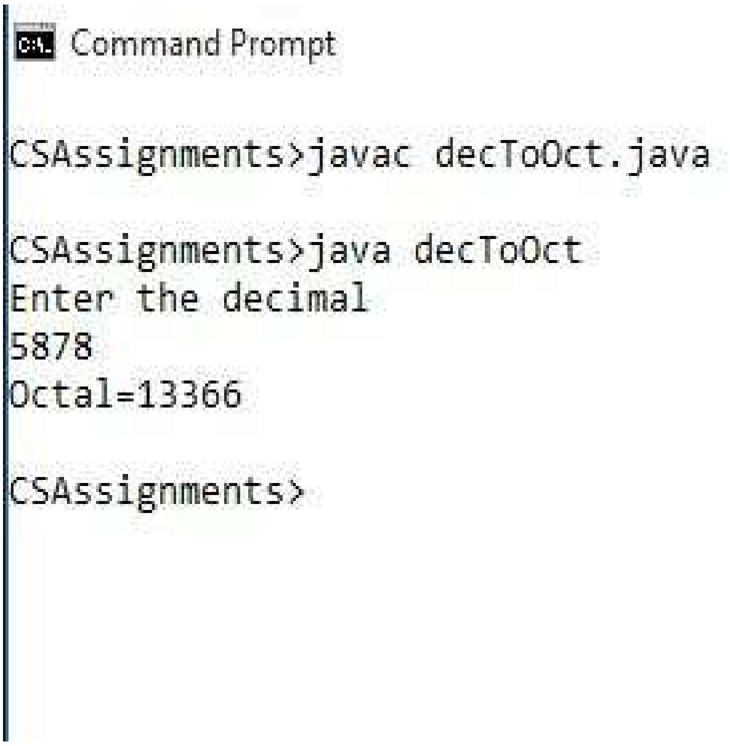
Source Code:

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

Variable Description Table

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

Input / Output Screen



```
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
```

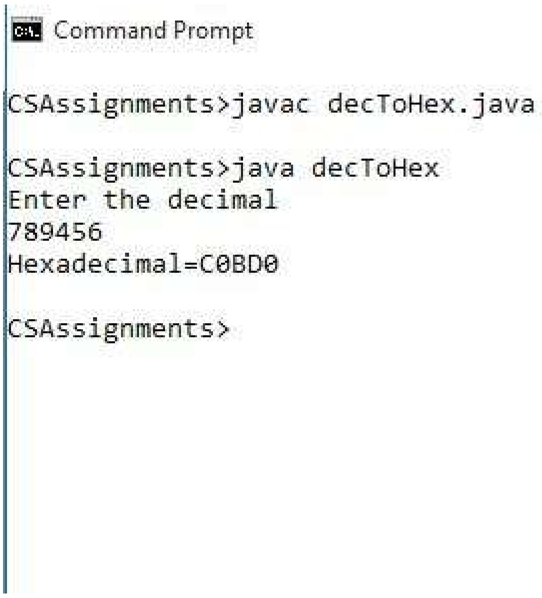
Source Code:

```
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 Description Table

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

Input / Output Screen



```
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
```

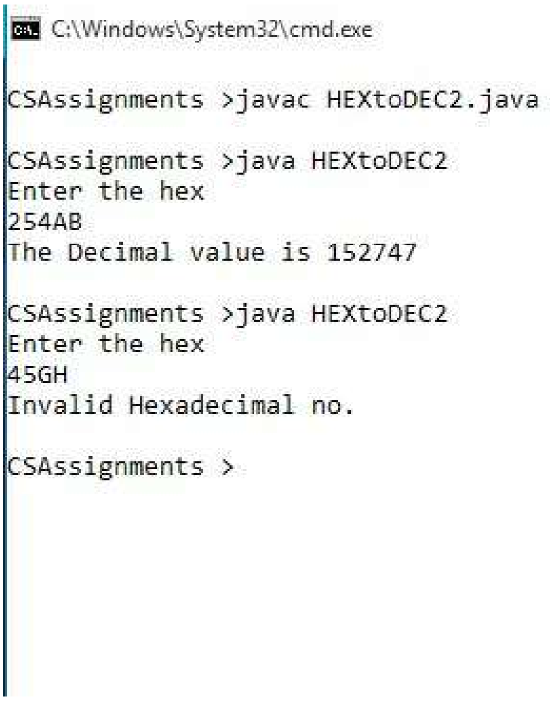
Source Code:

```
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 Description Table

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



```
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 × 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:

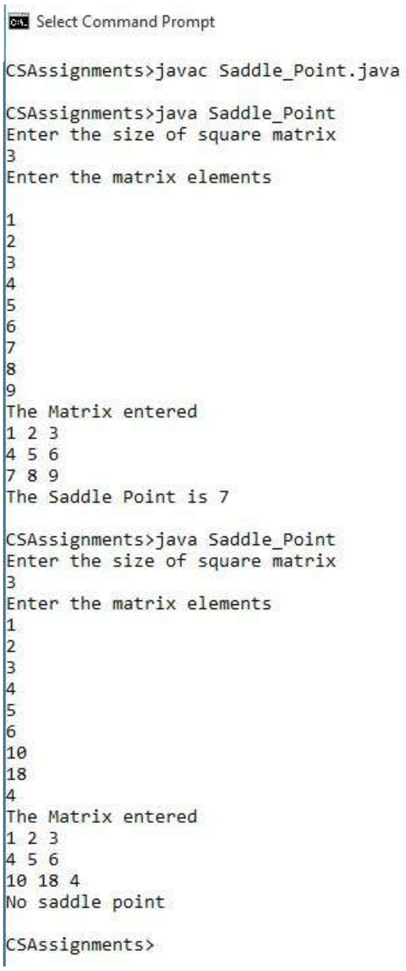
```
import java.util.*;
class Saddle_Point
{
void saddle()
{
int rowmin,col,i,j,n,p,sp=1;
Scanner in=new Scanner(System.in);
System.out.println("Enter the size of square matrix");
n=in.nextInt();
int arr[][]=new int[n][n];
p=arr.length;
System.out.println("Enter the matrix elements");
for(i=0;i<n;i++)
for(j=0;j<n;j++)
arr[i][j]=in.nextInt();
System.out.println("The Matrix entered");
for(i=0;i<n;i++)
{
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++)
{
if(arr[i][j]<rowmin)
{
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 Description Table

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
3
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
3
Enter the matrix elements
1
2
3
4
5
6
10
18
4
The Matrix entered
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<l
           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<l
           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 m^th 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 j^th 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[j]
                    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
```

<u>Source Code:</u>

```
import java.util.*;
class Sentence
{
void Sent(String sin)
{
int i,j,k=0,l,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<l;i++)
{
char ch=sin.charAt(i);
if(ch==' ')
k++;
}
String sar[]=new String[k];
for(i=0;i<l;i++)
{
```

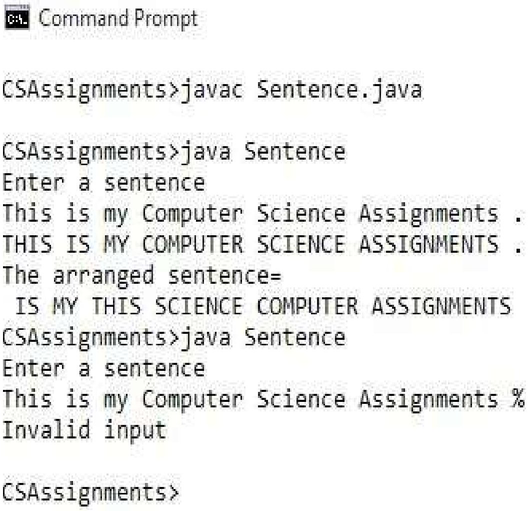
```
char ch=sin.charAt(i);
if(ch!=' ')
w=w+ch;
else
{
sar[m]=w;
w="";
m++;
}
}
   for(i=0;i<(k-1);i++)
{
for(j=0;j<(k-1-i);j++)
{
if(sar[j].equals(" . ") || sar[j].equals(" ! ") ||
sar[j].equals(" ? "))
continue;
if(sar[j].length()>sar[j+1].length())
{
temp=sar[j];
sar[j]=sar[j+1];
sar[j+1]=temp;
}
}
}
System.out.println("The arranged sentence=");
for(i=0;i<k;i++)
 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 Description Table

Variable	Data Type	Function
i,j	int	Loop variables
k	int	Counter for the size of array sar[]
l	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

Input / Output Screen



```
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<l 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
```

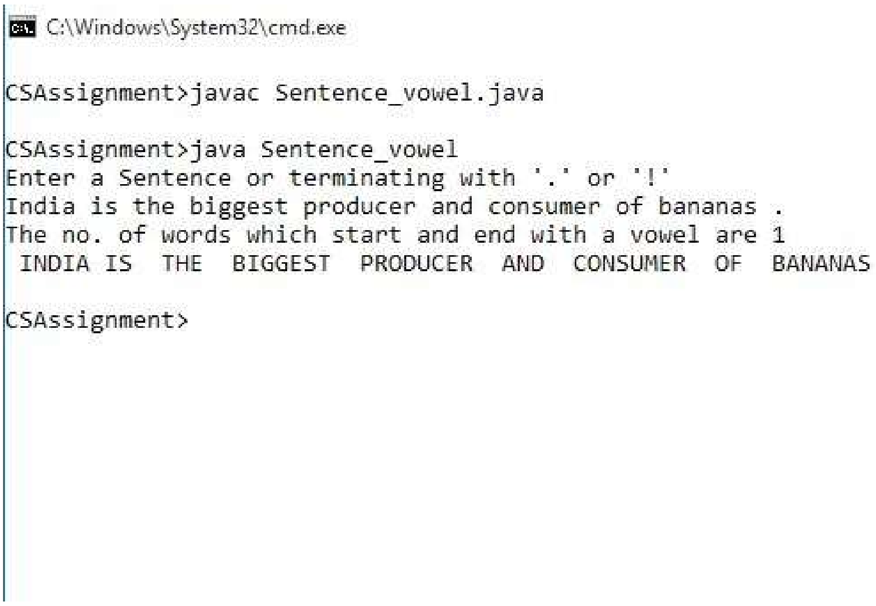
Source Code:

```
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<l;i++)
{
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
l	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

Input / Output Screen



```
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][j] 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
```

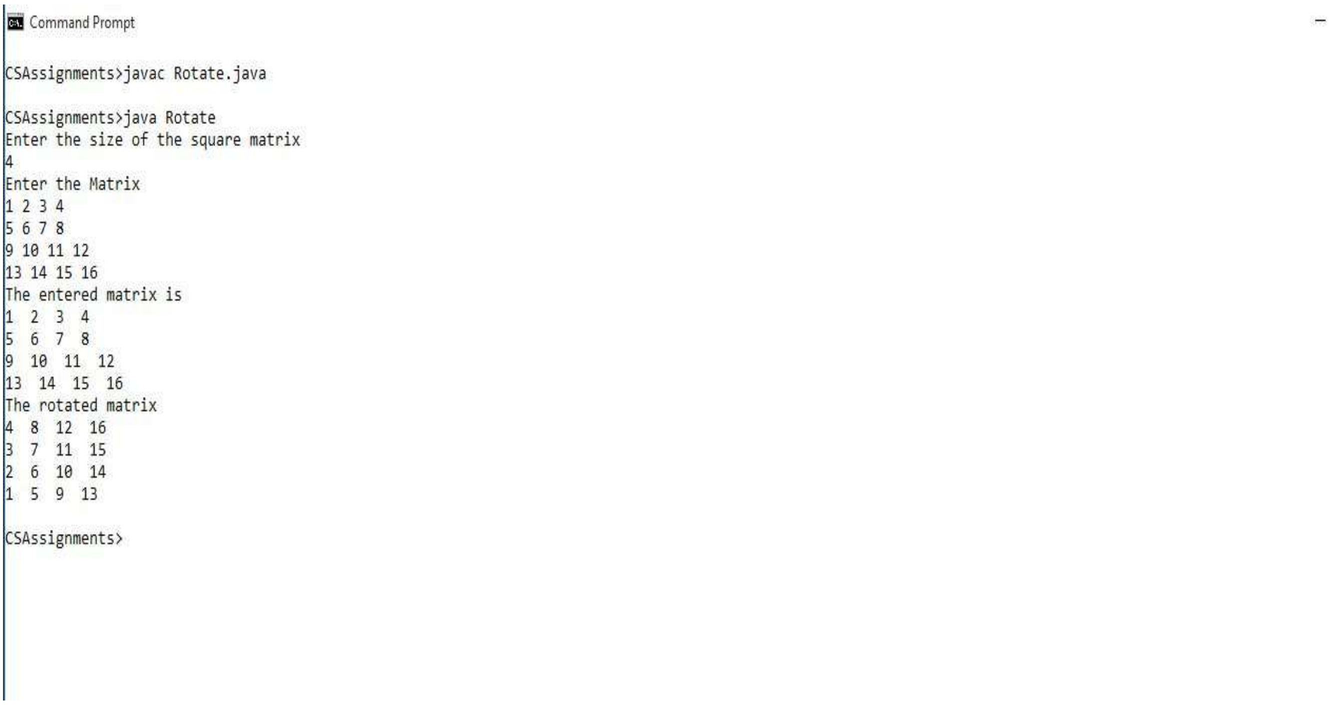
Source Code:

```
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 Description Table

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:

Name: **COMPUTER SCIENCE with JAVA**
Author: **SUMITA ARORA**
Publication: **DHANPAT RAI & CO. (Pvt.) Ltd.**

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