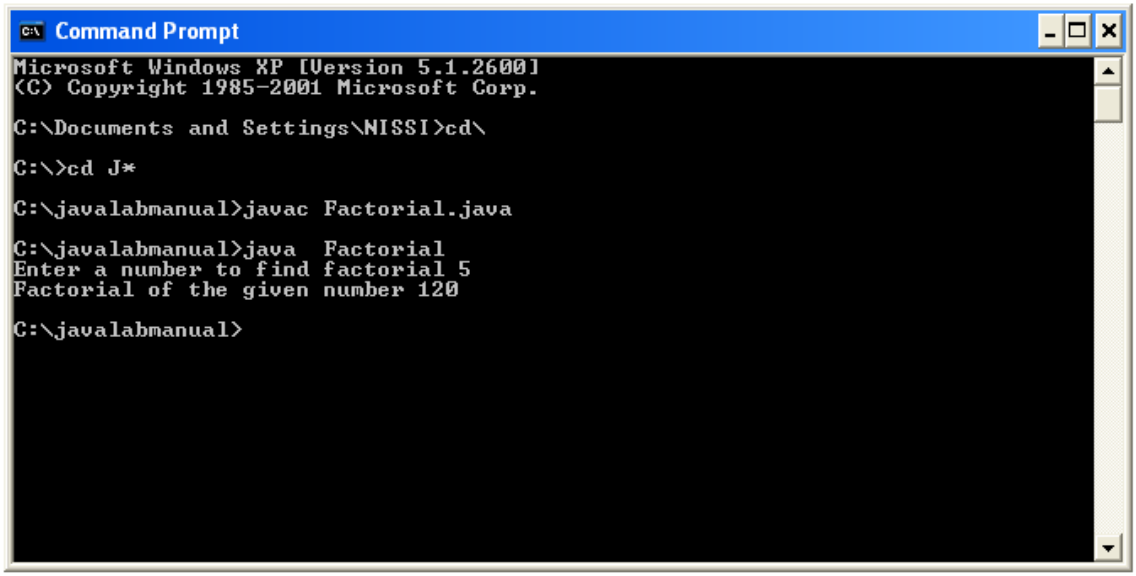
1. **Write a Java Program for calculating the factorial of a given number.**

Program:

```
import java.util.*;
class Factorial
{
        public static void main(String[] args)
        {
                int n,fact=1;
                Scanner ob=new Scanner(System.in);
                System.out.print("Enter a number to find factorial ");
                n=ob.nextInt();
                for(int i=1;i<=n;i++)
                        fact*=i;
                System.out.println("Factorial of the given number "+fact);
         }
}
```

Output:

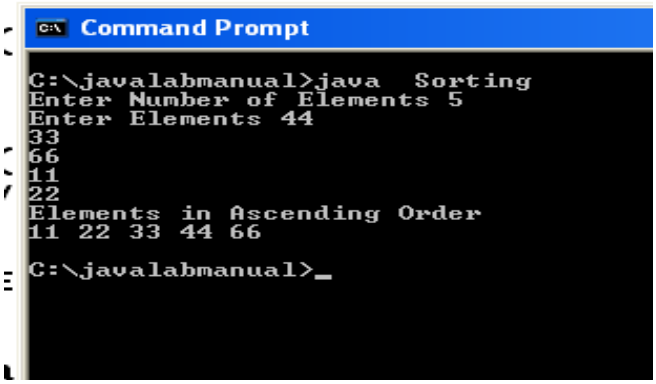


2. Write a Java program to print given list of elements in sorting order.

Program:

```
import java.io.*;
import java.util.*;
class Sorting
{
 public static void main(String[] args)
{
        int n;
        int a[];
        System.out.print("Enter Number of Elements ");
        Scanner ob=new Scanner(System.in);
        n=ob.nextInt();
        a=new int[n];
        System.out.print("Enter Elements ");
        for(int i=0;i<n;i++)
        {
                a[i]=ob.nextInt();
        }
        for(int i=0;i<n;i++)
        {
                for(int j=i+1;j<n;j++)
                {               if(a[i]>a[j])
                        {
                                int temp=a[i];
                                a[i]=a[j];
                                a[j]=temp;
                }
                }
        }
        System.out.println("Elements in Ascending Order");
        for(int i=0;i<n;i++)
        {
                System.out.print(a[i]+" ");
        }
        System.out.println();
}
}
```

Output:

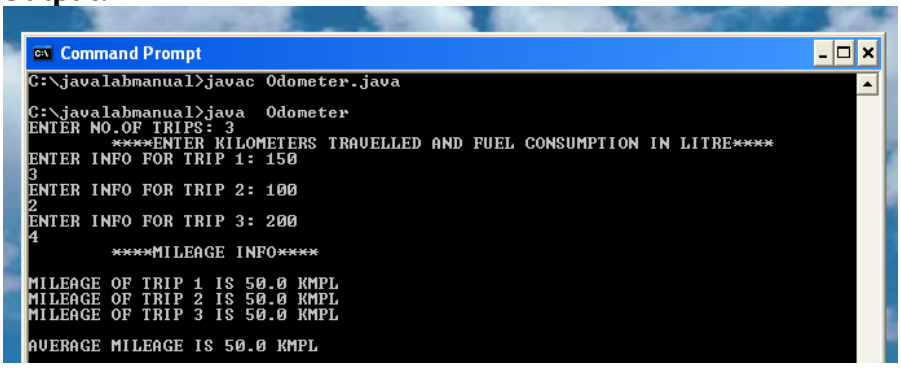


3. Write a Java program for a class Odometer that displays the no. of kilometers travelled, fuel consumption per liter. Give samples as trip information like number of kilometers travelled, fuel consumption per liter. The task is to find the mileage of the vehicle at different samples.

Program:

```
import java.io.*;
import java.util.*;
class Odometer
{
public static void main(String args[])
{
        double kms,fcpl,avg=0;
        double[] mileage=new double[100];

        System.out.print("ENTER NO.OF TRIPS: ");
        Scanner ob=new Scanner(System.in);
        n=ob.nextInt();
        System.out.println("\t****ENTER KILOMETERS TRAVELLED AND
                                FUEL CONSUMPTION IN LITRE****");
        for(i=1;i<=n;i++)
        {
                System.out.print("ENTER INFO FOR TRIP "+i+": ");
                kms=ob.nextDouble();
                fcpl=ob.nextDouble();
                mileage[i]=kms/fcpl;
                avg+=mileage[i];
        }
        avg=avg/n;
        System.out.println("\t****MILEAGE INFO**** ");
        System.out.println();
        for(i=1;i<=n;i++)
        {
        System.out.println("MILEAGE OF TRIP "+i+" IS "+mileage[i]+"  KMPL");
        }
        System.out.println();
        System.out.println("AVERAGE MILEAGE IS "+avg+" KMPL");
}
}
```

Output:



4. Create a class day that represents day, month, and year of the calendar day. They should be able to accept the date, update the date, and delete the date from calendar activities. Create a class time that represents hours, minutes, and seconds of a calendar. Time should accept the time, update the time, and delete the time from the list of every time a day using day class.

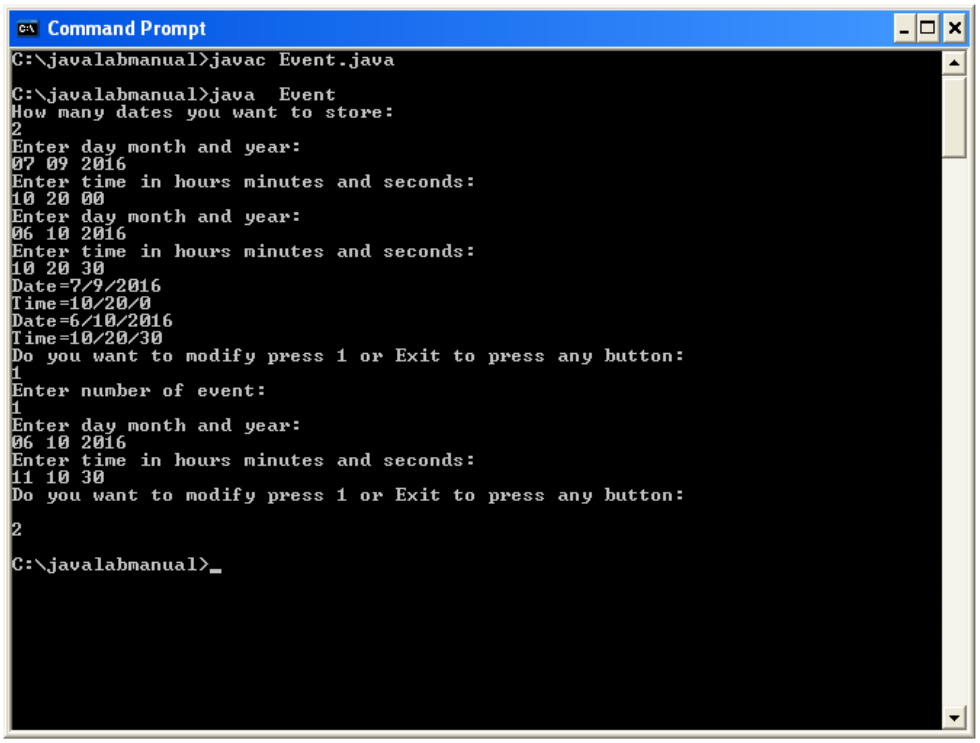
Program:

```
import java.util.Scanner;
import java.lang.*;
class Day
{
	 int day,month,year,i;
	 void accept()
	{
		System.out.println("Enter day month and year:");
		Scanner s=new Scanner(System.in);
		day=s.nextInt();
		month=s.nextInt();
		year=s.nextInt();
	}
	void show()
	{
		System.out.println("Date=" +day+ "/" +month+ "/" +year);
	}
}

class Time extends Day
{
	 int hrs,min,sec;
	void intake()
	{
		System.out.println("Enter time in hours minutes and seconds:");
		Scanner s =new Scanner(System.in);
		hrs=s.nextInt();
		min=s.nextInt();
		sec=s.nextInt();
	}
	void display()
	{
		System.out.println("Time=" +hrs+ "/" +min+ "/" +sec);
	}
}

class Event
{
public static void main(String args[])
{
	int n,i,k,ch=1,d=1;
	System.out.println("How many dates you want to store:");
	Scanner obj=new Scanner(System.in);
```

```
n=obj.nextInt();
Time[] o=new Time[n];
for(i=0;i<n;i++)
{
	o[i]=new Time();
	o[i].accept();
	o[i].intake();
}
for(i=0;i<n;i++)
{
	o[i].show();
	o[i].display();
}
while(ch==1)
{
System.out.println("Do you want to modify press 1 or Exit to press any button:");
	ch=obj.nextInt();
	if(ch==1)
	{
		System.out.println("Enter number of event:" );
		k=obj.nextInt();
		o[k-1].accept();
		o[k-1].intake();
	}
	else
		System.exit(0);
}
for(i=0;i<n;i++)
{
	o[i].show();
	o[i].display();
}
while(d==1)
{
System.out.println("Do you want to delete press 1 or Exit to press any button:");
	d=obj.nextInt();
	if(d==1)
	{
		System.out.println("Enter no. of event");
		k=obj.nextInt();
		o[k-1]=null;
		for(i=0;i<n;i++)
		{
			if(i!=k-1)
			{
				o[i].show();
				o[i].display();
			}
		}
	}
```

```
                else
                        System.exit(0);

        }
}
}
```

Output:

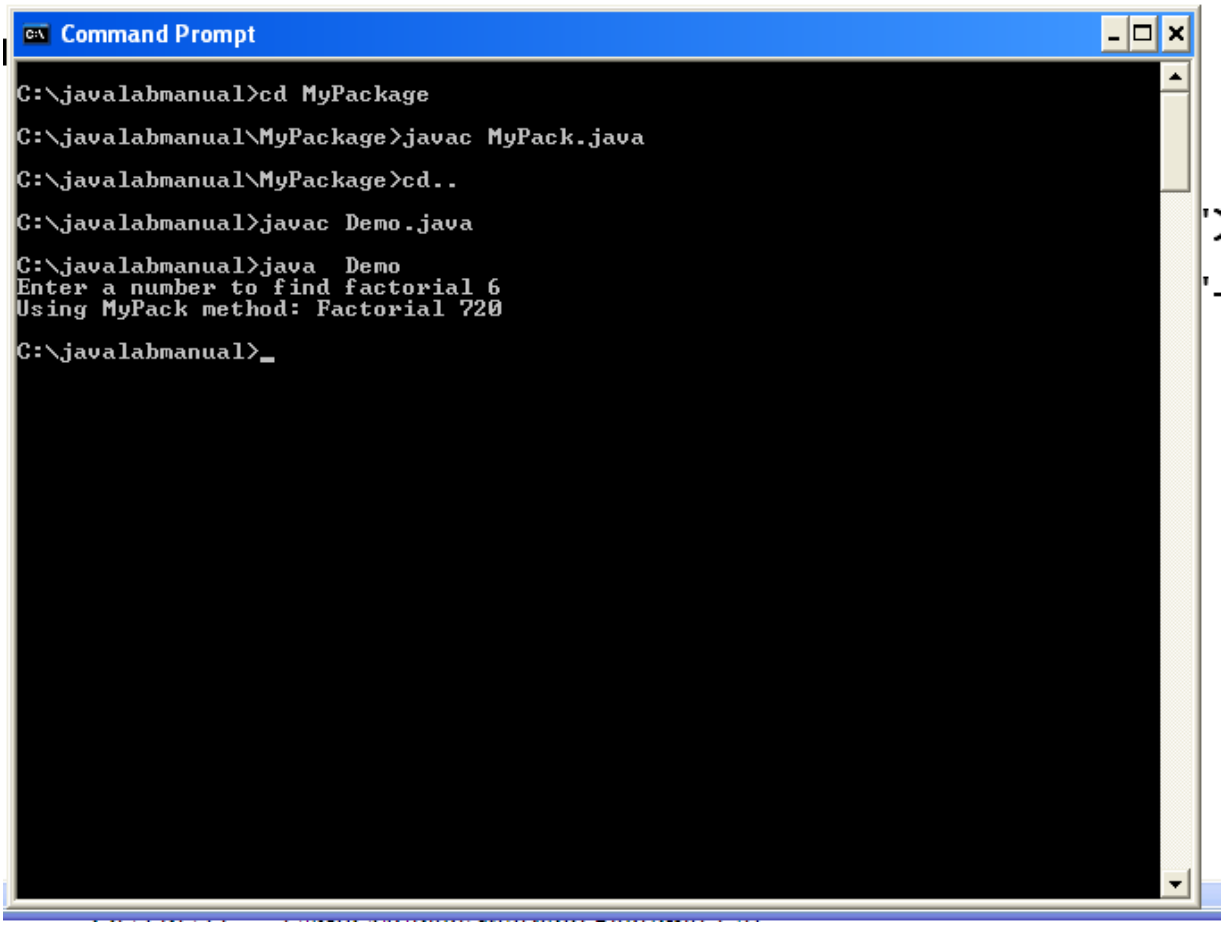


5. Write a Java program to illustrate the use of packages

Program:

```
//In MyPack….
package MyPackage;

import java.util.*;
public class MyPack
{
	public int fact(int n)
	{
		int i,fact1=1;
		for(i=1;i<=n;i++)
		{
			fact1*=i;
		}
		return fact1;
	}

	public static void main(String args[])
	{
		int n;
		MyPack m1=new MyPack();
		Scanner ob=new Scanner(System.in);
		System.out.print("Enter a number to find factorial ");
		n=ob.nextInt();

		System.out.println(m1.fact(n));

	}
}
//In Main Class importing the package
import java.io.*;
import java.util.*;
import MyPackage.*;
class Demo
{
	public static void main(String[] args)
	{
		MyPack p=new MyPack();
		Scanner ob=new Scanner(System.in);
		System.out.print("Enter a number to find factorial ");
		n=ob.nextInt();
		System.out.println("Using MyPack method: Factorial "+p.fact(n));

	}


}
```

Output:

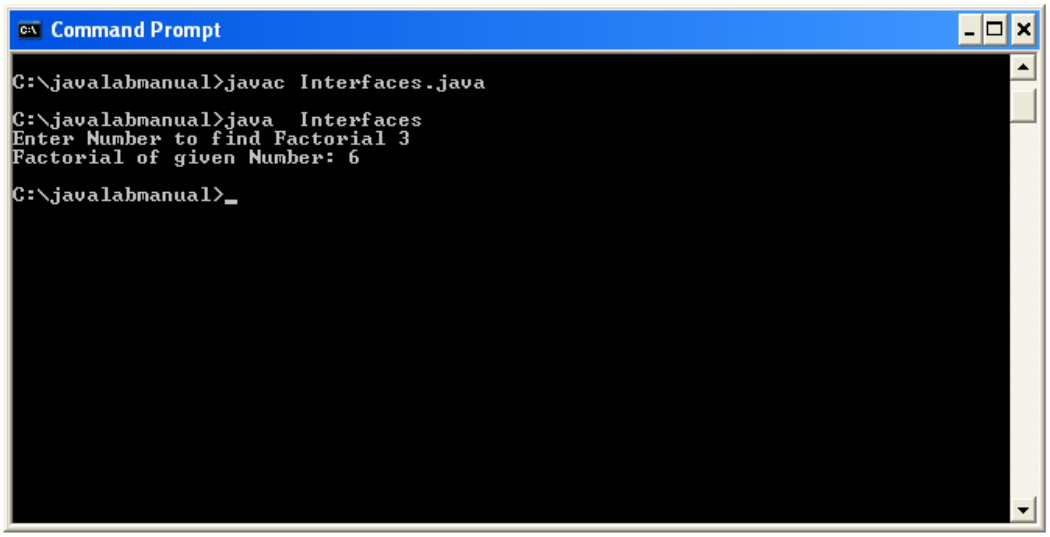

Command Prompt
C:\javalabmanual>cd MyPackage
C:\javalabmanual\MyPackage>javac MyPack.java
C:\javalabmanual\MyPackage>cd..
C:\javalabmanual>javac Demo.java
C:\javalabmanual>java Demo
Enter a number to find factorial 6
Using MyPack method: Factorial 720
C:\javalabmanual>

6. Write a Java program to implement interfaces.

Program:

```
import java.io.*;
import java.util.*;
interface Factorial
{
        public int fact(int n);
}
class Interfaces implements Factorial
{
                public static void main(String[] args)
                {
                Scanner ob=new Scanner(System.in);
                System.out.print("Enter Number to find Factorial ");
                int n=ob.nextInt();
                Interfaces i=new Interfaces();
                System.out.println("Factorial of given Number: "+i.fact(n));
                }

                public int fact(int n)
                {
                        if(n==1)
                                return 1;
                        else
                                return n*fact(n-1);
                }
}
```

Output:



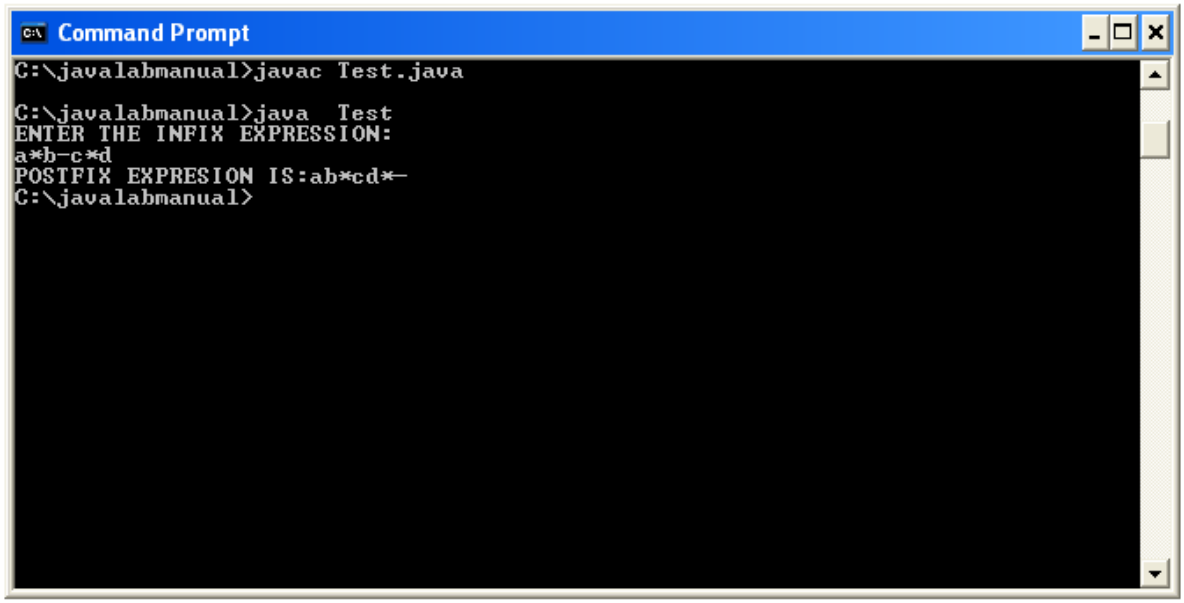
7. Write a Java program that implements Stack ADT to perform expression conversion.

Program:

```
import java.util.Scanner;
interface Inin
{
	public void push1(char ele);
	public char pop1();
}
class Inex implements Inin
{
	public int top;
	public  char st[];
	Inex()
	{
			top=-1;
			st=new char[15];
	}
	int incpr(char ch)
	{	switch(ch)
		{
			case '+':
			case '-':return 1;
			case '/':
			case '*':return 2;
			case '(':return 3;
			case ')':return -2;
			default:return -1;
		}
	}
	int instkpr(char ch)
	{	switch(ch)
		{
			case '+':
			case '-':return 1;
			case '/':
			case '*':return 2;
			case '(':return 0;
		}
		 return -1;
	}
	public void push1(char e)
	{
		st[++top]=e;
	}
	public  char pop1()
	{
		return st[top--];
	}
}
```

```
class Test
{
	public static void main(String args[])
	{
		Inex ix=new Inex();
		int i,j;
		char pos[]=new char[20];
		Scanner s=new Scanner(System.in);
		System.out.println("ENTER THE INFIX EXPRESSION:");
		String sr;
		char in[]=new char[20];
		sr=s.nextLine();
		in=sr.toCharArray();
		for(i=0,j=0;i<in.length;i++)
		{
			if(ix.incpr(in[i])==-1)
				pos[j++]=in[i];
			else if(ix.incpr(in[i])==-2)
			{
				while(ix.instkpr(ix.st[ix.top])!=0)
				{
					pos[j++]=ix.pop1();
				}
				ix.pop1();
			}
			else if(ix.incpr(in[i])==3)
				ix.push1(in[i]);
			else if(ix.top==-1)
				ix.push1(in[i]);
			else
			{
				while(ix.top>-1 && ix.incpr(in[i])<ix.instkpr(ix.st[ix.top]))
				{
					pos[j++] = ix.pop1();
				}
				ix.push1(in[i]);
			 }
		 }
		 while(ix.top>-1)
		 {
			pos[j++] = ix.pop1();
		 }
		pos[j]='\0';
		System.out.print("POST FIX EXPRESION IS:");
		for(i=0;pos[i]!='\0';i++)
			System.out.print(""+pos[i]);
	}
}
```

Output:

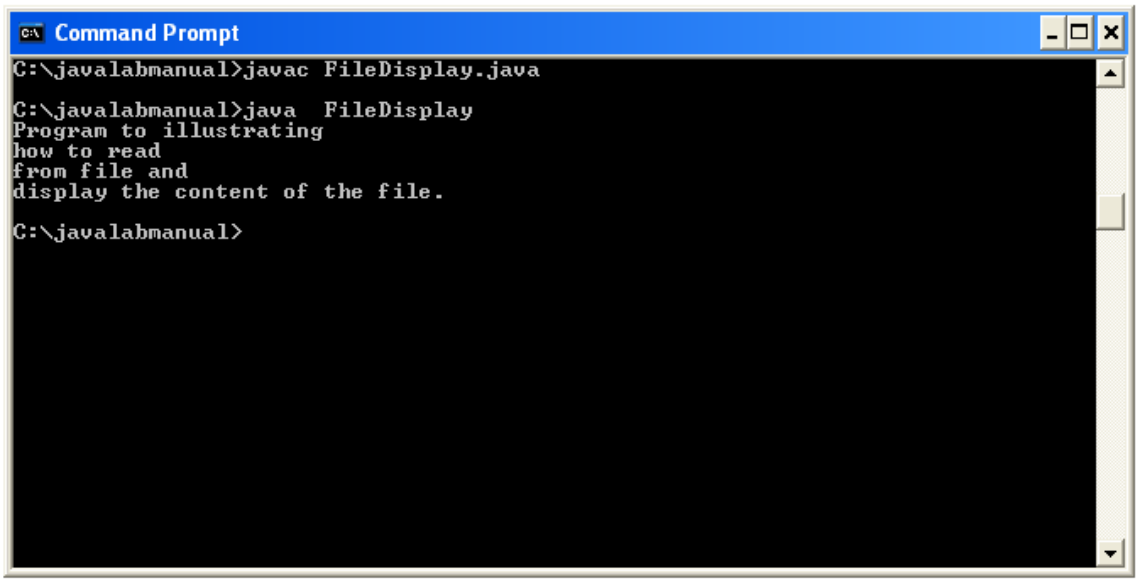

Command Prompt
C:\javalabmanual>javac Test.java
C:\javalabmanual>java Test
ENTER THE INFIX EXPRESSION:
a*b-c*d
POSTFIX EXPRESION IS:ab*cd*-
C:\javalabmanual>

8. Write a Java program to read from a file and display on screen.

Program:

```
import java.io.*;
import java.util.*;
class FileDisplay
{
public static void main(String[] args)
{
        try
        {
                String str;
                File file=new File("hello.txt");
                BufferedReader br=new BufferedReader(new FileReader(file));
                while((str=br.readLine())!=null)
                {
                        System.out.println(str);
                }
        }
        catch(FileNotFoundException e)
        {
                System.out.println(e);
        }
        catch(IOException e)
        {
                System.out.println(e);
        }
}
}
```

Output:

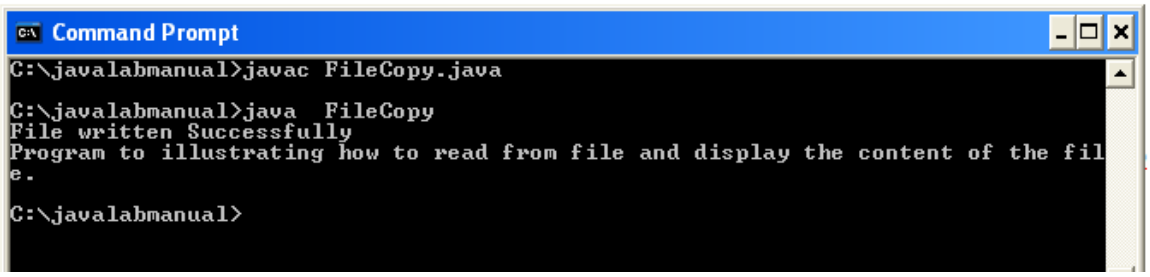


9. Write a Java program to copy contents of a file from one file to another.

Program:

```
import java.io.*;
public class FileCopy
{
 public static void main(String[] args)
 {	try
	{
		String str,str1;
		File file=new File("hello.txt");
		BufferedReader br=new BufferedReader(new FileReader(file));
		FileWriter fw = new FileWriter("filecopy.txt");
		BufferedWriter bw = new BufferedWriter(fw);
		while((str=br.readLine())!=null)
			bw.write(str);
		br.close();
		bw.close();
		BufferedReader br1=new BufferedReader(new FileReader("filecopy.txt"));
		System.out.println("File written Successfully");
		 while ((str1 = br1.readLine()) != null)
		{
			System.out.println(str1);
		}
		br1.close();
	}
	catch(FileNotFoundException e)
	{
		System.out.println(e);
	}
	catch(IOException e)
	{
		System.out.println(e);
	}
}
}
```

Output:

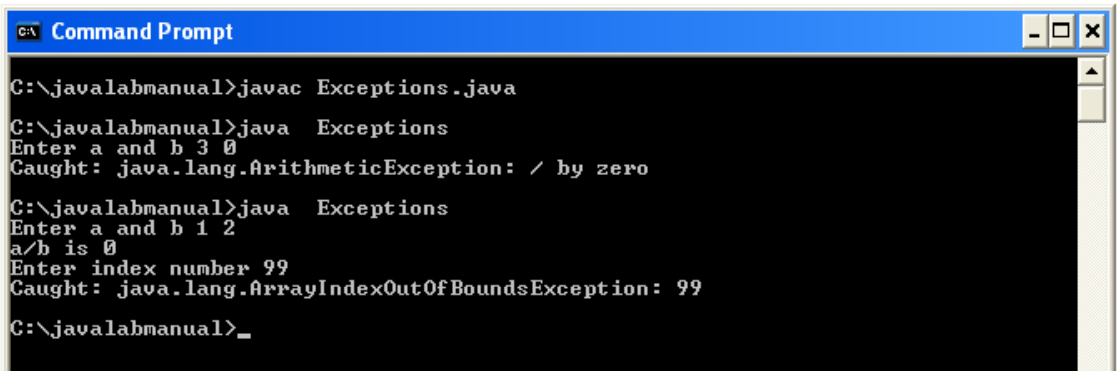


10. Write a Java program for ArrayIndexOutOfBoundsException and DivideByZero Exception.

Program:

```
import java.io.*;
import java.util.*;
class Exceptions
{
        public static void main(String[] args)
        {
                int n,a,b;
                int arr[]={1,2,3,4,5,6};
                Scanner ob=new Scanner(System.in);
                Try
                {
                        System.out.print("Enter a and b ");
                        a=ob.nextInt();
                        b=ob.nextInt();
                        System.out.println("a/b is "+(a/b));
                        System.out.print("Enter index number ");
                        n=ob.nextInt();
                         System.out.println("Element at given index number "+arr[n]);
                }
                 catch(ArithmeticException e)
                {
                         System.out.println("Caught: "+e);
                }
                catch(ArrayIndexOutOfBoundsException e)
                {
                         System.out.println("Caught: "+e);
                }
        }
}
```

Output:

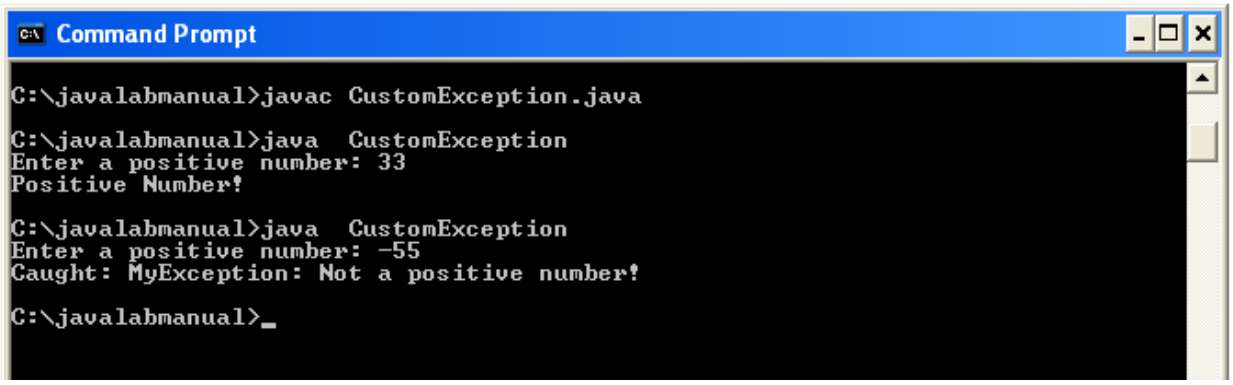


11. Write a Java Program for Custom Exception handling.

Program:

```
import java.io.*;
import java.util.*;
class MyException extends Exception
{
        public MyException(String str)
        {
                super(str);
        }
}
class CustomException
{
                public static void main(String[] args)
                {
                        Scanner ob=new Scanner(System.in);
                         int n;
                        System.out.print("Enter a positive number: ");
                         n=ob.nextInt();
                        try
                        {       if(n<0)
                                {
                                        throw new MyException("Not a positive number!");
                                 }
                                else
                                {
                                System.out.println("Positive Number!");
                                 }
                        }
                        catch(MyException e)
                        {
                                System.out.println("Caught: "+e);
                         }
                }
}
```

Output:



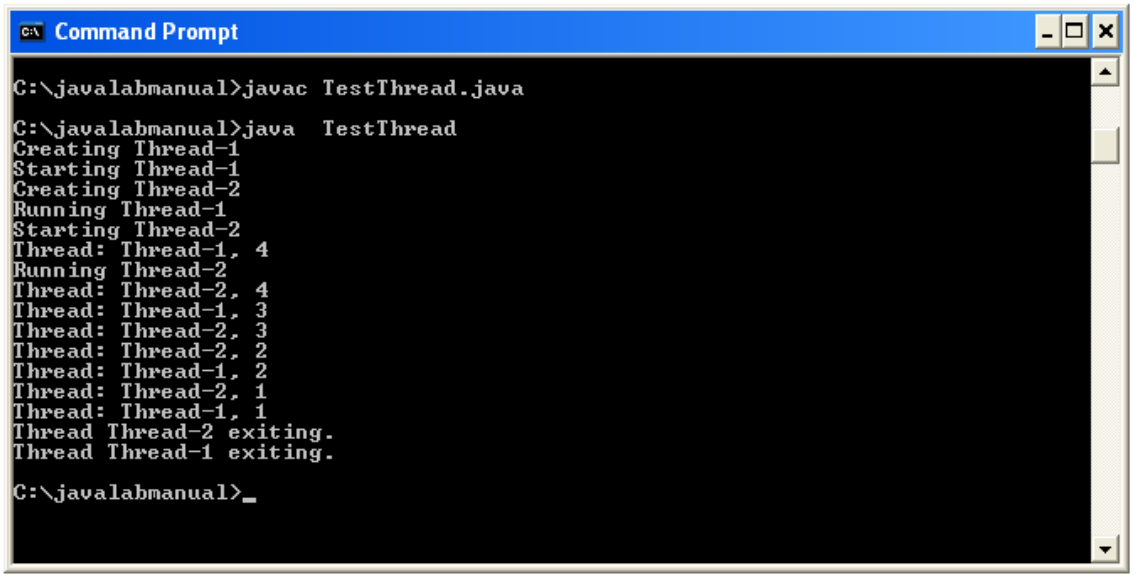
12. Write a Java program for multi threading showing how CPU time is shared among resources.

Program:

```
class ThreadDemo extends Thread
{
        private Thread t;
        private String threadName;

        ThreadDemo( String name)
        {
                threadName = name;
                System.out.println("Creating " +  threadName );
         }

        public void run()
        {
                 System.out.println("Running " +  threadName );
                try
                {
                         for(int i = 4; i > 0; i--)
                        {
                                System.out.println("Thread: " + threadName + ", " + i);
                                 // Let the thread sleep for a while.
                                Thread.sleep(50);
                        }
                }
                catch (InterruptedException e)
                {
                         System.out.println("Thread " +  threadName + " interrupted.");
                }
                System.out.println("Thread " +  threadName + " exiting.");
        }

        public void start ()
        {
                System.out.println("Starting " +  threadName );
                 if (t == null)
                {
                        t = new Thread (this, threadName);
                        t.start ();
                }
        }
}
```

```
public class TestThread
{
        public static void main(String args[])
        {
                ThreadDemo T1 = new ThreadDemo( "Thread-1");
                T1.start();
                ThreadDemo T2 = new ThreadDemo( "Thread-2");
                T2.start();
          }
}
```

Output:



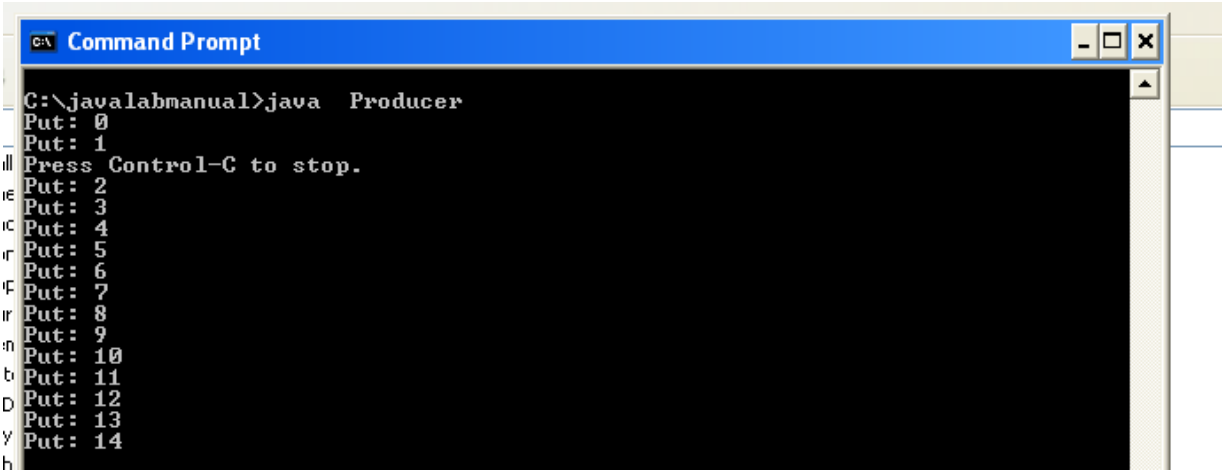
13. Write a Java program for Producer-Consumer problems using threads

Program:

```
class Q
{
	int n;
	synchronized int get()
	{
		System.out.println("Got: " + n);
		return n;
	}
	synchronized void put(int n)
	{
		this.n = n;
		System.out.println("Put: " + n);
	}
}
class Producer1 implements Runnable
{
	Q q;
	Producer1(Q q)
	{
		this.q = q;
		  new Thread(this, "Producer").start();
	}
	 public void run()
	{
		int i = 0;
		while(true)
		{
			q.put(i++);
		  }
	}
  }
class Consumer implements Runnable
{
	Q q;
	Consumer(Q q)
	{
		this.q = q;
		 new Thread(this, "Consumer").start();
	}
	public void run()
	{
		while(true)
		{
			q.get();
		}
	}
   }
```

```
class Producer
{
public static void main(String args[])
{
        Q q = new Q();
        new Producer1(q);
        new Consumer(q);
        System.out.println("Press Control-C to stop.");
}
}
```

Output:

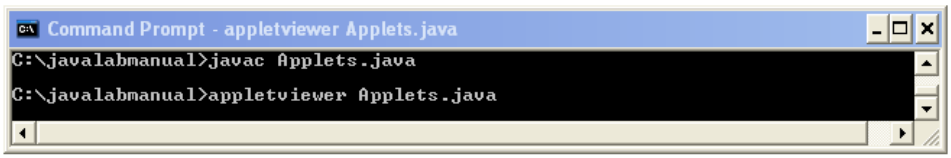


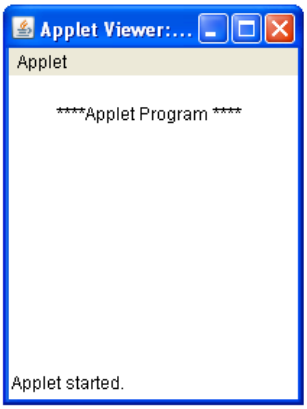
14. Write a Java program for displaying a simple message in an applet

Program:

```
import java.applet.*;
import java.awt.*;
import java.util.*;

/*<applet code="Applets.class" height=200 width=200></applet>*/

public class Applets extends Applet
{
        public void paint(Graphics g)
        {
                g.drawString(" ****Applet Program ****",30,30);
        }
}
```

Output:





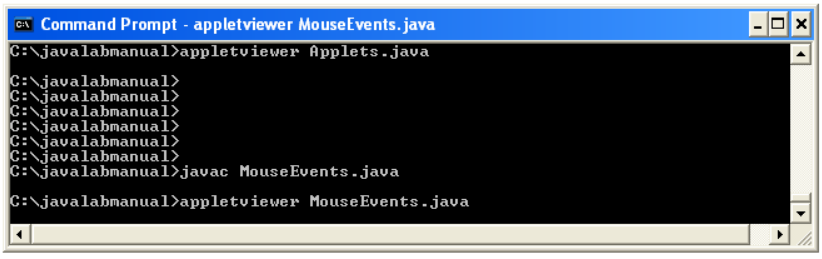
15. Write a Java program to handle mouse and keyboard events.

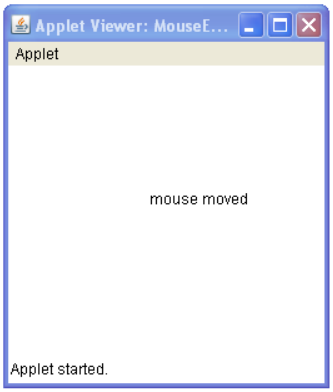
Program:

```
// Java program to handle Mouse Events
import java.awt.event.*;
import java.applet.*;
import java.util.*;
import java.awt.*;
/* <applet code=MouseEvents width=400 height=600>
</applet> */
public class MouseEvents extends Applet implements MouseListener,MouseMotionListener
{
	String msg="";
	int mousex=0,mousey=0;
	public void init()
	{
		addMouseListener(this);
		addMouseMotionListener(this);
	}
	public void mouseClicked(MouseEvent me)
	{
			msg="mouse clicked";
			mousex=me.getX();
			mousey=me.getY();
			repaint();
	}
	public void mousePressed(MouseEvent me)
	{
			msg="mouse pressed";
			mousex=me.getX();
			mousey=me.getY();
			repaint();
	}
	public void mouseDragged(MouseEvent me)
	{
			msg="mouse dragged";
			mousex=me.getX();
			mousey=me.getY();
			repaint();
	}
	public void mouseEntered(MouseEvent me)
	{
			msg="mouse entered";
			mousex=me.getX();
			mousey=me.getY();
			repaint();
	}

	public void mouseExited(MouseEvent me)
```

```
        {
                        msg="mouse exited";
                        mousex=me.getX();
                        mousey=me.getY();
                        repaint();
        }
        public void mouseReleased(MouseEvent me)
        {
                        msg="mouse released";
                        mousex=me.getX();
                        mousey=me.getY();
                        repaint();
        }
        public void mouseMoved(MouseEvent me)
        {
                        msg="mouse moved";
                        mousex=me.getX();
                        mousey=me.getY();
                        repaint();
        }
        //Override
        public void paint(Graphics g)
        {
                g.drawString(msg,mousex,mousey);
        }
}
```

Output:

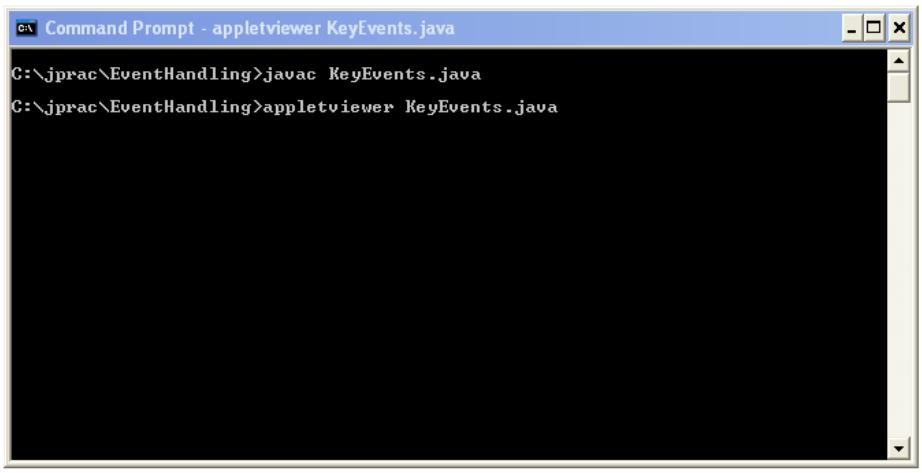


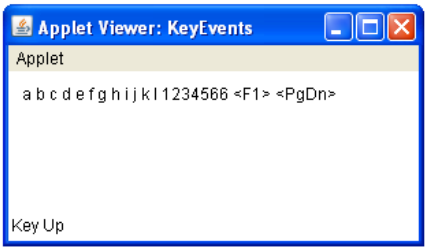


```
// Java program to handle Key Events.
import java.awt.*;
import java.awt.event.*;
import java.applet.*;

/* <applet code="KeyEvents" width=300 height=100>
</applet> */

public class KeyEvents extends Applet implements KeyListener
{
	String msg = "";
	int X = 10, Y = 20; // output coordinates
	public void init()
	{
		addKeyListener(this);
	}
	public void keyPressed(KeyEvent ke)
	{
		showStatus("Key Down");
		int key = ke.getKeyCode();
		switch(key)
		{
			case KeyEvent.VK_F1:
				msg += "<F1>";
				break;
			case KeyEvent.VK_F2:
				msg += "<F2>";
				break;
			case KeyEvent.VK_F3:
				msg += "<F3>";
				break;
			case KeyEvent.VK_PAGE_DOWN:
				msg += "<PgDn>";
				break;
			case KeyEvent.VK_PAGE_UP:
				msg += "<PgUp>";
				break;
			case KeyEvent.VK_LEFT:
				msg += "<Left Arrow>";
				break;
			case KeyEvent.VK_RIGHT:
				msg += "<Right Arrow>";
				break;
		}
		repaint();
}
public void keyReleased(KeyEvent ke)
{
	showStatus("Key Up");
}
```

```
public void keyTyped(KeyEvent ke)
{
        msg += ke.getKeyChar();
        repaint();
}

// Display keystrokes.
public void paint(Graphics g)
{
        g.drawString(msg, X, Y);
}
}
```

Output:





16. Write a Java program to design a basic Calculator using Applets.

Program:

```
import java.awt.*;
import java.awt.event.*;
import java.applet.*;

/*
<applet code="Calculator" width=500 height=500>
</applet>
*/

public class Calculator extends Applet implements ActionListener
{
String str="";
Button b[]= new Button[11];
Label l1,l2,l3;
Button add,sub,mul,div,mod,equal,clear;
TextField ti,to;
int i;

public void init()
        {
                setBackground(Color.gray);
                ti= new TextField(15);
                ti.addActionListener(this);
                to= new TextField(15);
                to.addActionListener(this);

                setLayout(new GridLayout(6,3));
                for( i=1;i<=9;i++)
                {
                        b[i]= new Button(""+i);
                        b[i].addActionListener(this);
                }
                b[i]= new Button(""+i);
                b[10].addActionListener(this);

                add= new Button("+");
                sub= new Button("-");
                mul= new Button("*");
                div= new Button("/");
                mod= new Button("%");
                clear= new Button("clear");
                equal= new Button("=");

                add.addActionListener(this);
                sub.addActionListener(this);
                mul.addActionListener(this);
                div.addActionListener(this);
```

```
                mod.addActionListener(this);
                clear.addActionListener(this);
                equal.addActionListener(this);
add(ti);
add(to);
add(clear);

add(b[1]);
add(b[2]);
add(add);

add(b[3]);
add(b[4]);
add(sub);

add(b[5]);
add(b[6]);
add(mul);

add(b[7]);
add(b[8]);
add(mod);

add(b[9]);
add(b[10]);
add(equal);

}

        public void actionPerformed(ActionEvent ae)
        {
                if(ae.getSource()==clear)
                {
                        str="";
                        ti.setText("");
                        to.setText("");
                }
                if(ae.getSource()==b[1])
                {
                        ti.setText(str+='1');
                }

                if(ae.getSource()==b[2])
                {
                        ti.setText(str+='2');
                }
                if(ae.getSource()==b[3])
                {
                        ti.setText(str+='3');
                }
```

```
    if(ae.getSource()==b[4])
    {
            ti.setText(str+='4');
    }
    if(ae.getSource()==b[5])
    {
            ti.setText(str+='5');
    }
    if(ae.getSource()==b[6])
    {
            ti.setText(str+='6');
    }
    if(ae.getSource()==b[7])
    {
            ti.setText(str+='7');
    }
    if(ae.getSource()==b[8])
    {
            ti.setText(str+='8');
    }
    if(ae.getSource()==b[9])
    {
            ti.setText(str+='9');
    }
    if(ae.getSource()==b[10])
    {
            ti.setText(str+'0');
    }
    if(ae.getSource()==add)
{
            ti.setText(str+='+');
    }
    if(ae.getSource()==sub)
    {
            ti.setText(str+='-');
    }
    if(ae.getSource()==mul)
    {
            ti.setText(str+='*');
    }
    if(ae.getSource()==div)
    {
            ti.setText(str+='/');
    }
    if(ae.getSource()==mod)
    {
            ti.setText(str+='%');
    }
```

```
        if(ae.getSource()==equal)
                {
                        int result=0;

                        char x=str.charAt(1);
                        int a,b;
                        a=Character.getNumericValue(str.charAt(0));
                        b=Character.getNumericValue(str.charAt(2));
                        if(x=='+')
                                result=(a+b);
                        if(x=='-')
                                result=(a-b);
                        if(x=='*')
                                result=(a*b);
                        if(x=='/')
                                result=(a/b);
                        if(x=='%')
                                result=(a%b);
                        str=String.valueOf(result);
                        to.setText(str);
                }
}
}
```

Output: