VINAYAKA MISSION'S RESEARCH FOUNDATION
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VINAYAKA MISSION'S KIRUPANANDA VARIYAR ENGINEERING COLLEGE

# VINAYAKA MISSION'S KIRUPANANDA VARIYAR ENGINEERING COLLEGE,
# SALEM – 636 308

**A Constituent College of VINAYAKA MISSION' S RESEARCH FOUNDATION**
**(Deemed to be University)**

**DEPARTMENT OF**

**COMPUTER SCIENCE AND ENGINEERING**

## 35021C09

# COMPUTER NETWORKS
**(Theory and Practical)**

# LABORATORY RECORD

**Name** _____

**Semester** _____

**Roll No** _____ **Reg. No.** _____

**Subject** _____

# CONTENTS

**EX.NO:1 IMPLEMENTATION OF STOP AND WAIT PROTOCOL**

**AIM**

To write a java program to Implement of Stop and Wait Protocol and Sliding Window Protocol.

**ALGORITHM:**

1. Start the program.
2. Get the frame size from the user
3. To create the frame based on the user request.
4. To send frames to server from the client side.
5. If your frames reach the server it will send ACK signal to client otherwise it will send NACK signal to client.
6. Stop the program.

**PROGRAM:**

```
//Implementation of Stop and Wait Protocol
//SENDER PROGRAM

import java.io.*;
import java.net.*;
import java.lang.String;
import java.util.Date;

class Sender{
Socket sender;
ObjectOutputStream out;
ObjectInputStream in;
String packet,ack,str,msg;
int n,i=0,sequence=0;
Sender(){}
public void run()
{
```

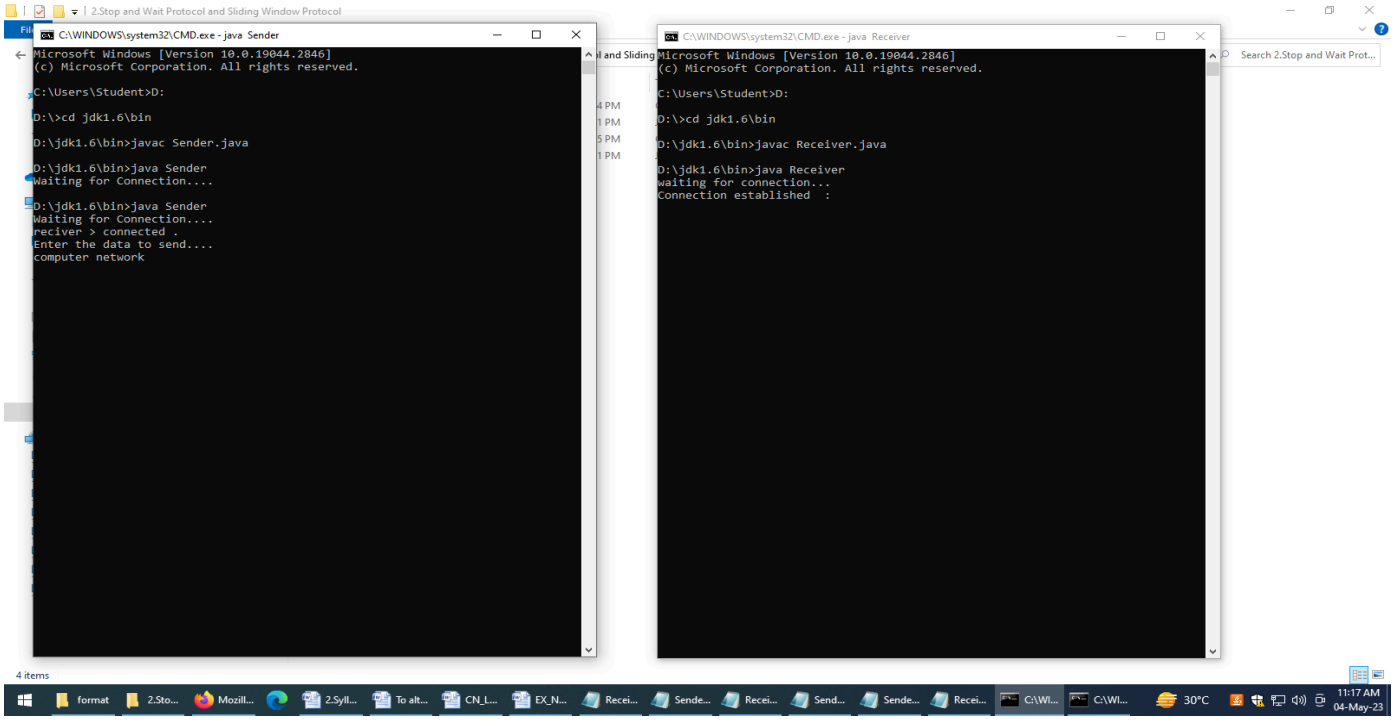
```
try{
BufferedReader br=new BufferedReader(new InputStreamReader(System.in));
System.out.println("Waiting for Connection....");
sender = new Socket("localhost",2004);
sequence=0;
out=new ObjectOutputStream(sender.getOutputStream());
out.flush();
in=new ObjectInputStream(sender.getInputStream());
str=(String)in.readObject();
System.out.println("reciver > "+str);
System.out.println("Enter the data to send....");
packet=br.readLine();
n=packet.length();
do{
try{
if(i<n)
{
msg=String.valueOf(sequence);
msg=msg.concat(packet.substring(i,i+1));
}
else if(i==n)
{
msg="end";out.writeObject(msg);break;
}
out.writeObject(msg);
sequence=(sequence==0)?1:0;
out.flush();
System.out.println("data sent>"+msg);
ack=(String)in.readObject();
System.out.println("waiting for ack.....\n\n");
if(ack.equals(String.valueOf(sequence))){
i++;
System.out.println("receiver > "+" packet recieved\n\n");
}
else{
System.out.println("Time out resending data....\n\n");
sequence=(sequence==0)?1:0;
}
```

```
}catch(Exception e){}
}while(i<n+1);
System.out.println("All data sent.exiting.");
}catch(Exception e)
 {
 }
finally
{
try{
in.close();
out.close();
sender.close();
}
catch(Exception e){}
}
}
public static void main(String args[])throws Exception
 {
Sender s=new Sender();
s.run();
 }
}

//Implementation of Stop and Wait Protocol
//RECEIVER PROGRAM

import java.io.*;
import java.net.*;
import java.lang.String;
import java.util.Date;

public class Receiver
{
ServerSocket reciever;
Socket connection=null;
ObjectOutputStream out;
ObjectInputStream in;
String packet,ack,data="";
```

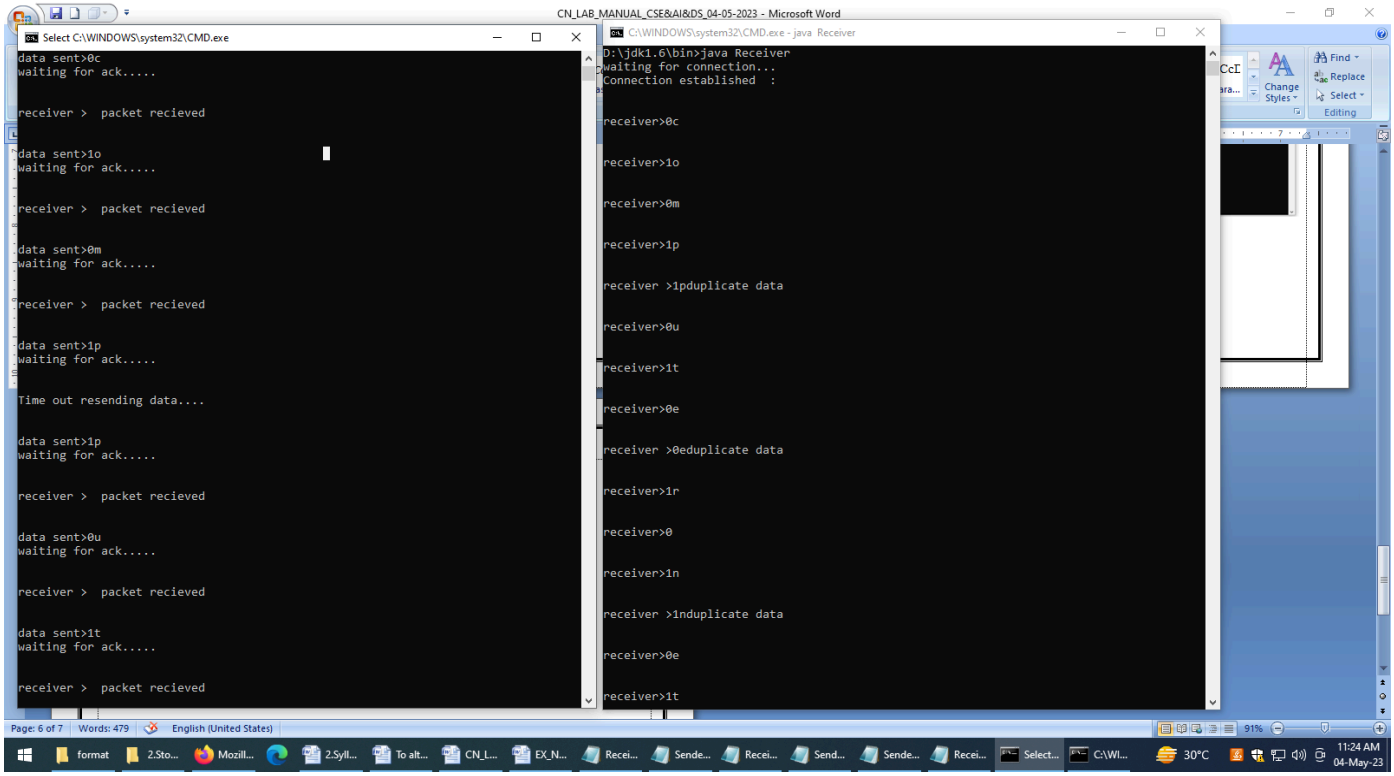
```
int i=0,sequence=0;
Receiver(){}
public void run(){
try{

BufferedReader br=new BufferedReader(new InputStreamReader(System.in));
reciever = new ServerSocket(2004,10);
System.out.println("waiting for connection...");
connection=reciever.accept();
sequence=0;
System.out.println("Connection established  :");

out=new ObjectOutputStream(connection.getOutputStream()); out.flush();

in=new                                  ObjectInputStream(connection.getInputStream());
out.writeObject("connected ."); do{

try{
packet=(String)in.readObject();
if(Integer.valueOf(packet.substring(0,1))==sequence){
data+=packet.substring(1);
sequence=(sequence==0)?1:0;
System.out.println("\n\nreceiver>"+packet);
}
else
{
System.out.println("\n\nreceiver >"+packet +"duplicate data");
}
if(i<3)
{
out.writeObject(String.valueOf(sequence));i++;
}
else
{
out.writeObject(String.valueOf((sequence+1)%2));
i=0;
}
}
```

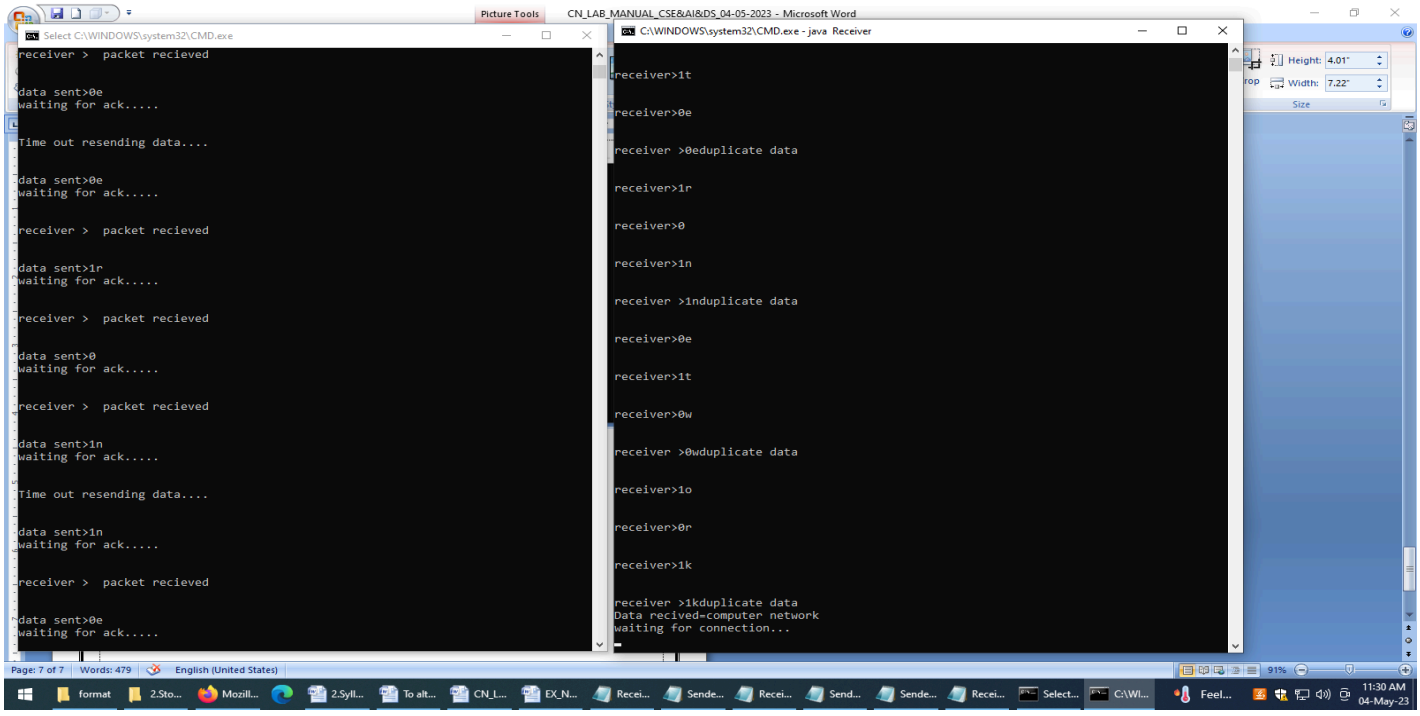
```
catch(Exception e){}
}while(!packet.equals("end"));

System.out.println("Data recived="+data);
out.writeObject("connection ended.");
}
catch(Exception e){}
finally{
try{
in.close();
out.close();
reciever.close();
}
catch(Exception e){}
}
}

public static void main(String args[])throws Exception
{
Receiver s=new Receiver();
while(true){
s.run();
}
}
}
```

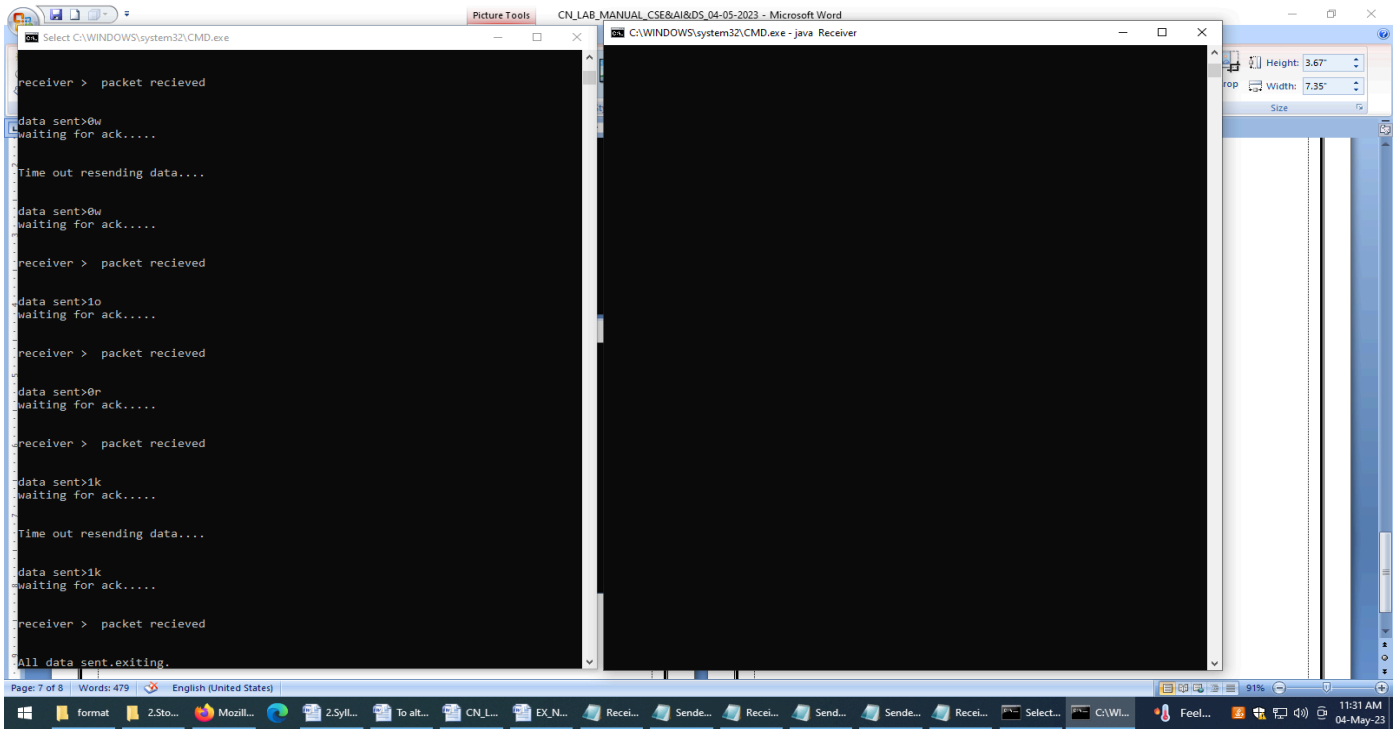
**INPUT:**


2.Stop and Wait Protocol and Sliding Window Protocol
C:\WINDOWS\system32\CMD.exe - java Sender
Microsoft Windows [Version 10.0.19044.2846]
(c) Microsoft Corporation. All rights reserved.
C:\Users\Student>D:
D:\>cd jdk1.6\bin
D:\jdk1.6\bin>javac Sender.java
D:\jdk1.6\bin>java Sender
Waiting for Connection....
D:\jdk1.6\bin>java Sender
Waiting for Connection....
reciver > connected .
Enter the data to send....
computer network
C:\WINDOWS\system32\CMD.exe - java Receiver
Microsoft Windows [Version 10.0.19044.2846]
(c) Microsoft Corporation. All rights reserved.
C:\Users\Student>D:
D:\>cd jdk1.6\bin
D:\jdk1.6\bin>javac Receiver.java
D:\jdk1.6\bin>java Receiver
waiting for connection...
Connection established :
4 items
30°C
11:17 AM
04-May-23

OUTPUT:


CN_LAB_MANUAL_CSE&AI&DS_04-05-2023 - Microsoft Word
Select C:\WINDOWS\system32\CMD.exe
data sent>0c
waiting for ack.....
receiver > packet recieved
data sent>1o
waiting for ack.....
receiver > packet recieved
data sent>0m
waiting for ack.....
receiver > packet recieved
data sent>1p
waiting for ack.....
Time out resending data....
data sent>1p
waiting for ack.....
receiver > packet recieved
data sent>0u
waiting for ack.....
receiver > packet recieved
data sent>1t
waiting for ack.....
receiver > packet recieved
C:\WINDOWS\system32\CMD.exe - java Receiver
D:\jdk1.6\bin>java Receiver
waiting for connection...
Connection established :
receiver>0c
receiver>1o
receiver>0m
receiver>1p
receiver >1pduplicate data
receiver>0u
receiver>1t
receiver>0e
receiver >0eduplicate data
receiver>1r
receiver>0
receiver>1n
receiver >1nduplicate data
receiver>0e
receiver>1t


Picture Tools
CN_LAB_MANUAL_CSE&AI&DS_04-05-2023 - Microsoft Word
Select C:\WINDOWS\system32\CMD.exe
receiver > packet recieved
data sent>0e
waiting for ack.....
Time out resending data....
data sent>0e
waiting for ack.....
receiver > packet recieved
data sent>1r
waiting for ack.....
receiver > packet recieved
data sent>0
waiting for ack.....
receiver > packet recieved
data sent>1n
waiting for ack.....
Time out resending data....
data sent>1n
waiting for ack.....
receiver > packet recieved
data sent>0e
waiting for ack.....
C:\WINDOWS\system32\CMD.exe - java Receiver
receiver>1t
receiver>0e
receiver >0eduplicate data
receiver>1r
receiver>0
receiver>1n
receiver >1nduplicate data
receiver>0e
receiver>1t
receiver>0w
receiver >0wduplicate data
receiver>1o
receiver>0r
receiver>1k
receiver >1kduplicate data
Data recived=computer network
waiting for connection...




**RESULT**:

Thus the program Implement of Stop and Wait Protocol and Sliding Window Protocol was executed successfully.

## EX.NO:2 STUDY OF SOCKET PROGRAMMING AND CLIENT–SERVER MODE

**AIM:**

To write a java program to Study of Socket Programming and Client – Server model

**ALGORITHM:**

### Server:

1.Create a server socket and bind it to port.
2.Listen for new connection and when a connection arrives accept it.
3.Send server's date and time to the client.
4.Read clients IP address sent by the client.
5.Display the client details.
6.Repeatsteps2-5untilthe server is terminated.
7.Close all streams.
8.Close the server socket.
9.Stop.

### Client:

1.Create a client socket and connect it to the server sport number.
2.Retrieve its own IPaddress using built-in function.
3.Send its address to the server.
4.Display the date&time sent by the server.
5.Close the input and output streams.
6.Close the client socket.
7.Stop.

**PROGRAM:**

```
// A Java program for a Server

import java.net.*;
import java.io.*;

public class Server
{
```

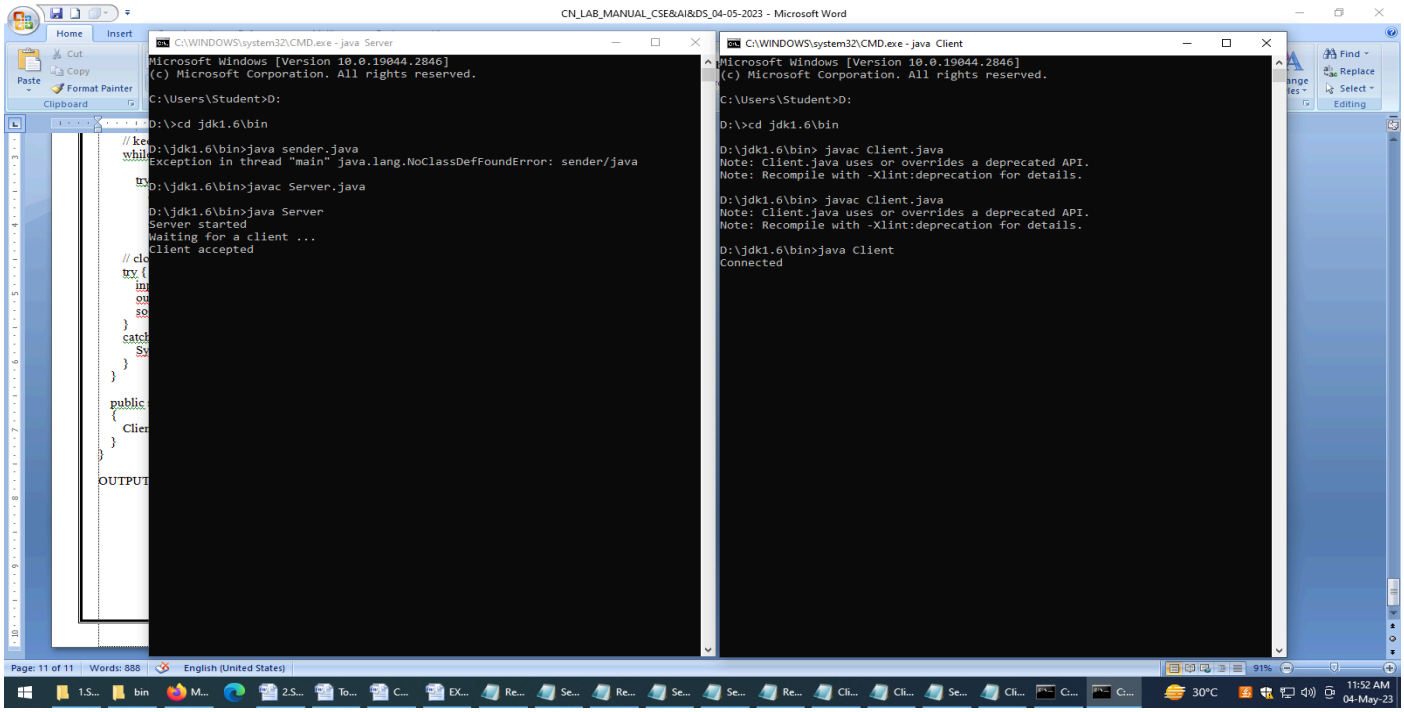
```
//initialize socket and input stream
private Socket          socket   = null;
private ServerSocket    server   = null;
private DataInputStream in       =  null;

// constructor with port
public Server(int port)
{
   // starts server and waits for a connection
   try
   {
      server = new ServerSocket(port);
      System.out.println("Server started");

      System.out.println("Waiting for a client ...");

      socket = server.accept();
      System.out.println("Client accepted");

      // takes input from the client socket
      in = new DataInputStream(
         new BufferedInputStream(socket.getInputStream()));

      String line = "";

      // reads message from client until "Over" is sent
      while (!line.equals("Over"))
      {
         try
         {
            line = in.readUTF();
            System.out.println(line);

         }
         catch(IOException i)
         {
            System.out.println(i);
         }
```

```
            }
            System.out.println("Closing connection");

            // close connection
            socket.close();
            in.close();
        }
        catch(IOException i)
        {
            System.out.println(i);
        }
    }

    public static void main(String args[])
    {
        Server server = new Server(5000);
    }
}

// A Java program for a Client

import java.io.*;
import java.net.*;
import java.lang.String;
import java.util.Date;

public class Client {
    // initialize socket and input output streams
    private Socket socket = null;
    private DataInputStream input = null;
    private DataOutputStream out = null;
    // constructor to put ip address and port
    public Client(String address,int port)
    {
        // establish a connection
        try {
            socket = new Socket(address,port);
            System.out.println("Connected");
```

```
    // takes input from terminal
    input = new DataInputStream(System.in);

    // sends output to the socket
    out = new DataOutputStream(socket.getOutputStream());
}
catch (UnknownHostException u) {
    System.out.println(u);
    return;
}
catch (IOException i)
{
    System.out.println(i);
    return;
}

// string to read message from input
String line = "";

// keep reading until "Over" is input
while (!line.equals("Over"))
        {
    try {
        line = input.readLine();
        out.writeUTF(line);
        }catch (IOException i) { System.out.println(i); }
        }

// close the connection
try {
    input.close();
    out.close();
    socket.close();
}
catch (IOException i) {
    System.out.println(i);
}
```

```
    }

    public static void main(String args[])throws Exception
    {
        Client client = new Client("127.0.0.1",5000);
    }
}
```

## OUTPUT:




**RESULT:**

Thus the program for Study of Socket Programming and Client – Server model was executed successfully.

**EX.NO:3 Write a code simulating ARP/RARP Protocols.**

**Aim:**

1. To write a java program for simulating ARP protocols using TCP

**ALGORITHM:**

**Client**

2. Start the program
3. Using socket connection is established between client and server.
4. Get the IPaddress to be converted into MAC address.
5. Send this IPaddress to server.
6. Server returns the MAC address to client.

**Server**

1. Start the program
2. Accept the socket which is created by the client.
3. Server maintains the table in which IP and corresponding MAC addresses are stored.
4. Read the IP address which is send by the client.
5. Map the IP address with its MAC address and return the MAC address to client.

**PROGRAM:**

## SERVERARP:

```
 import java.io.*;
import java.net.*;
import java.util.*;
class Serverarp
{
public static void main(String args[])
{
try
{
ServerSocket obj=new ServerSocket(139);
Socket obj1=obj.accept();
```

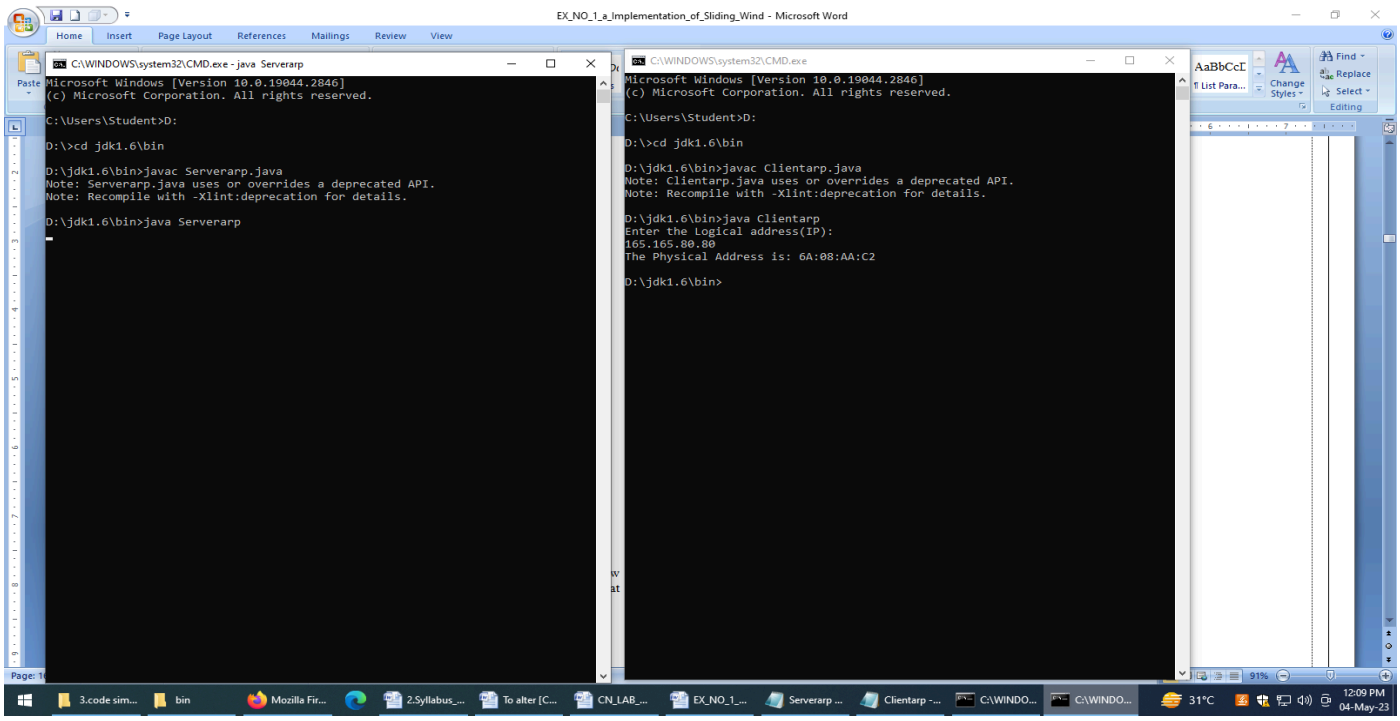
```
while(true)
{
DataInputStream din=new DataInputStream(obj1.getInputStream());
DataOutputStream dout=new DataOutputStream(obj1.getOutputStream());
String str=din.readLine();
String ip[]={"165.165.80.80","165.165.79.1"};
String mac[]={"6A:08:AA:C2","8A:BC:E3:FA"};
for(int i=0;i<ip.length;i++)
{
if(str.equals(ip[i]))
{
dout.writeBytes(mac[i]+'\n');
break;
}
}
obj.close();
}
}
catch(Exception e)
{
System.out.println(e);
}
}
}
```

**CLIENTARP:**

```
import java.io.*;
import java.net.*;
import java.util.*;
class Clientarp
{
public static void main(String args[])
{
try
{
BufferedReader in=new BufferedReader(new InputStreamReader(System.in));
Socket clsct=new Socket("127.0.0.1",139);
```

```
DataInputStream din=new DataInputStream(clsct.getInputStream());
DataOutputStream dout=new DataOutputStream(clsct.getOutputStream());
System.out.println("Enter the Logical address(IP):");
String        str1=in.readLine();
dout.writeBytes(str1+'\n');
String str=din.readLine();
System.out.println("The Physical Address is: "+str);
clsct.close();
}
catch (Exception e)
{
System.out.println(e);
}
}
}
```

OUTPUT:




**RESULT:**

Thus a program for simulating ARP protocols using TCP was executed successfully.

## EX-NO.4 . WRITE A CODE SIMULATING PING AND TRACE ROUTE COMMANDS

**Aim:**

To Write the java program for simulating ping command

**Algorithm:**

Step1:start the program.
Step2:Include necessary package in java.
Step3:To create a process object to implement the ping command.
Step4:declare one Buffered Reader stream class object.
Step5:Get the details of the
server
5.1:length of the IP
address
5.2 :time required to get the details.
5.3 :send packets,receive packet sand lost packets .5.4:minimum ,maximum and average times.
Step6:printthe
results.
Step7:Stoptheprog
ram.

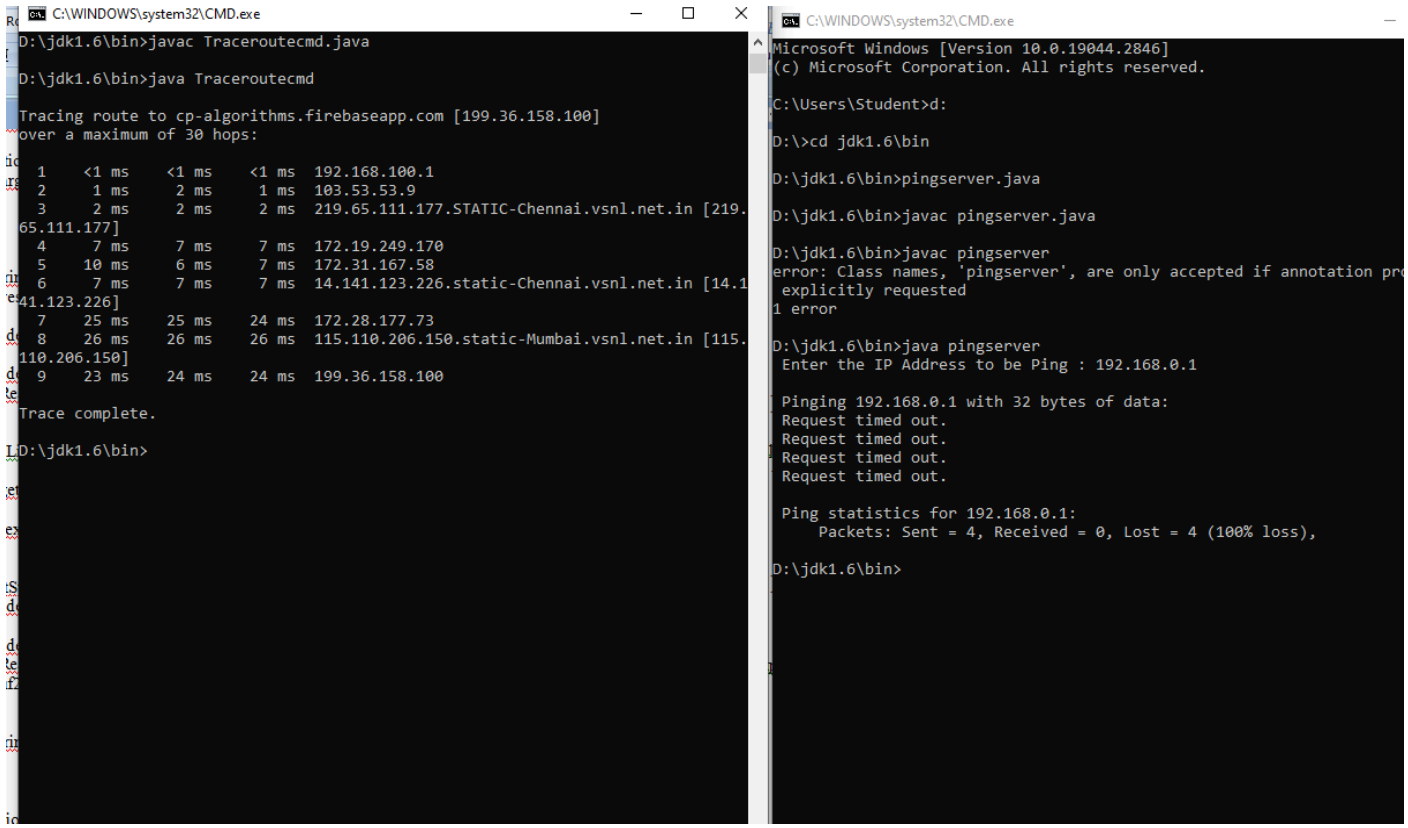
**PROGRAM:**

```
//PING SERVER
import java.io.*;
import java.net.*;
class pingserver
```

```
{
public static void main(String args[])
{
try
{
String str;
System.out.print(" Enter the IP Address to be Ping : ");
BufferedReader buf1=new BufferedReader(new
InputStreamReader(System.in));
String ip=buf1.readLine();
Runtime H=Runtime.getRuntime();
Process p=H.exec("ping " + ip);
InputStream in=p.getInputStream();
BufferedReader buf2=new BufferedReader(new InputStreamReader(in));
while((str=buf2.readLine())!=null)
{
System.out.println(" " + str);
}
}
catch(Exception e)
{
System.out.println(e.getMessage());
}
}
}
//TRACEROUTE commands-
import java.io.BufferedReader;
import java.io.InputStreamReader;

public class traceroutecmd
{
    public static void runSystemCommand(String command)
    {
        try
        {
            Process p = Runtime.getRuntime().exec(command);
            BufferedReader inputStream = new BufferedReader(
            new InputStreamReader(p.getInputStream()));
```

```
            String s = "";
            while ((s = inputStream.readLine()) != null)
                System.out.println(s);
        }
        catch (Exception e)
        {
        }
    }

    public static void main(String[] args)
    {
        // String ip = "www.google.co.in";
        // String ip = "127.0.0.1";
        String ip = "www.cp-algorithms.com";
        runSystemCommand("tracert " + ip);
    }
}
```

**OUTPUT:**




**RESULT:**

Thus the program the java program for simulating ping command was executed successfully.

## EX-NO 05 STUDY OF NETWORK SIMULATOR (NS) AND SIMULATION OF CONGESTION CONTROL ALGORITHMS USING NS

**Aim:**

To Study of Network simulator(NS).and Simulation of Congestion Control Algorithms using NS

**Algorithm**:

There are several variants off loading algorithm. Most work roughly as follows:

Each node acts as both a transmitter and a receiver.

Each node tries to forward every message to everyone of its neighbour's except the source node.

This results in every message eventually being delivered to all reachable parts of the network.

Algorithms may need to be more complex than this, since, in some case, precautions have to be taken to avoid wasted duplicate deliveries and infinite loops, and to allow messages to eventually expire from the system. A variant of flooding called selective flooding partially addresses these issues by only sending packets to routers in the same direction. In selective flooding the routersdon'tsendeveryincomingpacketoneverylinebutonlyonthoselineswhicharegoi ngapproximatelyin the right direction

**PROGRAM:**

Sample Ns2 program for Congestion control

```
include <wifi_lte/wifi_lte_rtable.h>
  struct r_hist_entry *elm, *elm2;
int num_later = 1;
elm = STAILQ_FIRST(&r_hist_);
while (elm != NULL && num_later <= num_dup_acks_){
        num_later;
        elm = STAILQ_NEXT(elm, linfo_);
}

      if (elm != NULL){
        elm = findDataPacketInRecvHistory(STAILQ_NEXT(elm,linfo_));

        if (elm != NULL){
                elm2 = STAILQ_NEXT(elm, linfo_);
                while(elm2 != NULL){
                        if (elm2->seq_num_ < seq_num && elm2->t_recv_ < time){
                                STAILQ_REMOVE(&r_hist_,elm2,r_hist_entry,linfo_);
                               delete elm2;
                        } else
                                elm = elm2;
                        elm2 = STAILQ_NEXT(elm, linfo_);
```

```
                }
        }
}
}
void DCCPTFRCAgent::removeAcksRecvHistory(){
struct r_hist_entry *elm1 = STAILQ_FIRST(&r_hist_);
struct r_hist_entry *elm2;

int num_later = 1;
while (elm1 != NULL && num_later <= num_dup_acks_){
        num_later;
        elm1 = STAILQ_NEXT(elm1, linfo_);
}

if(elm1 == NULL)
        return;

elm2 = STAILQ_NEXT(elm1, linfo_);
while(elm2 != NULL){
        if (elm2->type_ == DCCP_ACK){
                STAILQ_REMOVE(&r_hist_,elm2,r_hist_entry,linfo_);
                delete elm2;
        } else {
                elm1 = elm2;
        }
        elm2 = STAILQ_NEXT(elm1, linfo_);
}
}


inline                                                                  r_hist_entry
*DCCPTFRCAgent::findDataPacketInRecvHistory(r_hist_entry *start){
while(start != NULL && start->type_ == DCCP_ACK)
        start = STAILQ_NEXT(start,linfo_);
```

```
return start;
}
```

**OUTPUT**:

## EX-NO 6 SIMPLE TCP/IP CLIENT SERVER COMMUNICATION

**Aim:**

To write a java program for application using TCP Sockets Links

**Algorithm:**

1.Start the program.
2.Get the frame size from the user
3.To create the frame based on the user request.
4.To send frames to server from the client side.
5.If your frames reach the server it will send ACK signal to client otherwise it will send NACK signal to client.
Stop the program

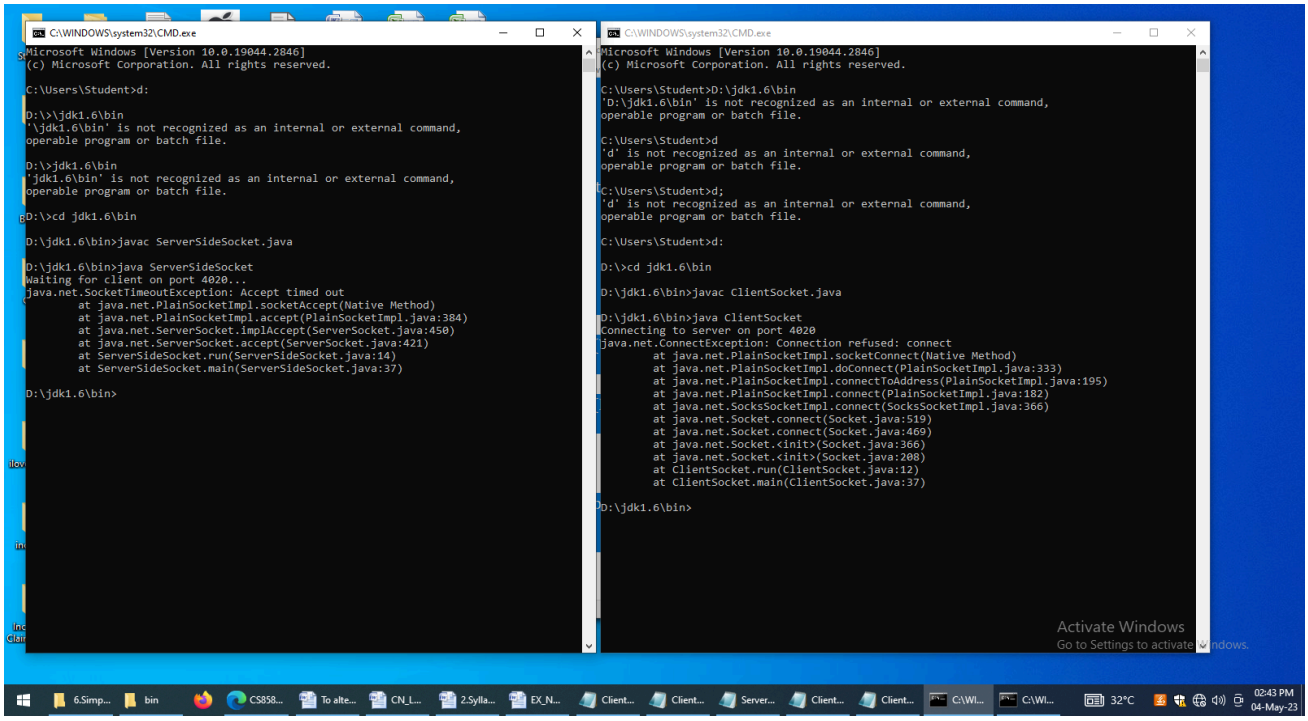
**PROGRAM**:

```
// Server Side
import java.net.*;
import java.io.*;

public class ServerSideSocket {
  public void run() {
        try {
              int serverPort = 4020;
              ServerSocket serverSocket = new ServerSocket(serverPort);
              serverSocket.setSoTimeout(10000);
              while(true) {
                    System.out.println("Waiting for client on port " +
serverSocket.getLocalPort() + "...");

                    Socket server = serverSocket.accept();
                    System.out.println("Just connected to " +
server.getRemoteSocketAddress());

                    PrintWriter toClient =
                          new PrintWriter(server.getOutputStream(),true);
                    BufferedReader fromClient =
                          new BufferedReader(
```

```
                                        new
InputStreamReader(server.getInputStream()));
                        String line = fromClient.readLine();
                        System.out.println("Server received: " + line);
                        toClient.println("Thank you for connecting to " +
server.getLocalSocketAddress() + "\nGoodbye!");
                }
        }
        catch(UnknownHostException ex) {
                ex.printStackTrace();
        }
        catch(IOException e){
                e.printStackTrace();
        }
 }

 public static void main(String[] args) {
        ServerSideSocket srv = new ServerSideSocket();
        srv.run();
 }
}

 // Client Side

import java.io.*;
import java.net.*;

public class ClientSocket {
  public void run() {
    try {
        int serverPort = 4020;
        InetAddress host = InetAddress.getByName("localhost");
        System.out.println("Connecting to server on port " + serverPort);

        Socket socket = new Socket(host,serverPort);
        //Socket socket = new Socket("127.0.0.1", serverPort);
        System.out.println("Just connected to " +
```

```
socket.getRemoteSocketAddress());
        PrintWriter toServer =
                new PrintWriter(socket.getOutputStream(),true);
        BufferedReader fromServer =
                new BufferedReader(
                        new InputStreamReader(socket.getInputStream()));
        toServer.println("Hello from " + socket.getLocalSocketAddress());
        String line = fromServer.readLine();
        System.out.println("Client received: " + line + " from Server");
        toServer.close();
        fromServer.close();
        socket.close();
    }
    catch(UnknownHostException ex) {
        ex.printStackTrace();
    }
    catch(IOException e){
        e.printStackTrace();
    }
  }

  public static void main(String[] args) {
        ClientSocket client = new ClientSocket();
        client.run();
  }
}
```

OUTPUT:




RESULT:

Thus the program for application using TCP Sockets Links was executed successfully.

**EX.NO 7:**

**PROGRAM FOR REVERSE ADDRESS RESOLUTION PROTOCOL (RARP) USING UDP**

**Aim:**

To write a java program for simulating RARP protocols using UDP

**ALGORITHM:**

**Client**

1. Start the program
2. using datagram sockets UDP function is established.2.Get the MAC address to be converted into IP address.3.SendthisMAC address to server.
4. Server returns the IP address to client.

**Server**

1. Start the program.

2. Server maintains the table in which IP and corresponding MAC addresses are stored.
3. Read the MAC address which is send by the client.
4. Map the IP address with its MAC address and return the IP address to client

PROGRAM:

CLIENT

```
import java.net.*;
import java.io.*;
public class UDPEchoClient
{
 public static class UDPEchoReader extends Thread
 {
 public UDPEchoReader(DatagramSocket socket)
 {
 datagramSocket = socket;
 active = true;
 }
 public void run()
 {
 byte[] buffer = new byte[1024];
 DatagramPacket incoming = new DatagramPacket(buffer, buffer.length);
 String receivedString;
 while(active)
 {
 try
 {
 // listen for incoming datagram packet
 datagramSocket.receive(incoming);
 // print out received string
 receivedString = new String(incoming.getData(),
 0, incoming.getLength());
 System.out.println("Received from server: "+receivedString);
 }
 catch(IOException e)
 {
```

```
System.out.println(e);
active = false;
}
}
}
public boolean active;
public DatagramSocket datagramSocket;
}
public static void main(String[] args)
{
InetAddress address = null;
int port = 8000;
DatagramSocket datagramSocket = null;
BufferedReader keyboardReader = null;
// Create a Datagram Socket...
try
{
address = InetAddress.getByName("127.0.0.1");
datagramSocket = new DatagramSocket();
keyboardReader = new BufferedReader(new
InputStreamReader(System.in));
}
catch (IOException e)
{
System.out.println(e);
System.exit(1);
}
// Start the listening thread...
UDPEchoReader reader = new UDPEchoReader(datagramSocket);
reader.setDaemon(true);
reader.start();
System.out.println("Ready to send your messages...");
try
{
String input;
while (true)
{
// read input from the keyboard
```

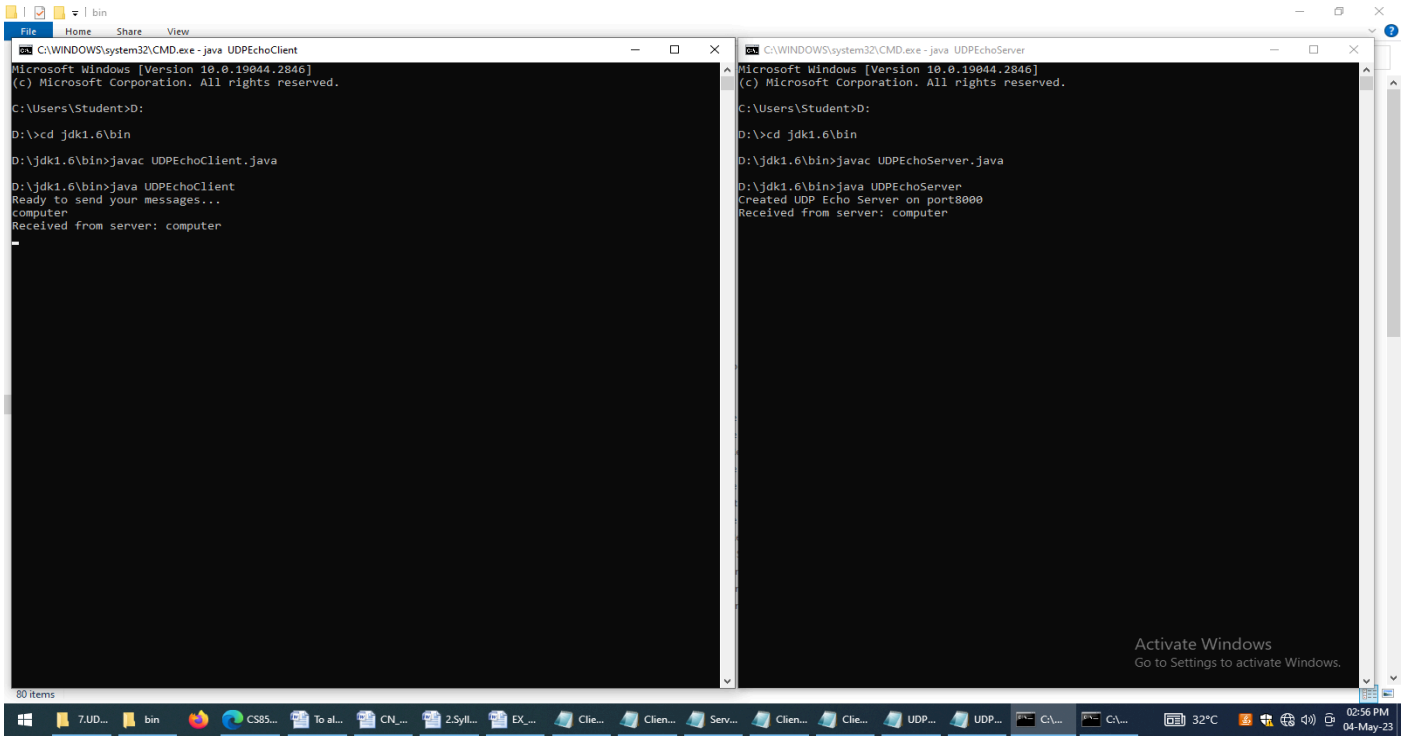
```
        input = keyboardReader.readLine();
        // send datagram packet to the server
        DatagramPacket datagramPacket = new DatagramPacket
        (input.getBytes(), input.length(), address, port);
        datagramSocket.send(datagramPacket);
        }
        }
        catch(IOException e)
        {
        System.out.println(e);
        }
        }
       }.
```

SERVER:

```
import java.net.*;
import java.io.*;
public class UDPEchoServer
{
 public static void main(String args[])
 {
 int port = 8000;
 // create the server...
 DatagramSocket serverDatagramSocket = null;
 try
 {
 serverDatagramSocket = new DatagramSocket(port);
 System.out.println("Created UDP Echo Server on port"+port);
 }
 catch(IOException e)
 {
 System.out.println(e);
 System.exit(1);
 }
 try
 {
 byte buffer[] = new byte[1024];
 DatagramPacket datagramPacket = new
```

```
DatagramPacket(buffer, buffer.length);
String input;
while(true)
{
// listen for datagram packets
serverDatagramSocket.receive(datagramPacket);
input = new String(datagramPacket.getData(), 0,
datagramPacket.getLength());
System.out.println("Received from server: "+input);
// send received packet back to the client
serverDatagramSocket.send(datagramPacket);
}
}
catch(IOException e)
{
System.out.println(e);
}
}
}
```

OUTPUT:



RESULT:

Thus the for simulating RARP protocols using UDP was executed successfully.

## EX.NO:8 HALF DUPLEX CHAT USING TCP/IP

**AIM:**

To implement a chat server and client in java using TCP sockets in half duplex mode.

DESCRIPTION:

TCP Clients send requests to the server and the server will receive the request and response with
acknowledgement. Every time either a client or a server can send and receive the messages

**ALGORITHM**:

Server

1. Create a server socket and bind it to the port.
2. Listen for new connections and when a connection arrives, accept it.
3. Read Client's message and display it
4. Get a message from user and send it to client
5. Repeat steps 3-4 until the client terminates
6. Close all streams
7. Close the server and client socket
8. Stop

**Client:**

1. Create a client socket and connect it to the server’s port number
2. Get a message from user and send it to server
3. Read server's response and display it

4. Repeat steps 2-3 until chat is terminated with "exit" message
5. Close all input/output streams
6. Close the client socket
7. Stop

**PROGRAM:**

**//Server**

```
import java.io.*;
import java.net.*;

class Server_HalfDup {

   public static void main(String args[])
      throws Exception
   {

      // Create server Socket
      ServerSocket ss = new ServerSocket(888);

      // connect it to client socket
      Socket s = ss.accept();
      System.out.println("Connection established");

      // to send data to the client
      PrintStream ps
         = new PrintStream(s.getOutputStream());

      // to read data coming from the client
      BufferedReader br
```

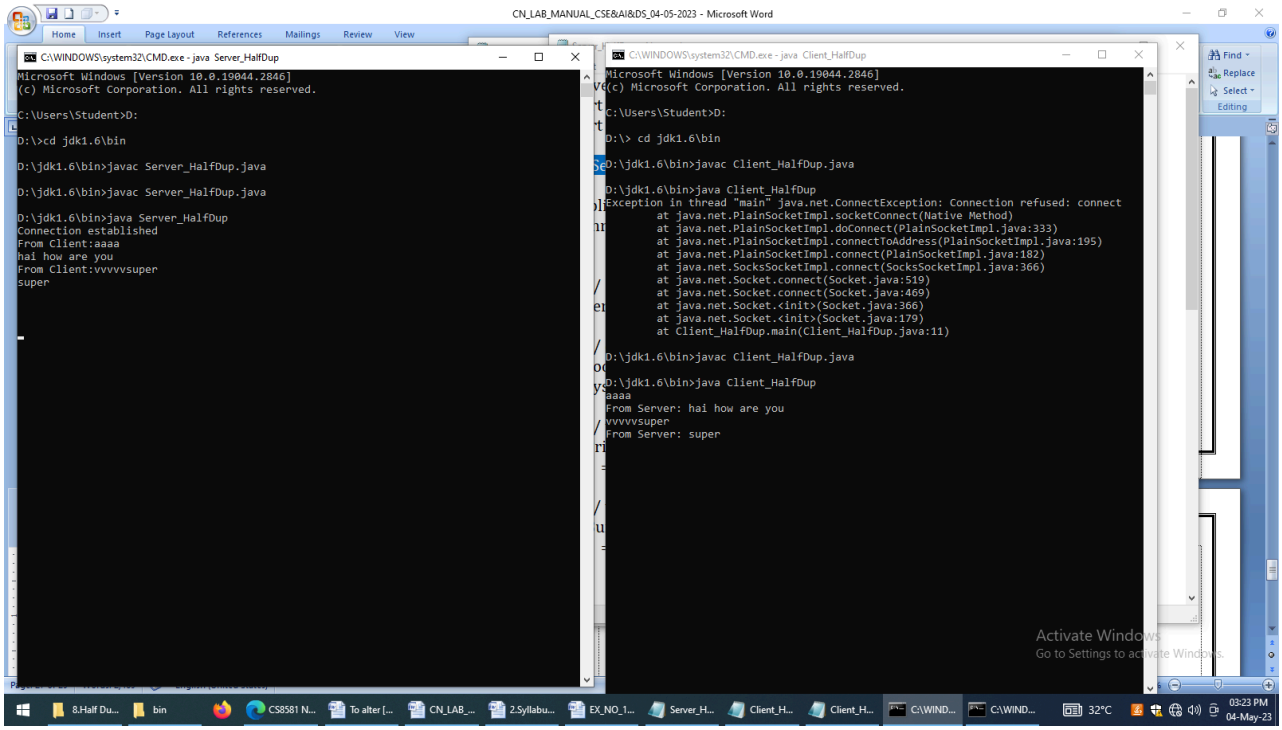
```
            = new BufferedReader(
                new InputStreamReader(
                    s.getInputStream()));

        // to read data from the keyboard
        BufferedReader kb = new BufferedReader(new
InputStreamReader(System.in));
        // server executes continuously
        while (true) {

            String str, str1;

            // repeat as long as the client
            // does not send a null string

            // read from client
            while ((str = br.readLine()) != null) {
                System.out.println("From Client:"+str);
                str1 = kb.readLine();

                // send to client
                ps.println(str1);
            }

            // close connection
            ps.close();
            br.close();
            kb.close();
            ss.close();
            s.close();

            // terminate application
            System.exit(0);

        } // end of while
    }
}
```

**//Client**

```
import java.io.*;
import java.net.*;
  class Client_HalfDup {

    public static void main(String args[])
        throws Exception
    {

        // Create client socket
        Socket s = new Socket("localhost", 888);

        // to send data to the server
        DataOutputStream dos = new DataOutputStream(s.getOutputStream());

        // to read data coming from the server
        BufferedReader br
            = new BufferedReader(
                new InputStreamReader(
                    s.getInputStream()));

        // to read data from the keyboard
        BufferedReader kb
            = new BufferedReader(
                new InputStreamReader(System.in));
        String str, str1;

        // repeat as long as exit
        // is not typed at client
        while (!(str = kb.readLine()).equals("exit"))
    {
            // send to the server
            dos.writeBytes(str + "\n");

            // receive from the server
            str1 = br.readLine();
```

```
            System.out.println("From Server: "+str1);
        }

        // close connection.
        dos.close();
        br.close();
        kb.close();
        s.close();
    }
}
```

OUTPUT:




## EX.NO 9 FULL DUPLEX CHAT USING TCP/IP

AIM:

To implement a chat server and client in java using TCP sockets in half duplex mode.

**DESCRIPTION**:

TCP Clients send requests to the server and the server will receive the request and response with

acknowledgement. Every time either a client or a server can send and receive the

messages

ALGORITHM:

Server
1. Create a server socket and bind it to the port.
2. Listen for new connections and when a connection arrives, accept it.
3. Read Client's message and display it
4. Get a message from user and send it to client
5. Repeat steps 3-4 until the client terminates
6. Close all streams
7. Close the server and client socket
8. Stop

Client
1. Create a client socket and connect it to the server's port number
2. Get a message from user and send it to server
3. Read server's response and display it
4. Repeat steps 2-3 until chat is terminated with "exit" message
5. Close all input/output streams
6. Close the client socket
7. Stop

**Server:**

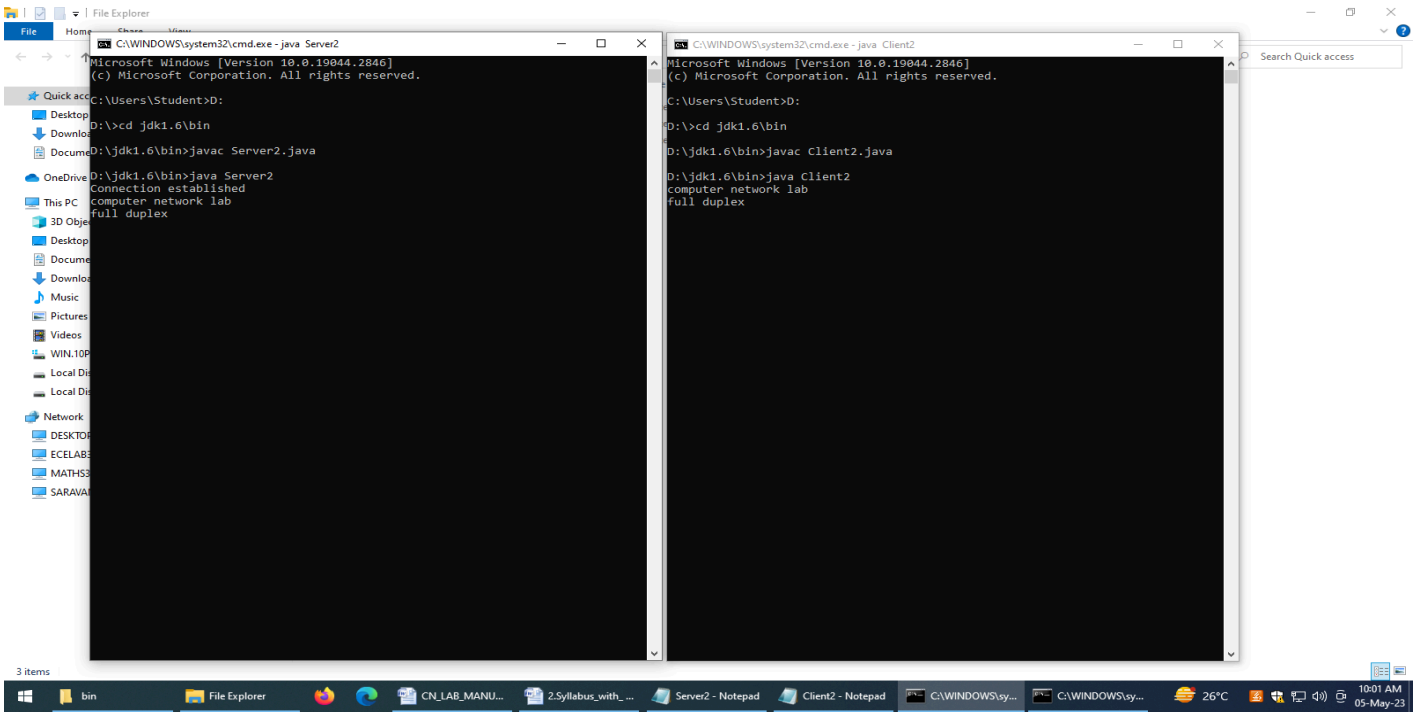
```
import java.io.*;
import java.net.*;

class Server2 {

   public static void main(String args[])
      throws Exception
   {

      // Create server Socket
      ServerSocket ss = new ServerSocket(888);
```

```
// connect it to client socket
Socket s = ss.accept();
System.out.println("Connection established");

// to send data to the client
PrintStream ps
    = new PrintStream(s.getOutputStream());

// to read data coming from the client
BufferedReader br
    = new BufferedReader(
        new InputStreamReader(
            s.getInputStream()));

// to read data from the keyboard
BufferedReader kb
    = new BufferedReader(
        new InputStreamReader(System.in));

// server executes continuously
while (true) {

    String str, str1;

    // repeat as long as the client
    // does not send a null string

    // read from client
    while ((str = br.readLine()) != null) {
        System.out.println(str);
        str1 = kb.readLine();

        // send to client
        ps.println(str1);
    }

    // close connection
    ps.close();
```

```
            br.close();
            kb.close();
            ss.close();
            s.close();

            // terminate application
            System.exit(0);

        } // end of while
    }
}

// Client2 class that
// sends data and receives also

import java.io.*;
import java.net.*;

class Client2 {

    public static void main(String args[])
        throws Exception
    {

        // Create client socket
        Socket s = new Socket("localhost", 888);

        // to send data to the server
        DataOutputStream dos
            = new DataOutputStream(
                s.getOutputStream());

        // to read data coming from the server
        BufferedReader br
            = new BufferedReader(
                new InputStreamReader(
                    s.getInputStream()));
```

```
        // to read data from the keyboard
        BufferedReader kb
           = new BufferedReader(
              new InputStreamReader(System.in));
        String str, str1;

        // repeat as long as exit
        // is not typed at client
        while (!(str = kb.readLine()).equals("exit")) {

           // send to the server
           dos.writeBytes(str + "\n");

           // receive from the server
           str1 = br.readLine();

           System.out.println(str1);
        }

        // close connection.
        dos.close();
        br.close();
        kb.close();
        s.close();
     }
}
```

OUTPUT:




RESULT:

Thus the program for Full Duplex Chat Using TCP/IP was executed successfully.

## Ex.No: 10 SIMULATION OF DISTANCE VECTOR/ LINK STATE ROUTING ALGORITHM.

**AIM**:

To simulate the Distance vector and link state routing protocols using NS2

.

**ALGORITHM**:

1. Create a Simulator object.
2. Set routing as dynamic.
3. Open the trace and nam trace files
4. Define the finish procedure.
5. Create nodes and the links between them.
6. Create the agents and attach them to the nodes
7. Create the applications and attach them to the udp agent.
8. Connect udp and null..
9. At 1 sec the link between node 1 and 2 is broken

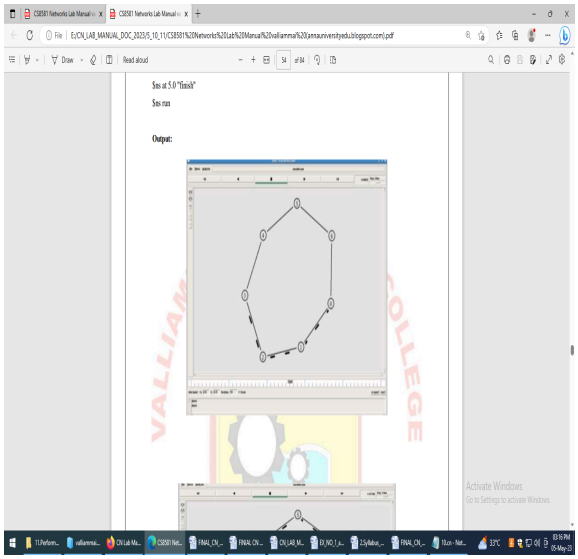
. 10. At 2 sec the link is up again.
11.Run the simulation.

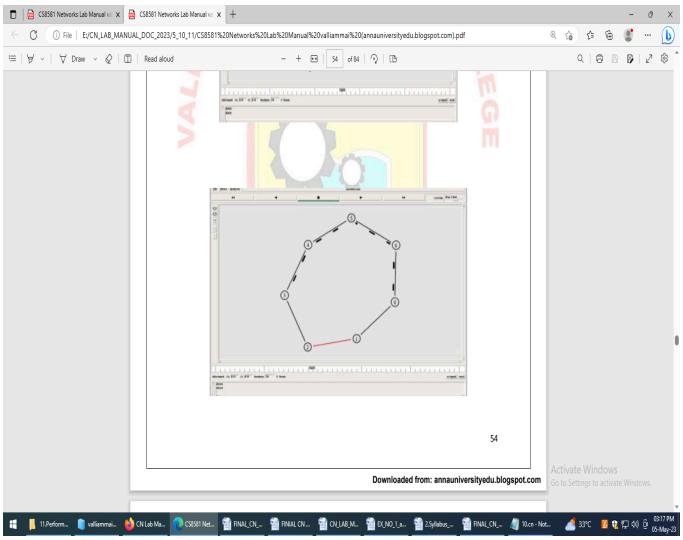
LINK STATE ROUTING PROTOCOL

**PROGRAM**

```
set ns [new Simulator]
$ns rtproto LS
set nf [open linkstate.nam w]
$ns namtrace-all $nf
set f0 [open linkstate.tr w]
$ns trace-all $f0
proc finish {} {
global ns f0 nf
$ns flush-trace
close $f0
close $nf
exec nam linkstate.nam &
exit 0
}
for {set i 0} {$i <7} {incr i} {
set n($i) [$ns node]
}
for {set i 0} {$i <7} {incr i} {
$ns duplex-link $n($i) $n([expr ($i+1)%7]) 1Mb 10ms DropTail
}
set udp0 [new Agent/UDP]
$ns attach-agent $n(0) $udp0
set cbr0 [new Application/Traffic/CBR]
$cbr0 set packetSize_ 500
$cbr0 set interval_ 0.005
$cbr0 attach-agent $udp0
set null0 [new Agent/Null]
$ns attach-agent $n(3) $null0
$ns connect $udp0 $null0
$ns at 0.5 "$cbr0 start"
$ns rtmodel-at 1.0 down $n(1) $n(2)
$ns rtmodel-at 2.0 up $n(1) $n(2)
$ns at 4.5 "$cbr0 stop"
```

$ns at 5.0 "finish"
$ns run
**OUTPUT:**




## EX.no 10(b) DISTANCE VECTOR ROUTING ALGORITHM

**ALGORITHM:**

1. Create a simulator object
2. Set routing protocol to Distance Vector routing
3. Trace packets on all links onto NAM trace and text trace file
4. Define finish procedure to close files, flush tracing and run NAM
5. Create eight node

s 6. Specify the link characteristics between nodes

7. Describe their layout topology as a octagon
8. Add UDP agent for node n1

9. Create CBR traffic on top of UDP and set traffic parameters.

10. Add a sink agent to node n4
11. Connect source and the sink
12. Schedule events as follows: a. Start traffic flow at 0.5 b. Down the link n3-n4 at 1.0 c. Up the link n3-n4 at 2.0 d. Stop traffic at 3.0 e. Call finish procedure at 5.0
13. Start the scheduler
14. Observe the traffic route when link is up and down
15. View the simulated events and trace file analyze it.

16.stop.

**PROGRAM:**

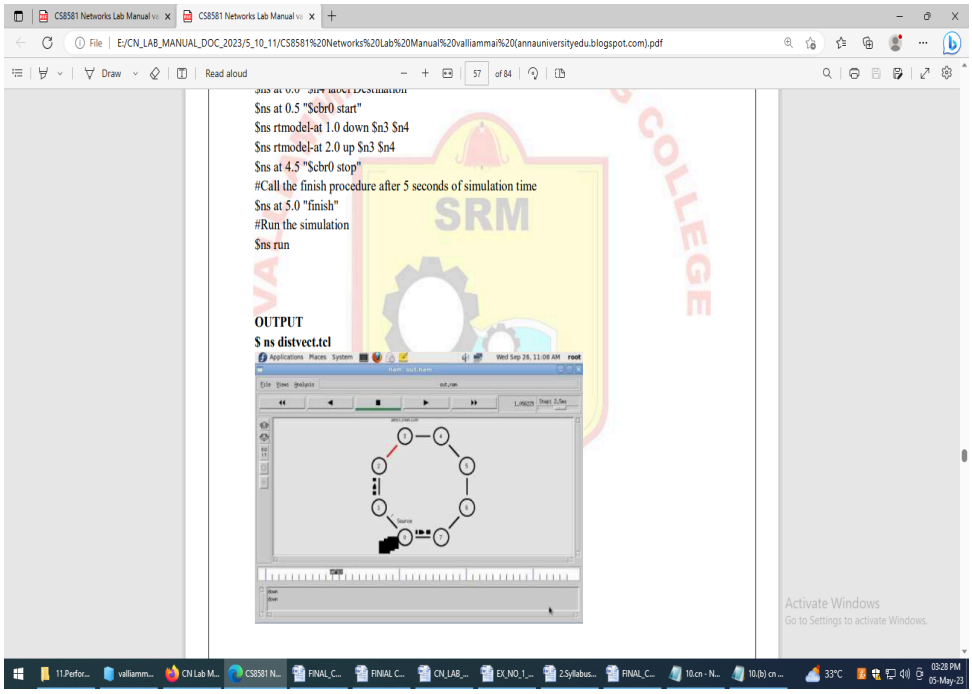
```
#Distance vector routing protocol – distvect.tcl
#Create a simulator object
set ns [new Simulator]
#Use distance vector routing
$ns rtproto DV
#Open the nam trace file
set nf [open out.nam w]
$ns namtrace-all $nf
# Open tracefile
set nt [open trace.tr w]
$ns trace-all $nt
#Define 'finish' procedure
```

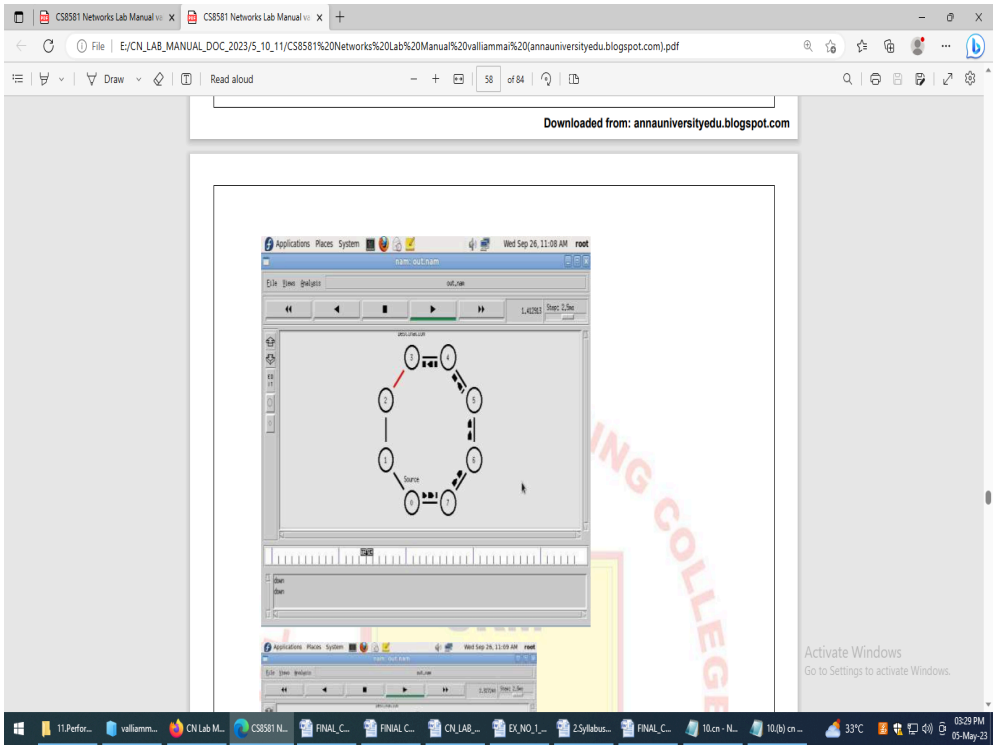

```
proc finish {}
{
global ns nf
$ns flush-trace
#Close the trace file
close $nf
#Execute nam on the trace file
exec nam -a out.nam &
exit 0
}
# Create 8 nodes
set n1 [$ns node]
set n2 [$ns node]
set n3 [$ns node]
set n4 [$ns node]
set n5 [$ns node]
set n6 [$ns node]
set n7 [$ns node]
set n8 [$ns node]
# Specify link characterestics
```

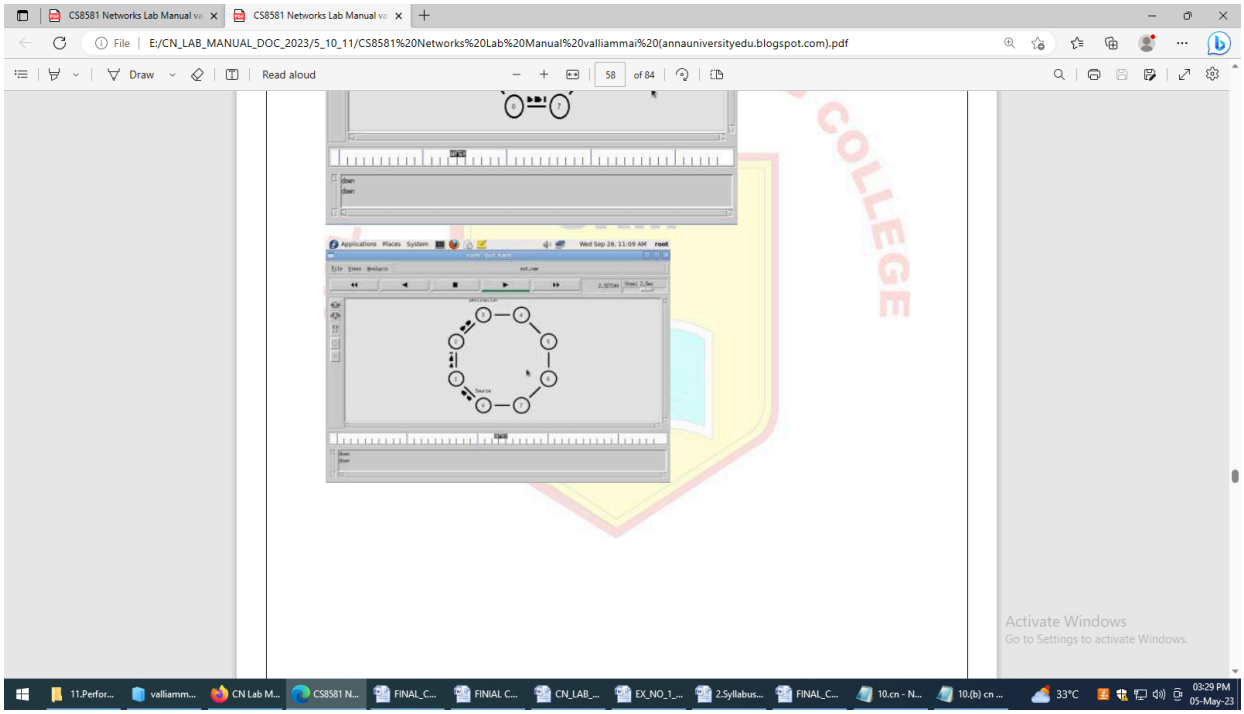
```
$ns duplex-link $n1 $n2 1Mb 10ms DropTail
$ns duplex-link $n2 $n3 1Mb 10ms DropTail
$ns duplex-link $n3 $n4 1Mb 10ms DropTail
$ns duplex-link $n4 $n5 1Mb 10ms DropTail
$ns duplex-link $n5 $n6 1Mb 10ms DropTail
$ns duplex-link $n6 $n7 1Mb 10ms DropTail
$ns duplex-link $n7 $n8 1Mb 10ms DropTail
$ns duplex-link $n8 $n1 1Mb 10ms DropTail
# specify layout as a octagon
$ns duplex-link-op $n1 $n2 orient left-up
$ns duplex-link-op $n2 $n3 orient up
$ns duplex-link-op $n3 $n4 orient right-up
$ns duplex-link-op $n4 $n5 orient right
$ns duplex-link-op $n5 $n6 orient right-down
$ns duplex-link-op $n6 $n7 orient down
$ns duplex-link-op $n7 $n8 orient left-down
$ns duplex-link-op $n8 $n1 orient left
#Create a UDP agent and attach it to node n1
set udp0 [new Agent/UDP]
$ns attach-agent $n1 $udp0
#Create a CBR traffic source and attach it to udp0
set cbr0 [new Application/Traffic/CBR]
$cbr0 set packetSize_ 500
$cbr0 set interval_ 0.005
$cbr0 attach-agent $udp0
#Create a Null agent (a traffic sink) and attach it to node n4
set null0 [new Agent/Null]
$ns attach-agent $n4 $null0
#Connect the traffic source with the traffic sink
$ns connect $udp0 $null0
#Schedule events for the CBR agent and the network dynamics
$ns at 0.0 "$n1 label Source"
$ns at 0.0 "$n4 label Destination"
$ns at 0.5 "$cbr0 start"
$ns rtmodel-at 1.0 down $n3 $n4
$ns rtmodel-at 2.0 up $n3 $n4
$ns at 4.5 "$cbr0 stop"
#Call the finish procedure after 5 seconds of simulation time
```

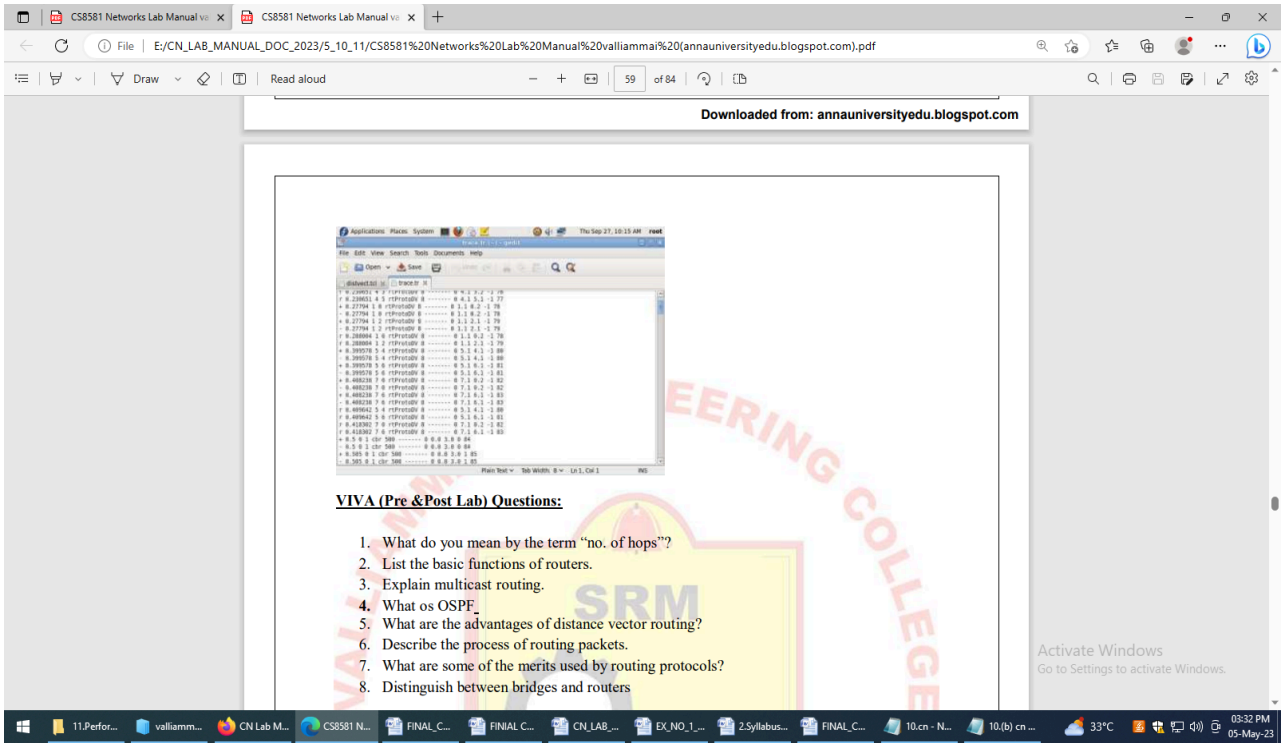
$ns at 5.0 "finish"
#Run the simulation
$ns run

**OUTPUT:**








**VIVA (Pre &Post Lab) Questions:**

1. What do you mean by the term "no. of hops"?
2. List the basic functions of routers.
3. Explain multicast routing.
4. What os OSPF
5. What are the advantages of distance vector routing?
6. Describe the process of routing packets.
7. What are some of the merits used by routing protocols?
8. Distinguish between bridges and routers

**RESULT**:

Thus the program for simulate the Distance vector and link state routing protocols using NS2 was executed successfully.

## Ex.no.11 PERFORMANCE EVALUATION OF ROUTING PROTOCOLS USING SIMULATION TOOL.

## A) UNICAST ROUTING PROTOCOL

**Aim:**

To write ans2 program for implementing unicast routing protocol.

Algorithm:

Step1:start the program.
Step2:declare the global variables ns for creating a new simulator.
Step3: set the color for packets.
Step4:open the network animator file in the name of file2in the write mode.
Step5: open the trace file in the name of file 1in the write mode.
Step6:set the unicast routing protocol to transfer the packet sin network.Step7: create the required no of nodes.
Step8: create the duplex-link between the nodes including the delay time,bandwidth and dropping
. queue mechanism.
Step 9: give the position for the links between the nodes.
Step10: seta tcp reno connection for source node.
Step11: set the destination node using tcp sink.
Step12:setup after connection over the tcp connection.
Step13:down the connection between any nodes at a particular time.
Step14: reconnect the downed connection at a particular time.
Step15:define the finish procedure.
Step16:in the definition of the finish procedure declare the global variables ns,file1,file2.
Step17: close the tracefile and namefile and execute the network animation file.
Step18:at theparticulartimecallthefinishprocedure.

Step19: stop the program.
PROGRAM:

```
setns [new Simulator]

#Definedifferent colors fordata flows (forNAM)
$nscolor1 Blue
$nscolor 2 Red

#OpentheTracefil
esetfile1[openout
.trw]
$nstrace-all$file1
```

```
#Open the NAM
trace
filesetfile2[openout
.namw]
$nsnamtrace-all$file2

#Definea'finish'proc
edureprocfinish {} {
    globalnsfile1file2
    $ns
    flush-trace
    close
    $file1close
    $file2
    execnamout.na
    m&exit 3
}

#Next line should becommented out tohavethestatic routing
$nsrtproto DV

#Create six
nodesset n0
[$ns node]set
n1 [$ns
node]set n2
[$ns node]set
n4 [$ns
node]set n4
[$ns
node]setn5
[$ns node]

#Createlinksbetweenthenodes
$nsduplex-link $n0 $n10.3Mb 10ms DropTail
$nsduplex-link $n1 $n20.3Mb 10ms DropTail
$nsduplex-link $n2 $n30.3Mb 10ms DropTail
$nsduplex-link $n1 $n40.3Mb 10ms DropTail
```

```
$nsduplex-link $n3 $n50.5Mb 10ms DropTail
$nsduplex-link $n4 $n50.5Mb 10ms DropTail

#Givenodeposition (for NAM)
$nsduplex-link-op$n0$n1orient right
$nsduplex-link-op$n1$n2orient right
$nsduplex-link-op$n2 $n3orient up
$nsduplex-link-op$n1$n4orientup-left
$nsduplex-link-op$n3$n5orientleft-up
$nsduplex-link-op$n4$n5 orientright-up


#SetupaTCPconnection
settcp[newAgent/TCP/Newreno]
$nsattach-agent$n0 $tcp
setsink[newAgent/TCPSink/DelAck]
$nsattach-agent$n5$sink
$nsconnect$tcp$sink
$tcpset fid_1
```

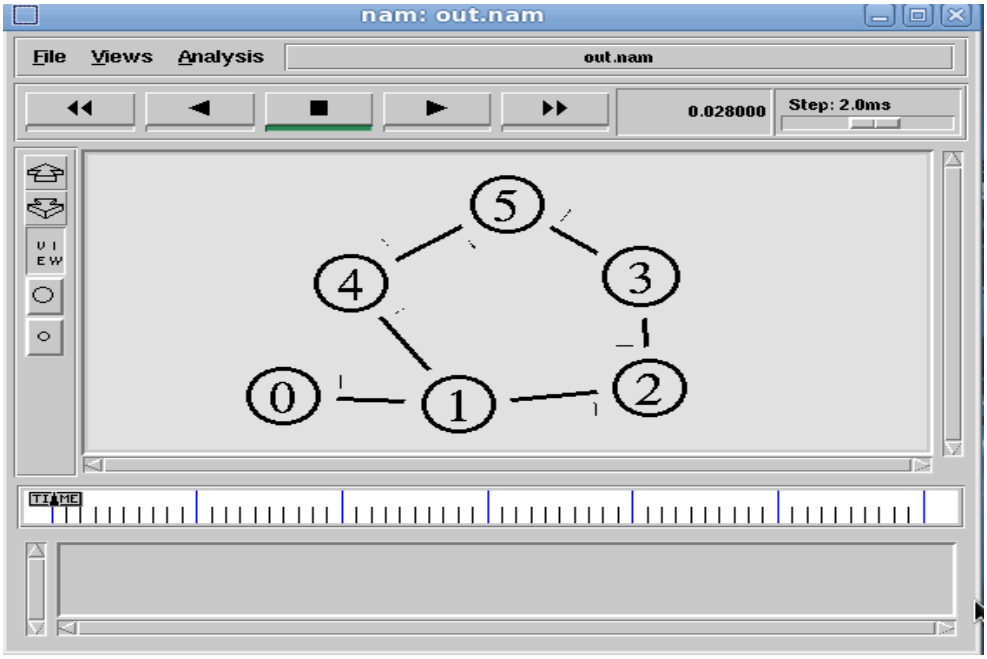
#SetupaFTPoverTCPconn
ectionsetftp
[newApplication/FTP]
$ftpattach-agent$tcp
$ftpsettype_FTP

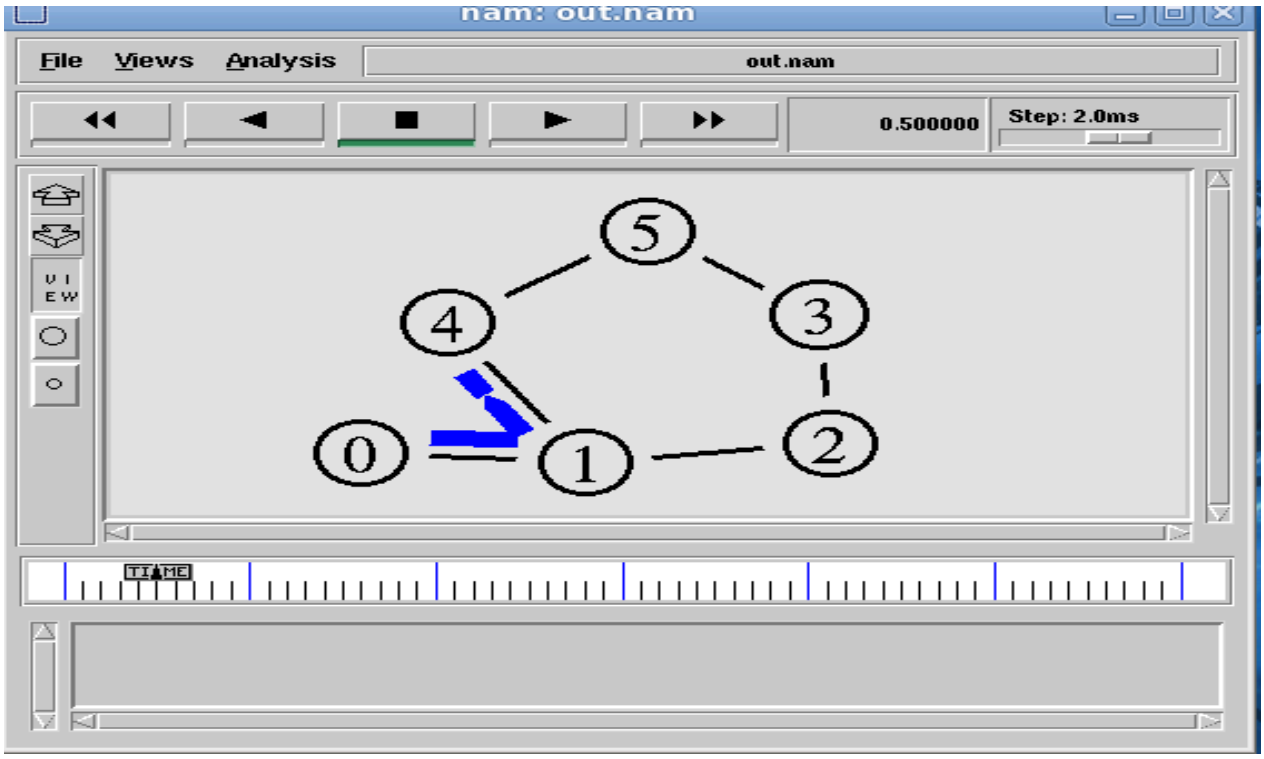
$nsrtmodel-at 1.0 down$n1 $n4
$nsrtmodel-at 4.5 up$n1 $n4

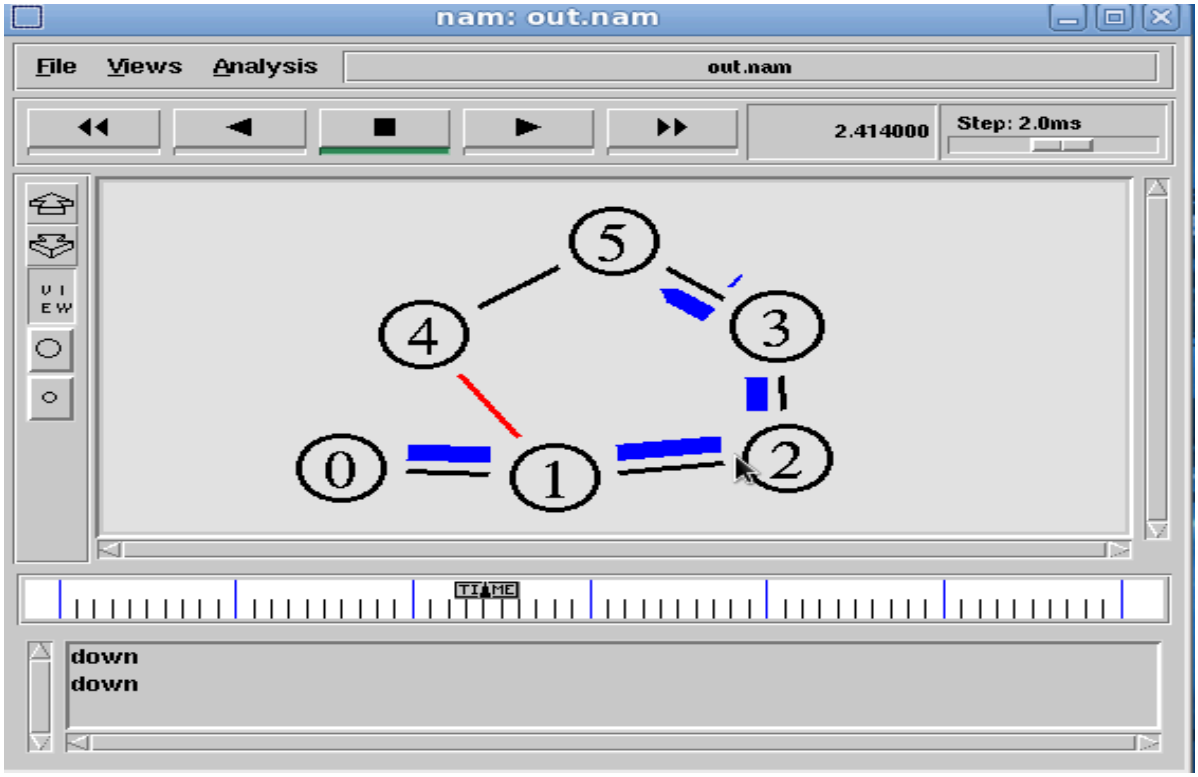
$nsat0.1"$ftp start"

$nsat 6.0 "finish"

$nsrun




nam: out.nam
File
Views
Analysis
out.nam
0.500000
Step: 2.0ms
VIEW
TIME
5
4
3
0
1
2


nam: out.nam
File
Views
Analysis
out.nam
2.414000
Step: 2.0ms
VIEW
TIME
5
4
3
0
1
2
down
down

**Ex.no.11(B).**

## MULTICASTINGROUTINGPROTOCOL

Aim:

To write ans2 program forimplementingmulticastingroutingprotocol.

Algorithm:

Step1:starttheprogram.
Step2:declarethe globalvariablesnsforcreatinganew simulator.Step3: set thecolor forpackets.
Step4:open thenetworkanimatorfileinthenameof file2in thewritemode.Step5: open the tracefilein thename of file 1in thewritemode.
Step6:set themulticast routingprotocolto transferthepacketsin network.Step7: create themulticast capable no ofnodes.
Step8: create theduplex-link between the nodes includingthe delaytime,bandwidth and dropping
. queuemechanism.
Step9: give theposition for thelinks between the nodes.

Step10:set audpconnection forsourcenode.
Step 11: set the destination node ,port and random false for the source and destination files.Step12: setup atrafficgenerator CBR forthe sourceanddestination files.
Step13: downtheconnectionbetweenanynodesat aparticular time.
Step14: createthereceiveagentfor joiningand leavingifthenodes inthegroup.Step15: definethe finish procedure.
Step 16: in the definition of the finish procedure declare the global variables.Step17: closethe tracefile andnamefileandexecute thenetworkanimationfile.Step18: at theparticular time call the finish procedure.
Step19:stoptheprogram.

Program:

```
#Createscheduler
#Create an event scheduler wit
multicast turned onsetns [new
Simulator -multicast on]

#$ns
multicast#Tu
rnonTracing
settf[open output.trw]
$nstrace-all$tf

#TurnonnamTracin
gsetfd[openmcast.n
amw]
$nsnamtrace-all$fd

#       Create
nodesset   n0
[$ns
node]set   n1
[$ns
node]set   n2
[$ns
```

```
node]set   n3
[$ns
node]set   n4
[$ns
node]set   n5
[$ns
node]set   n6
[$ns
node]setn7[
$nsnode]

#Createlinks
$nsduplex-link $n0 $n21.5Mb10ms DropTail
```

```
$nsduplex-link $n1 $n21.5Mb 10ms DropTail
$nsduplex-link $n2 $n31.5Mb 10ms DropTail
$nsduplex-link $n3 $n41.5Mb 10ms DropTail
$nsduplex-link $n3 $n71.5Mb 10ms DropTail
$nsduplex-link $n4 $n51.5Mb 10ms DropTail
$nsduplex-link $n4 $n61.5Mb 10ms DropTail

#Routingprotocol:saydistanc
evector#Protocols: CtrMcast,
DM, ST, BSTsetmproto DM
setmrthandle[$ns mrtproto $mproto{}]

# Allocate group
addressessetgroup1[
Nodeallocaddr]setgr
oup2[Nodeallocaddr
]

#UDPTransportagentforthetraffic
sourcesetudp0 [new Agent/UDP]
$nsattach-agent$n0 $udp0
$udp0set dst_addr_$group1
$udp0 set dst_port_ 0
setcbr1[newApplication/Traffic/CBR]
$cbr1attach-agent$udp0

#Transportagentforthetraffic
sourcesetudp1 [new
Agent/UDP]
$nsattach-agent$n1 $udp1
$udp1set dst_addr_$group2
$udp1set dst_port_ 0
setcbr2[newApplication/Traffic/CBR]
$cbr2attach-agent$udp1

#Createreceiver
setrcvr1[newAgent/Null]
```

$nsattach-agent$n5$rcvr1 $nsat1.0"$n5join-group$rcvr1$ group1"setrcvr2 [new Agent/Null] $nsattach-agent$n6$rcvr2 $nsat1.5"$n6join-group$rcvr2$ group1"setrcvr3 [new Agent/Null] $nsattach-agent$n7$rcvr3 $nsat2.0"$n7join-group$rcvr3$ group1"setrcvr4 [new Agent/Null] $nsattach-agent$n5$rcvr1 $nsat2.5"$n5join-group$rcvr4$ group2"setrcvr5 [new Agent/Null] $nsattach-agent$n6$rcvr2 $nsat3.0"$n6join-group$rcvr5$ group2"setrcvr6 [new Agent/Null] $nsattach-agent$n7$rcvr3

```
$nsat3.5"$n7join-group$rcvr6$group2"
$nsat4.0"$n5leave-group$rcvr1 $group1"
$nsat4.5"$n6leave-group$rcvr2 $group1"
$nsat5.0"$n7leave-group$rcvr3 $group1"
$nsat5.5"$n5leave-group$rcvr4 $group2"
$nsat6.0"$n6leave-group$rcvr5 $group2"
$nsat6.5"$n7leave-group$rcvr6 $group2"

#Scheduleevents
$nsat 0.5"$cbr1 start"
$nsat 9.5"$cbr1 stop"
$nsat 0.5"$cbr2 start"
$nsat 9.5"$cbr2 stop"

#post-processing
$ns    at    10.0
"finish"procfi
nish {} {

 globalnstf
  $ns
  flush-trace
  close$tf
  exec              nam
  mcast.nam  &exit
  0
}



#Fornam
#Colorsforpackets fromtwomcast groups
$nscolor10red
$nscolor 11green
$nscolor 30purple
$nscolor31 green

#Manuallayout:orderofthelinkissign
```

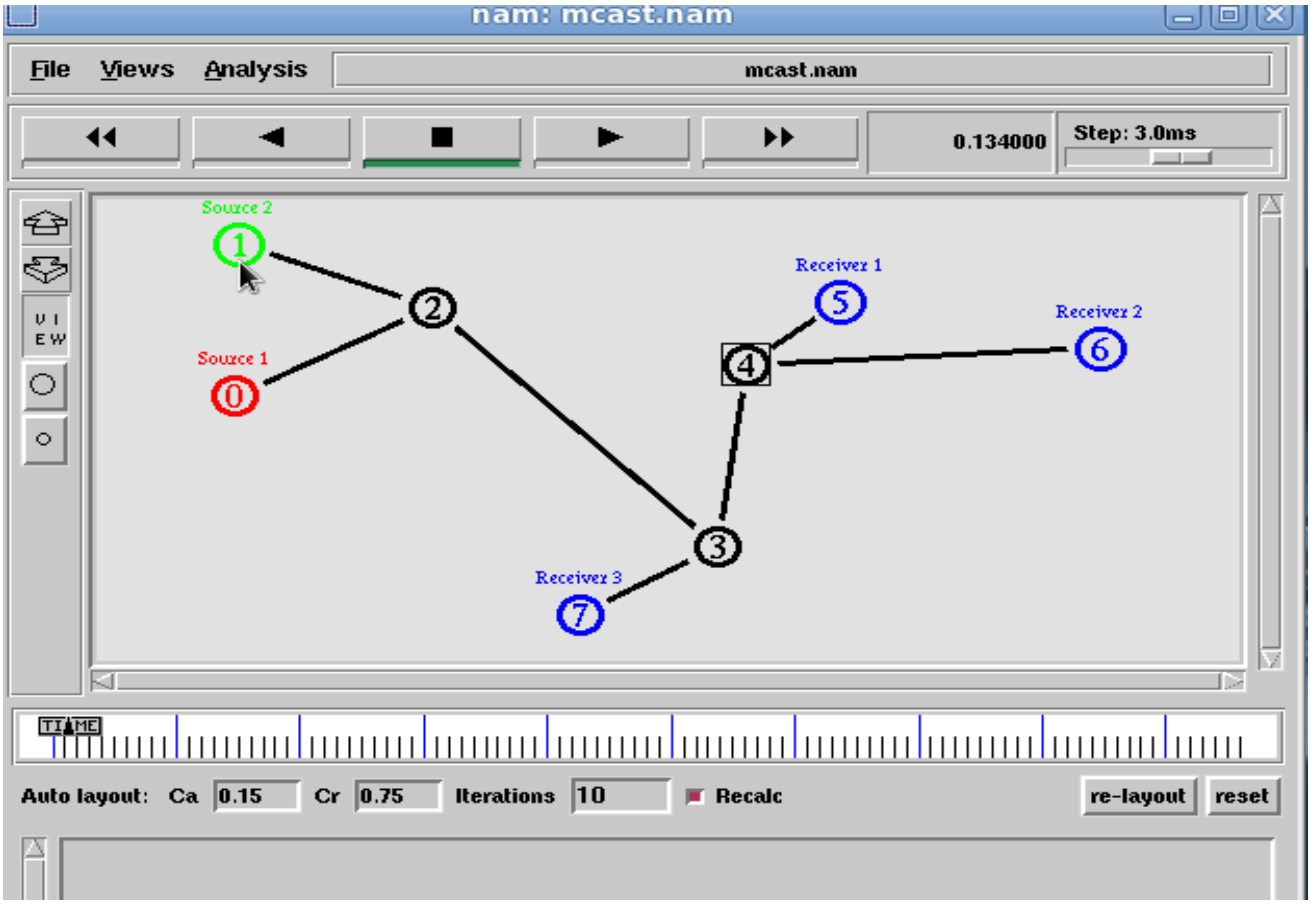
```
ificant!#$nsduplex-link-op   $n0$n1
orientright
#$ns duplex-link-op $n0 $n2 orient
right-up#$nsduplex-link-op$n0$n3
orientright-down#Show     queueon
simplexlink n0->n1
#$nsduplex-link-op $n2$n3 queuePos 0.5

#Group0 source
$udp0set fid_ 10
$n0colorred
$n0label "Source1"

#Group1 source
$udp1set fid_ 11
$n1color green
$n1label "Source2"
$n5label"Receiver1"
```

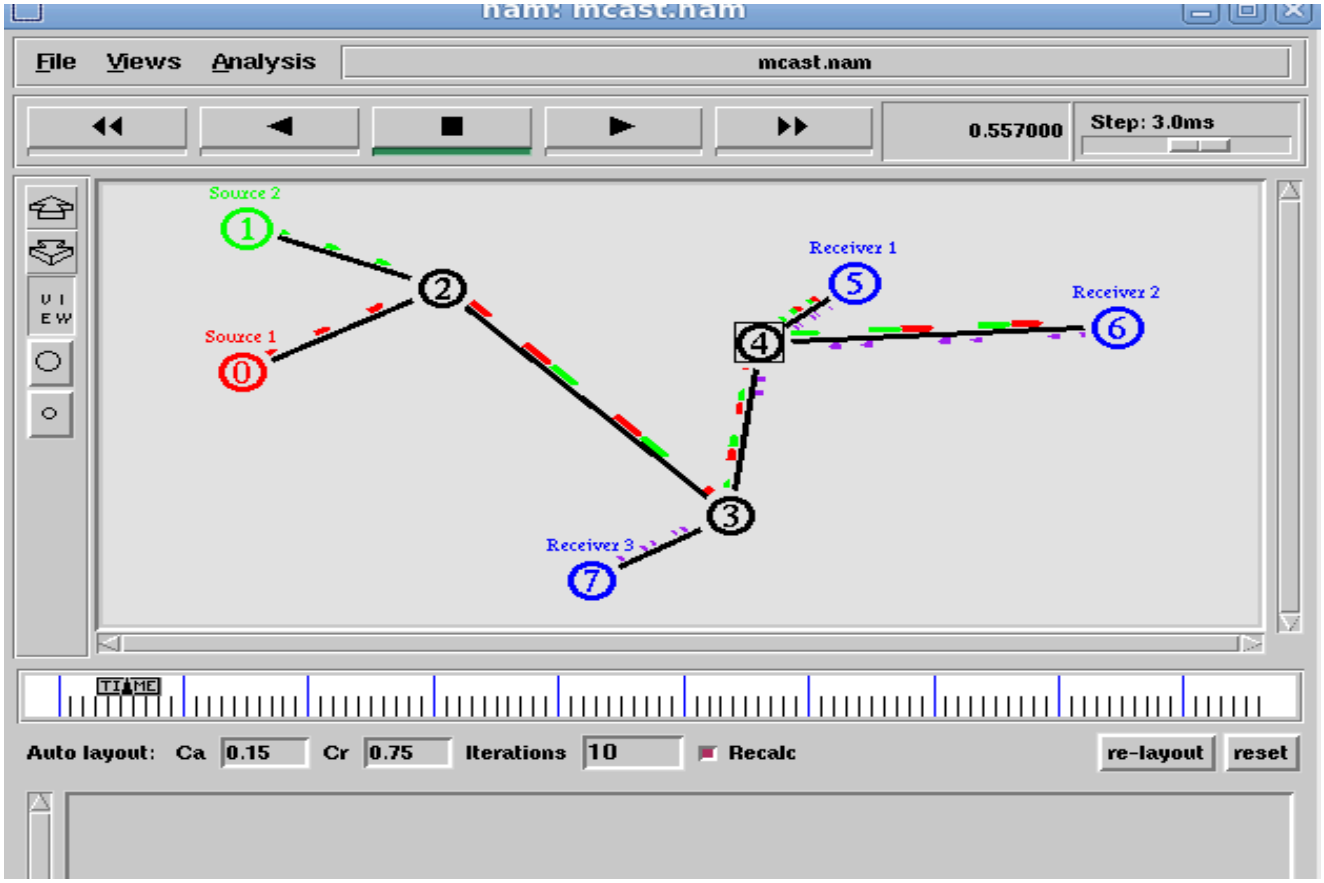
$n5color blue
$n6label"Receiver2"
$n6color blue
$n7label"Receiver3"
$n7color blue

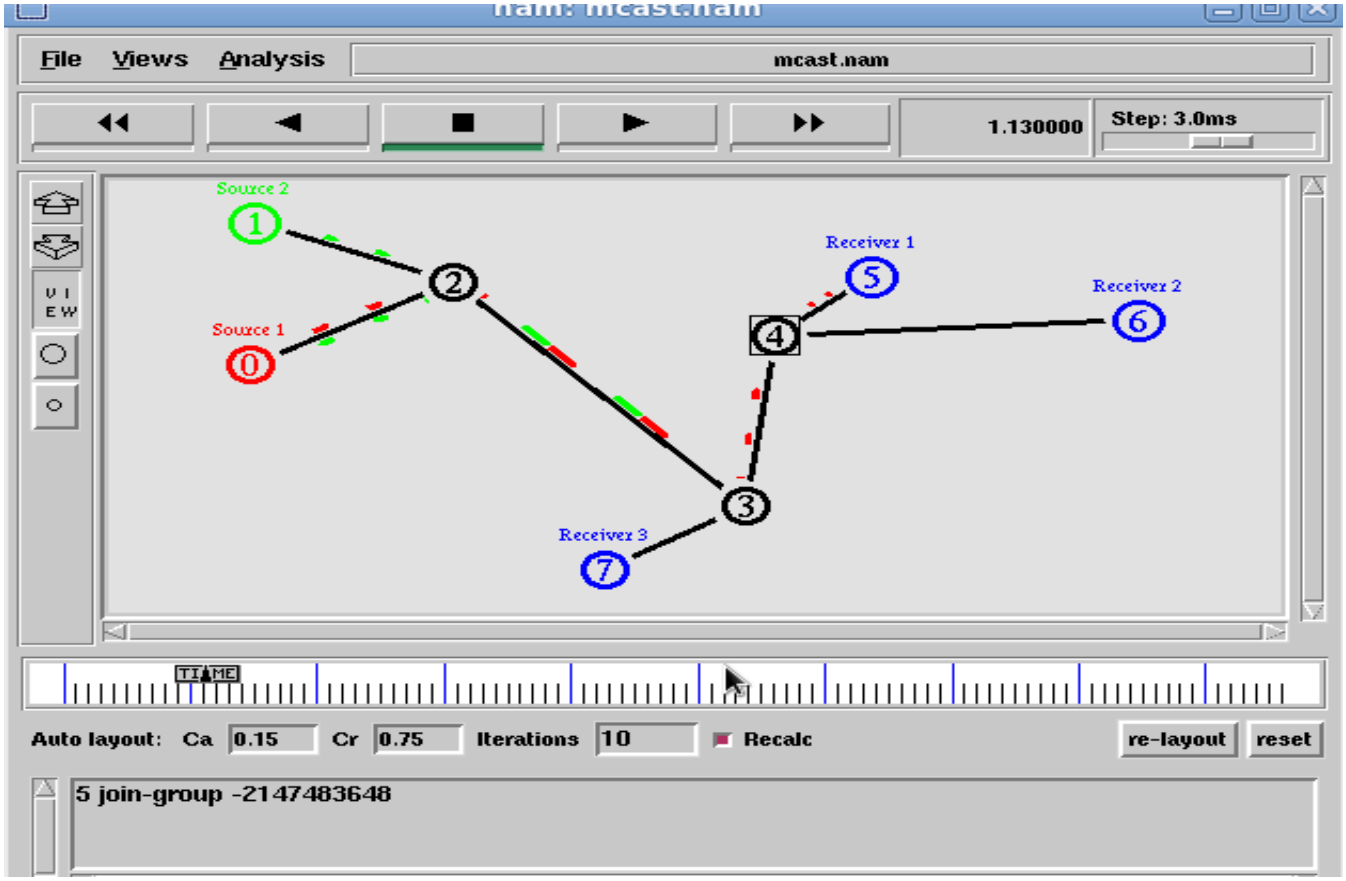
#$n2add-markm
0red#$n2delete-
markm0"

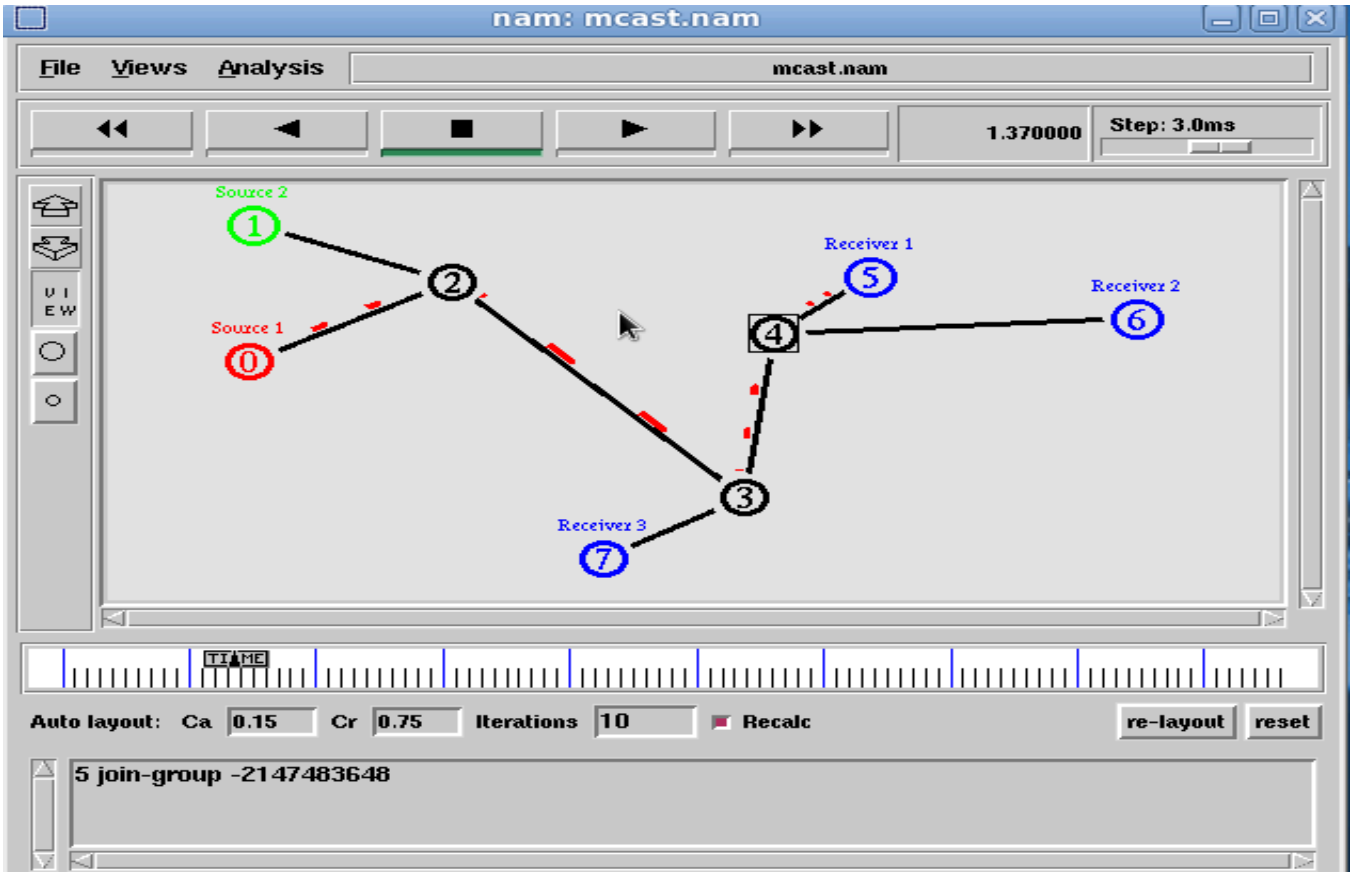
#Animationrate
$nsset-animation-rate3.0ms
$nsrun

**OUTPUT:**




nam: mcast.nam
File
Views
Analysis
mcast.nam
0.557000
Step: 3.0ms
Source 2
Source 1
Receiver 1
Receiver 2
Receiver 3
VIEW
TIME
Auto layout:
Ca
0.15
Cr
0.75
Iterations
10
Recalc
re-layout
reset


File Views Analysis
mcast.nam
1.130000
Step: 3.0ms
Source 2
Source 1
Receiver 1
Receiver 2
Receiver 3
TIME
Auto layout: Ca 0.15 Cr 0.75 Iterations 10 Recalc
re-layout
reset
5 join-group -2147483648


nam: mcast.nam
File Views Analysis
mcast.nam
1.370000
Step: 3.0ms
Source 2
Source 1
Receiver 1
Receiver 2
Receiver 3
TIME
Auto layout: Ca 0.15 Cr 0.75 Iterations 10 Recalc
re-layout
reset
5 join-group -2147483648

**RESULT:**

Thus the program for performance evaluation of routing protocols using simulation tool.

**Ex.no 12 SIMULATION OF ERROR CORRECTION CODE (LIKE CRC).**

AIM:

To implement error checking code using java.

ALGORITHM:

1. Start the Program
2. Given a bit string, append 0S to the end of it (the number of 0s is the same as the degree of the generator polynomial) let B(x) be the polynomial corresponding to B.
3. Divide B(x) by some agreed on polynomial G(x) (generator polynomial) and determine the remainder R(x). This division is to be done using Modulo 2 Division.
4. Define T(x) = B(x) –R(x)
5. (T(x)/G(x) => remainder 0)
6. Transmit T, the bit string corresponding to T(x).
7. Let T' represent the bit stream the receiver gets and T'(x) the associated polynomial. The receiver divides T1(x) by G(x). If there is a 0 remainder, the receiver concludes T = T' and no error occurred otherwise, the receiver concludes an error occurred and requires a retransmission
8. Stop the Program

**PROGRAM:**

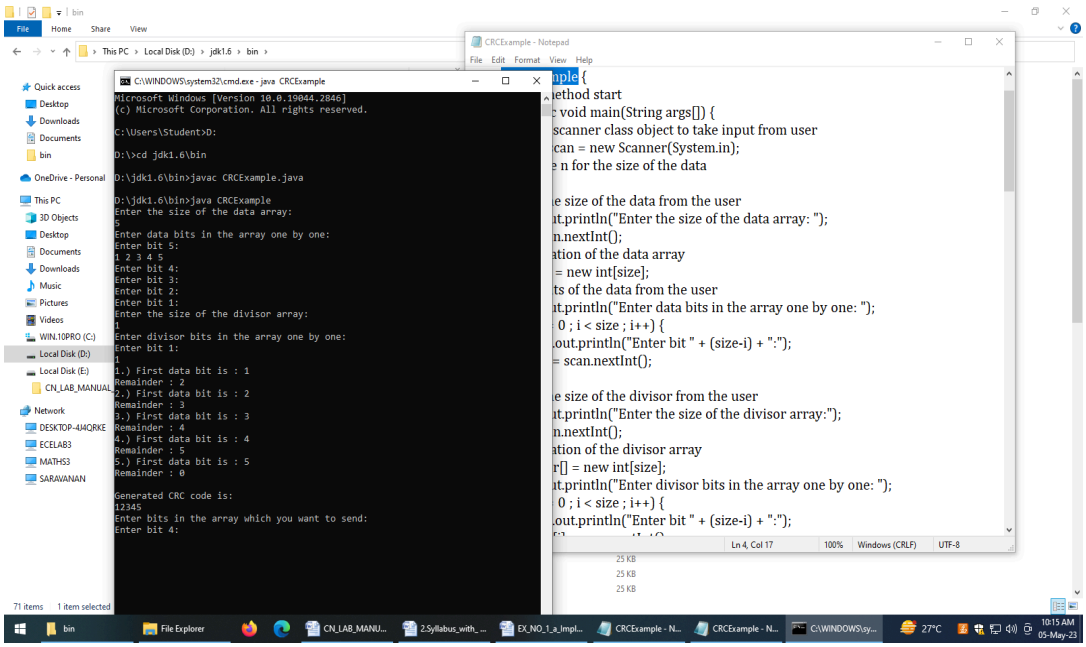
```
//package javaTpoint.MicrosoftJava;
import java.util.*;
// create CRCExample class to demonstrate the working of Cyclic Redundancy Check
  class CRCExample {
    // main() method start
```

```
public static void main(String args[]) {
    // create scanner class object to take input from user
    Scanner scan = new Scanner(System.in);
    // declare n for the size of the data
    int size;
    // take the size of the data from the user
    System.out.println("Enter the size of the data array: ");
    size = scan.nextInt();
    // declaration of the data array
    int data[] = new int[size];
    // take bits of the data from the user
    System.out.println("Enter data bits in the array one by one: ");
    for(int i = 0 ; i < size ; i++) {
        System.out.println("Enter bit " + (size-i) + ":");
        data[i] = scan.nextInt();
    }
    // take the size of the divisor from the user
    System.out.println("Enter the size of the divisor array:");
    size = scan.nextInt();
    // declaration of the divisor array
    int divisor[] = new int[size];
    System.out.println("Enter divisor bits in the array one by one: ");
    for(int i = 0 ; i < size ; i++) {
        System.out.println("Enter bit " + (size-i) + ":");
        divisor[i] = scan.nextInt();
    }
// Divide the input data by the input divisor and store the result in the rem array
    int rem[] = divideDataWithDivisor(data, divisor);
    // iterate rem using for loop to print each bit
    for(int i = 0; i < rem.length-1; i++) {
        System.out.print(rem[i]);
    }
    System.out.println("\nGenerated CRC code is: ");

    for(int i = 0; i < data.length; i++) {
        System.out.print(data[i]);
    }
```

```
        for(int i = 0; i < rem.length-1; i++) {
            System.out.print(rem[i]);
        }
        System.out.println();
        // we create a new array that contains the original data with its CRC code
        // the size of the sentData array with be equal to the sum of the data and the
rem arrays length
        int sentData[] = new int[data.length + rem.length - 1];
        System.out.println("Enter bits in the array which you want to send: ");
        for(int i = 0; i < sentData.length; i++) {
            System.out.println("Enter bit " +(sentData.length - 1)+ ":");
            sentData[i] = scan.nextInt();
        }
        receiveData(sentData, divisor);
    }
    // create divideDataWithDivisor() method to get CRC
    static int[] divideDataWithDivisor(int oldData[], int divisor[]) {
        // declare rem[] array
        int rem[] = new int[divisor.length];
        int i;
        int data[] = new int[oldData.length + divisor.length];
    // use system's arraycopy() method for copying data into rem and data arrays
        System.arraycopy(oldData, 0, data, 0, oldData.length);
        System.arraycopy(data, 0, rem, 0, divisor.length);
        // iterate the oldData and exor the bits of the remainder and the divisor
        for(i = 0; i < oldData.length; i++) {
            System.out.println((i+1) + ".) First data bit is : "+ rem[0]);
            System.out.print("Remainder : ");
            if(rem[0] == 1) {
                // We have to exor the remainder bits with divisor bits
                for(int j = 1; j < divisor.length; j++) {
                    rem[j-1] = exorOperation(rem[j], divisor[j]);
                    System.out.print(rem[j-1]);
                }
            }
            else {
                // We have to exor the remainder bits with 0
```

```
            for(int j = 1; j < divisor.length; j++) {
                rem[j-1] = exorOperation(rem[j], 0);
                System.out.print(rem[j-1]);
            }
        }
        // The last bit of the remainder will be taken from the data
        // This is the 'carry' taken from the dividend after every step
        // of division
        rem[divisor.length-1] = data[i+divisor.length];
        System.out.println(rem[divisor.length-1]);
    }
    return rem;
}
// create exorOperation() method to perform exor data
static int exorOperation(int x, int y) {
    // This simple function returns the exor of two bits
    if(x == y) {
        return 0;
    }
    return 1;
}
// method to print received data
static void receiveData(int data[], int divisor[]) {

    int rem[] = divideDataWithDivisor(data, divisor);
    // Division is done
    for(int i = 0; i < rem.length; i++) {
        if(rem[i] != 0) {
            // if the remainder is not equal to zero, data is currupted
            System.out.println("Currupted data received...");
            return;
        }
    }
    System.out.println("Data received without any error.");
}
}
```

OUTPUT:




RESULT:

Thus the program for Simulation of error correction code (like CRC) was executed successfully.