# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

**"Jnana Sangama", BELGAUM – 590 014**
**KARNATAKA**

## LABORATORY REPORT ON

# NETWORKS LABORATORY

in

## Computer Science and Engineering

# NETWORKS LABORATORY

**Sub Code : CSL77**

**Note : Student is required to solve one problem from PART-A and one problem from PART-B. Both the parts have equal weightage.**

## PART A – Simulation Exercises

***The following experiments shall be conducted using either NS228/OPNET or any other simulators.***

1. Simulate a three nodes point-to-point network with duplex links between them. Set the queue size vary the bandwidth and find the number of packets dropped.
2. Simulate a four node point-to-point network, and connect the links as follows: n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets by TCP/UDP.
3. Simulate the different types of Internet traffic such as FTP a TELNET over a network and analyze the throughput.
4. Simulate the transmission of ping messaged over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
5. Simulate an Ethernet LAN using N-nodes(6-10), change error rate and data rate and compare the throughput.
6. Simulate an Ethernet LAN using N nodes and set multiple traffic nodes and determine collision across different nodes.
7. Simulate an Ethernet LAN using N nodes and set multiple traffic nodes and plot congestion window for different source/destination.
8. Simulate simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.

## PART B

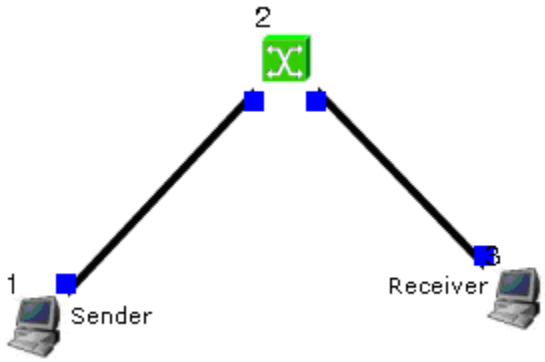
***The following experiments shall be conducted using C/C++.***

1. Write a program for error detecting code using CRC-CCITT (16-bits).
2. Write a program for frame sorting technique used in buffers.
3. Write a program for distance vector algorithm to find suitable path for transmission.
4. Using TCP/IP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.
5. Implement the above program using as message queues or FIFOs as IPC channels.
6. Write a program for simple RSA algorithm to encrypt and decrypt the data.
7. Write a program for Hamming Code generation for error detection and correction.
8. Write a program for congestion control using Leaky bucket algorithm.

# PART A Programs

1. Simulate a three-node point-to-point network with a duplex link between them. Set the queue size and vary the bandwidth and find the number of packets dropped.

Topology:-




Sender:-

stcp –p 2000 –l 1024 1.0.1.2

Receiver:-

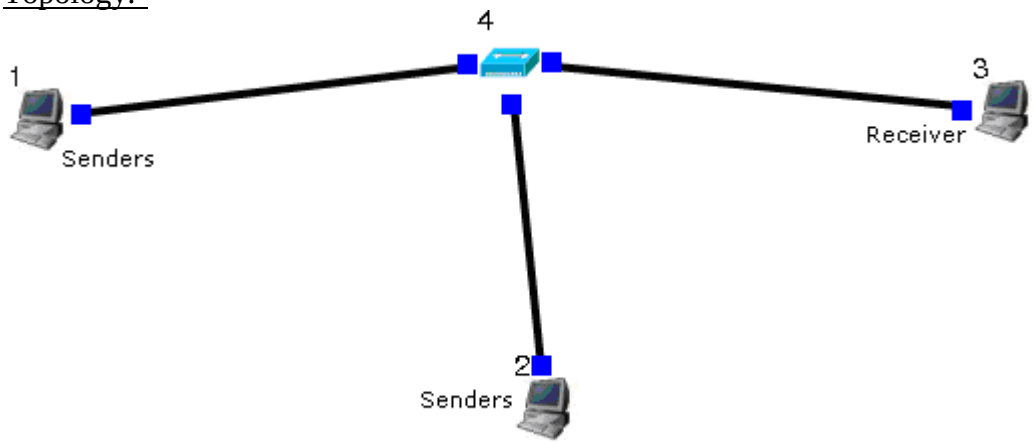
rtcp –p 2000 –l 1024

Parameters:-

Drop Packets and Collision Packets.

2. Simulate a four-node point-to-point network and connect the link as follows: Apply a TCP agent between n0 to n3 and apply a UDP agent between n1 and n3. Apply relevant applications over TCP and UDP agents changing the parameters and determine the number of packets sent by two agents.

Topology:-




Sender:-

stcp –p 3000 –l 1024 1.0.1.3
stg –u 1024 1.0.1.3

Receiver:-

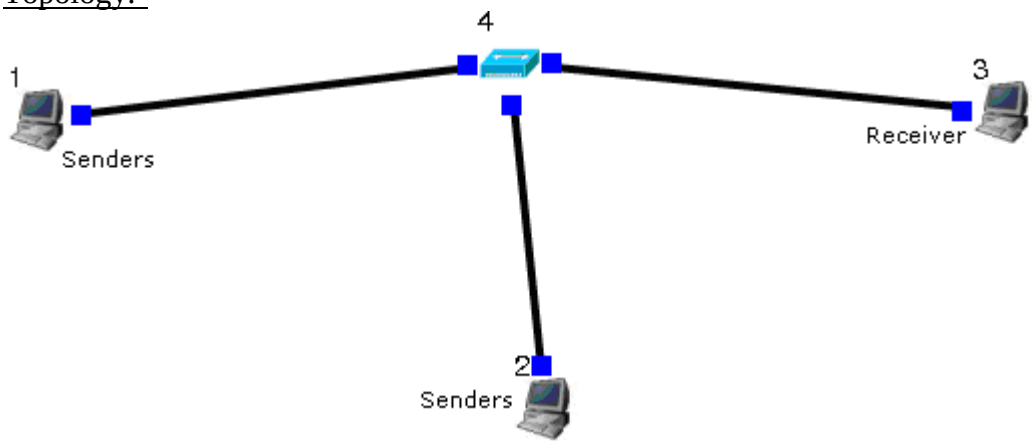
rtcp –p 3000 –l 1024
rtg –u 3000

Parameters:-

Throughput of incoming and outgoing Packets

3. Simulate the different types of Internet traffic such as FTP, TELNET over a network and analyze the throughput.

Topology:-




Sender:-

For FTP

stcp –p 21 –l 1024 1.0.1.3

For Telnet

stcp –p 23 –l 1024 1.0.1.3

Receiver:-

For FTP

rtcp –p 21 –l 1024

For Telnet

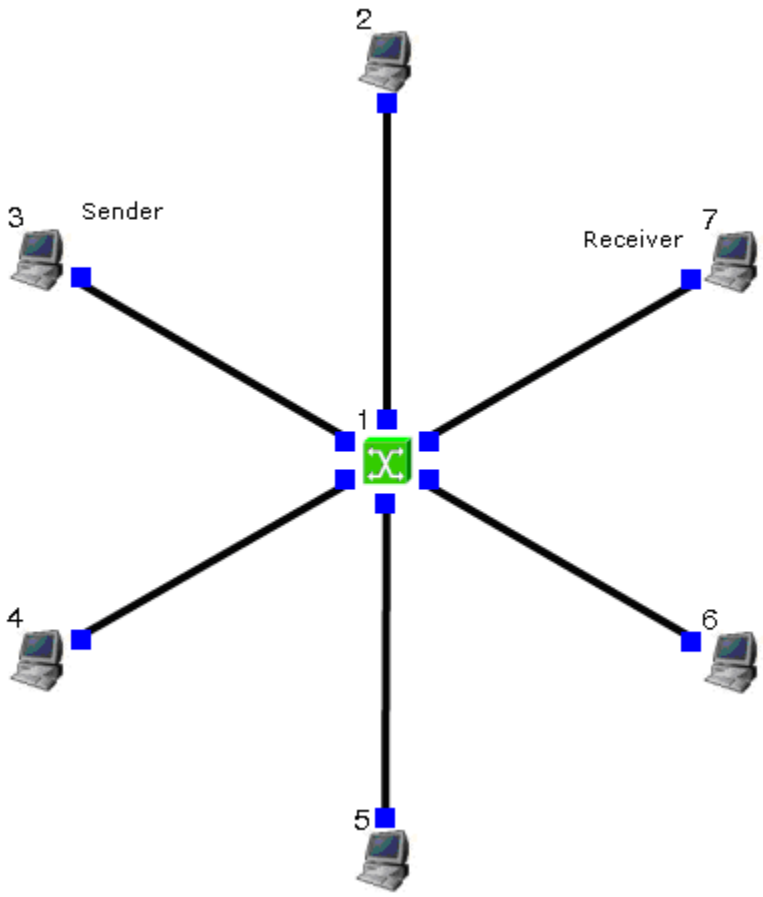
rtcp –p 23 –l 1024

Parameters:-

Throughput of incoming and outgoing Packets

4. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.

Topology:-




Sender:-

stcp –p 2000 –l 1024 1.0.1.4

Receiver:-

rtcp –p 2000 –l 1024

Command Console:-

Goto tools-> simulation time and change Simulation time to 100. During run mode, double click host 2 and then click command console. And execute the following command.

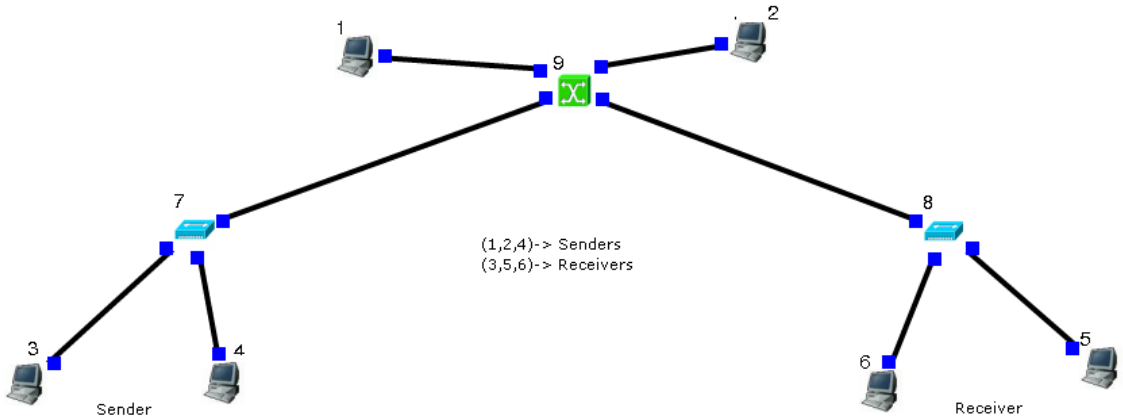
ping 1.0.1.4

Parameters:-

Drop Packets and Collision Packets.

5. Simulate an Ethernet LAN using N nodes (6-10), change error rate and data rate and compare throughput.

Topology:-




Sender:-

stcp –p 2000 –l 1024 1.0.1.4

Receiver:-

rtcp –p 2000 –l 1024

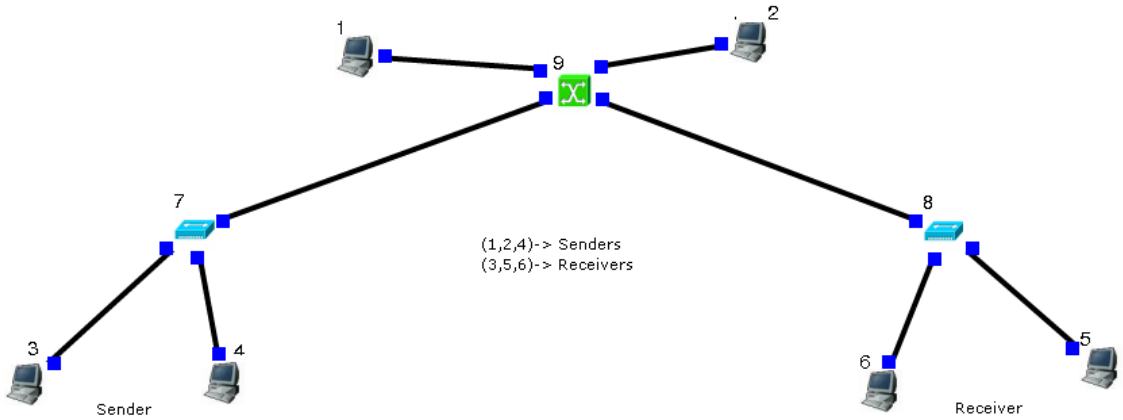
Double click on receiver link and change BER to 0.000001, Run Again.

Parameters:-

Throughput of outgoing Packets

6. Simulate an Ethernet LAN using N nodes and set multiple traffic nodes and determine collisions across different nodes.

Topology:-




Sender:-

stcp –p 2000 –l 1024 1.0.1.4

Receiver:-

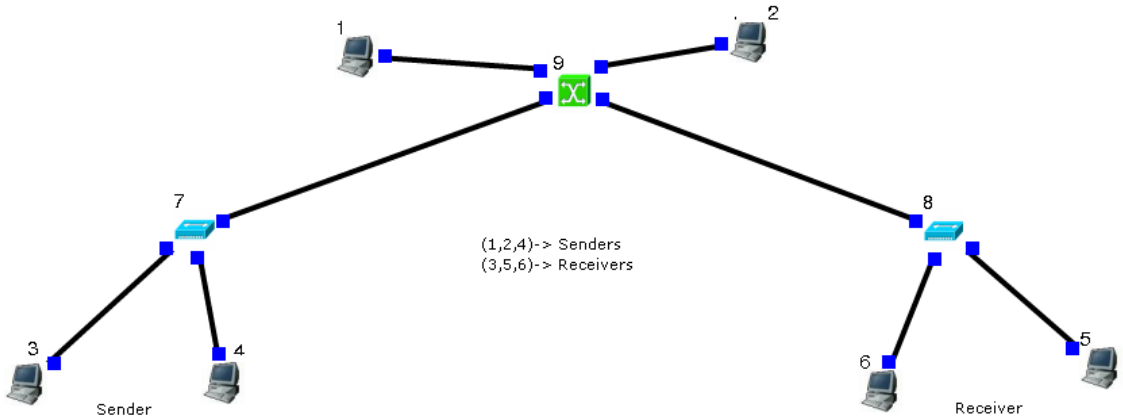
rtcp –p 2000 –l 1024

Parameters:-

Collision Packets and Drop Packets (Optional)

7. Simulate an Ethernet LAN using N nodes and set multiple traffic nodes and plot congestion window for different source/destination.

Topology:-




Sender:-

stcp –p 2000 –l 1024 1.0.1.4

Receiver:-

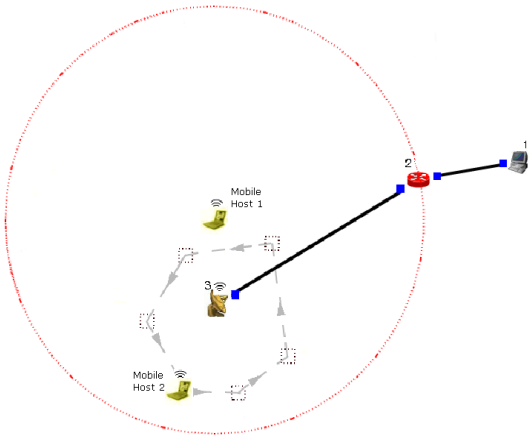
rtcp –p 2000 –l 1024

Parameters:-

Receiver side Collision Packets and Drop Packets

8. Simulate simple BSS and with transmitting nodes in wireless LAN by simulation and determine the performance with respect to transmission of packets.

Topology:-




Click on “access point”. Goto wireless interface and tick on “show transmission range and then click OK.

Double click on Router -> Node Editor and then
Left stack -> throughput of Incoming packets
Right stack -> throughput of Outgoing packets

Select mobile hosts and access points then click on.
Tools -> WLAN mobile nodes-> WLAN Generate infrastructure.
Subnet ID: Port number of router (2)
Gateway ID: IP address of router

Mobile Host 1
ttcp –t –u –s –p 3000 1.0.1.1

Mobile Host 1
ttcp –t –u –s –p 3001 1.0.1.1

Host(Receiver)
ttcp –r –u –s –p 3000
ttcp –r –u –s –p 3001

Run and then play to plot the graph.

# Part B Programs

## Experiment No 1
## CRC

### Problem Statement
Write a program for error detecting code using CRC-CCITT (16-bits).

### Theory
It does error checking via polynomial division. In general, a bit string

$$b_{n-1}b_{n-2}b_{n-3}\ldots b_2b_1b_0$$

As

$$b_{n-1}X^{n-1} + b_{n-2}X^{n-2} + b_{n-3}X^{n-3} + \ldots b_2X^2 + b_1X^1 + b_0$$

Ex: -

10010101110

As

$$X^{10} + X^7 + X^5 + X^3 + X^2 + X^1$$

All computations are done in modulo 2

### Algorithm:-
1. Given a bit string, append $0^S$ to the end of it (the number of $0^s$ is the same as the degree of the generator polynomial) let B(x) be the polynomial corresponding to B.
2. 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.
3. Define T(x) = B(x) –R(x)

   (T(x)/G(x) => remainder 0)

4. Transmit T, the bit string corresponding to T(x).
5. Let T' represent the bit stream the receiver gets and T'(x) the associated polynomial. The receiver divides $T^1(x)$ 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.

### Program

```
#include<stdio.h>
#include<string.h>
#include<conio.h>
#define N strlen(g)

char t[128], cs[128], g[]="10001000000100001";
int a, e, c;

void xor() {
  for(c=1;c<N;c++) cs[c]=((cs[c]==g[c])?'0':'1');
}

void crc() {
  for(e=0;e<N;e++) cs[e]=t[e];
  do {
    if(cs[0]=='1') xor();
    for(c=0;c<N-1;c++) cs[c]=cs[c+1];
    cs[c]=t[e++];
  }while(e<=a+N-1);
}
```

```
void main() {
  clrscr();
  printf("\nEnter poly : "); scanf("%s",t);
  printf("\nGenerating Polynomial is : %s",g);
  a=strlen(t);
  for(e=a;e<a+N-1;e++) t[e]='0';
  printf("\nModified t[u] is :  %s",t);
  crc();
  printf("\nChecksum is : %s",cs);
  for(e=a;e<a+N-1;e++) t[e]=cs[e-a];
  printf("\nFinal Codeword is : %s",t);
  printf("\nTest Error detection 0(yes) 1(no) ? : ");
  scanf("%d",&e);
  if(e==0) {
    printf("Enter position where error is to inserted : ");
    scanf("%d",&e);
    t[e]=(t[e]=='0')?'1':'0';
    printf("Errorneous data   : %s\n",t);
  }
  crc();
  for (e=0;(e<N-1)&&(cs[e]!='1');e++);
  if(e<N-1) printf("Error detected.");
  else printf("No Error Detected.");
  getch();
}
```

## Output

```
Enter poly : 1011101
Generating Polynomial is : 10001000000100001
Modified t[u] is :  10111010000000000000000
Checksum is : 1000101101011000
Final Codeword is : 10111011000101101011000
Test Error detection 0(yes) 1(no) ? : 0
Enter position where you want to insert error : 3
Errorneous data   : 1010101110001011010110000
Error detected.

Enter poly : 1011101
Generating Polynomial is : 10001000000100001
Modified t[u] is :  10111010000000000000000
Checksum is : 1000101101011000
Final Codeword is : 10111011000101101011000
Test Error detection 0(yes) 1(no) ? : 1
No Error Detected.
```

## Experiment No 2

# Frame Sorting

### Problem Statement

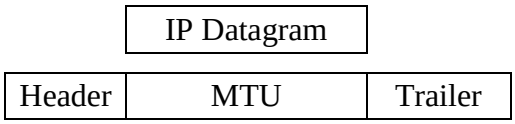
Write a program for frame sorting technique used in buffers.

### Theory

The data link layer divides the stream of bits received from the network layer into manageable data units called frames.

If frames are to be distributed to different systems on the network, the Data link layer adds a header to the frame to define the sender and/or receiver of the frame.

Each Data link layer has its own frame format. One of the fields defined in the format is the maximum size of the data field. In other words, when datagram is encapsulated in a frame, the total size of the datagram must be less than this maximum size, which is defined by restriction imposed by the hardware and software used in the network.




The value of MTU differs from one physical network to another

In order to make IP protocol portable/independent of the physical network, the packagers decided to make the maximum length of the IP datagram equal to the largest Maximum Transfer Unit (MTU) defined so far. However for other physical networks we must divide the datagrams to make it possible to pass through these networks. This is called fragmentation.

When a datagram is fragmented, each fragmented has its own header. A fragmented datagram may itself be fragmented if it encounters a network with an even smaller MTU. In another words, a datagram may be fragmented several times before it reached the final destination and also, the datagrams referred to as (frames in Data link layer) may arrives out of order at destination. Hence sorting of frames need to be done at the destination to recover the original data.

### Program

```
#include <stdlib.h>
#include <time.h>
#include <stdio.h>
#include <conio.h>
#include <string.h>

#define FSize 3

typedef struct packet{int SeqNum; char Data[FSize+1];}packet;

struct packet *readdata, *transdata;

int divide(char *msg) {
  int msglen, NoOfPacket, i, j;
  msglen = strlen(msg);
  NoOfPacket = msglen/FSize;
  if ((msglen%FSize)!=0) NoOfPacket++;
  readdata = (struct packet *)malloc(sizeof(packet) * NoOfPacket);
  for(i = 0; i < NoOfPacket; i++) {
     readdata[i].SeqNum = i + 1;
     for (j = 0; (j < FSize) && (*msg != '\0'); j++, msg++)
         readdata[i].Data[j] = *msg;
     readdata[i].Data[j] = '\0';
  }
  printf("\nThe Message has been divided as follows\n");
  printf("\nPacket No.         Data\n\n");
  for (i = 0; i < NoOfPacket; i++)
```

```
    printf("   %2d              %s\n", readdata[i].SeqNum,
           readdata[i].Data);
  return NoOfPacket;
}

void shuffle(int NoOfPacket) {
  int *Status;
  int i, j, trans;
  randomize();
  Status=(int * )calloc(NoOfPacket, sizeof(int));
  transdata = (struct packet *)malloc(sizeof(packet) * NoOfPacket);
  for (i = 0; i < NoOfPacket;) {
     trans = rand()%NoOfPacket;
     if (Status[trans]!=1) {
         transdata[i].SeqNum = readdata[trans].SeqNum;
         strcpy(transdata[i].Data, readdata[trans].Data);
         i++;     Status[trans] = 1;
     }
  }
  free(Status);
}

void sortframes(int NoOfPacket) {
  packet temp;
  int i, j;
  for (i = 0; i < NoOfPacket; i++)
    for (j = 0; j < NoOfPacket - i-1; j++)
       if (transdata[j].SeqNum > transdata[j + 1].SeqNum) {
           temp.SeqNum = transdata[j].SeqNum;
           strcpy(temp.Data, transdata[j].Data);
           transdata[j].SeqNum = transdata[j + 1].SeqNum;
           strcpy(transdata[j].Data, transdata[j + 1].Data);
           transdata[j + 1].SeqNum = temp.SeqNum;
           strcpy(transdata[j + 1].Data, temp.Data);
       }

}

void receive(int NoOfPacket) {
  int i;
  printf("\nPackets received in the following order\n");
  for (i = 0; i < NoOfPacket; i++) printf("%4d", transdata[i].SeqNum);
  sortframes(NoOfPacket);
  printf("\n\nPackets in order after sorting..\n");
  for (i = 0; i < NoOfPacket; i++) printf("%4d", transdata[i].SeqNum);
  printf("\n\nMessage received is :\n");
  for (i = 0; i < NoOfPacket; i++) printf("%s", transdata[i].Data);
}

void main() {
  char *msg;
  int NoOfPacket;
  clrscr();
  printf("\nEnter The message to be Transmitted :\n");
  scanf("%[^\n]", msg);
  NoOfPacket = divide(msg);
  shuffle(NoOfPacket);
  receive(NoOfPacket);
  free(readdata);
  free(transdata);
  getch();
}
```

Output

```
Enter The messgae to be Transmitted :
hi, it was nice meeting u on sunday

The Message has been divided as follows
Packet No.          Data

    1               hi,
    2                it
    3                wa
    4               s n
    5               ice
    6                me
    7               eti
    8               ng
    9               u o
   10               n s
   11               und
   12               ay

Packets received in the following order
   4   2   6   3   5   1   8   9  11   7  12  10

Packets in order after sorting..
   1   2   3   4   5   6   7   8   9  10  11  12

Message received is :
hi, it was nice meeting u on sunday
```

# Experiment No 3
# Distance Vector Routing

## Problem Statement

Write a program for distance vector algorithm to find suitable path for transmission.

## Theory

Routing algorithm is a part of network layer software which is responsible for deciding which output line an incoming packet should be transmitted on. If the subnet uses datagram internally, this decision must be made anew for every arriving data packet since the best route may have changed since last time. If the subnet uses virtual circuits internally, routing decisions are made only when a new established route is being set up. The latter case is sometimes called session routing, because a rout remains in force for an entire user session (e.g., login session at a terminal or a file).

Routing algorithms can be grouped into two major classes: adaptive and nonadaptive. Nonadaptive algorithms do not base their routing decisions on measurement or estimates of current traffic and topology. Instead, the choice of route to use to get from *I* to *J* (for all *I* and *J*) is compute in advance, offline, and downloaded to the routers when the network ids booted. This procedure is sometime called static routing.

Adaptive algorithms, in contrast, change their routing decisions to reflect changes in the topology, and usually the traffic as well. Adaptive algorithms differ in where they get information (e.g., locally, from adjacent routers, or from all routers), when they change the routes (e.g., every $\Delta T$ sec, when the load changes, or when the topology changes), and what metric is used for optimization (e.g., distance, number of hops, or estimated transit time).

Two algorithms in particular, distance vector routing and link state routing are the most popular. Distance vector routing algorithms operate by having each router maintain a table (i.e., vector) giving the best known distance to each destination and which line to get there. These tables are updated by exchanging information with the neighbors.

The distance vector routing algorithm is sometimes called by other names, including the distributed Bellman-Ford routing algorithm and the Ford-Fulkerson algorithm, after the researchers who developed it (Bellman, 1957; and Ford and Fulkerson, 1962). It was the original ARPANET routing algorithm and was also used in the Internet under the RIP and in early versions of DECnet and Novell's IPX. AppleTalk and Cisco routers use improved distance vector protocols.

In distance vector routing, each router maintains a routing table indexed by, and containing one entry for, each router in subnet. This entry contains two parts: the preferred out going line to use for that destination, and an estimate of the time or distance to that destination. The metric used might be number of hops, time delay in milliseconds, total number of packets queued along the path, or something similar.

The router is assumed to know the "distance" to each of its neighbor. If the metric is hops, the distance is just one hop. If the metric is queue length, the router simply examines each queue. If the metric is delay, the router can measure it directly with special ECHO packets hat the receiver just time stamps and sends back as fast as possible.

## The Count to Infinity Problem.

Distance vector routing algorithm reacts rapidly to good news, but leisurely to bad news. Consider a router whose best route to destination *X* is large. If on the next exchange neighbor *A* suddenly reports a short delay to *X*, the router just switches over to using the line to *A* to send traffic to *X*. In one vector exchange, the good news is processed.

To see how fast good news propagates, consider the five node (linear) subnet of following figure, where the delay metric is the number of hops. Suppose A is down initially and all the other routers know this. In other words, they have all recorded the delay to A as infinity.

| A | B | C | D | E | |
|---|---|---|---|---|---|
| ∞ | ∞ | ∞ | ∞ | Initially |
| 1 | ∞ | ∞ | ∞ | After 1 exchange |
| 1 | 2 | ∞ | ∞ | After 2 exchange |
| 1 | 2 | 3 | ∞ | After 3 exchange |
| 1 | 2 | 3 | 4 | After 4 exchange |

| A | B | C | D | E | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | Initially |
| 3 | 2 | 3 | 4 | After 1 exchange |
| 3 | 3 | 3 | 4 | After 2 exchange |
| 5 | 3 | 5 | 4 | After 3 exchange |
| 5 | 6 | 5 | 6 | After 4 exchange |
| 7 | 6 | 7 | 6 | After 5 exchange |
| 7 | 8 | 7 | 8 | After 6 exchange |
| | : | | | |
| ∞ | ∞ | ∞ | ∞ | |

Many ad hoc solutions to the count to infinity problem have been proposed in the literature, each one more complicated and less useful than the one before it. The **split horizon** algorithm works the same way as distance vector routing, except that the distance to *X* is not reported on line that packets for *X* are sent on (actually, it is reported as infinity). In the initial state of right figure, for example, *C* tells *D* the truth about distance to *A* but *C* tells *B* that its distance to *A* is infinite. Similarly, *D* tells the truth to *E* but lies to *C*.

Program

```
#include <conio.h>
#include <iostream.h>

#define MAX 10
int n;

class router {
    char adj_new[MAX],   adj_old[MAX];
    int  table_new[MAX], table_old[MAX];

  public:
    router(){
      for(int i=0;i<MAX;i++) table_old[i]=table_new[i]=99;
    }

    void copy(){
      for(int i=0;i<n;i++) {
        adj_old[i]  =adj_new[i];
        table_old[i]=table_new[i];
      }
    }

    int equal() {
      for(int i=0;i<n;i++)
        if(table_old[i]!=table_new[i]||adj_new[i]!=adj_old[i])return 0;
      return 1;
    }

    void input(int j) {
      cout<<"Enter 1 if the corresponding router is adjacent to router"
          <<(char)('A'+j)<<" else enter 99: "<<endl<<"             ";
      for(int i=0;i<n;i++)
        if(i!=j) cout<<(char)('A'+i)<<" ";
      cout<<"\nEnter matrix:";
      for(i=0;i<n;i++) {
```

```
        if(i==j)
          table_new[i]=0;
        else
          cin>>table_new[i];
        adj_new[i]= (char)('A'+i);
      }
      cout<<endl;
    }

    void display(){
      cout<<"\nDestination Router: ";
      for(int i=0;i<n;i++) cout<<(char)('A'+i)<<" ";
      cout<<"\nOutgoing Line:      ";
      for(i=0;i<n;i++) cout<<adj_new[i]<<" ";
      cout<<"\nHop Count:          ";
      for(i=0;i<n;i++) cout<<table_new[i]<<" ";
    }

    void build(int j) {
      for(int i=0;i<n;i++)
        for(int k=0;(i!=j)&&(k<n);k++)
          if(table_old[i]!=99)
            if((table_new[i]+r[i].table_new[k])<table_new[k]) {
              table_new[k]=table_new[i]+r[i].table_new[k];
              adj_new[k]=(char)('A'+i);
            }
    }
} r[10];

void build_table() {
  int i=0, j=0;
  while(i!=n) {
    for(i=j;i<n;i++) {
      r[i].copy();
      r[i].build(i);
    }
    for(i=0;i<n;i++)
      if(!r[i].equal()) {
        j=i;
        break;
      }
  }
}

void main() {
  clrscr();
  cout<<"Enter the number the routers(<"<<MAX<<"): "; cin>>n;
  for(int i=0;i<n;i++) r[i].input(i);
  build_table();
  for(i=0;i<n;i++) {
    cout<<"Router Table entries for router "<<(char)('A'+i)<<":-";
    r[i].display();
    cout<<endl<<endl;
  }
  getch();
}
```

## Output

```
Enter the number the routers: 5
Enter 1 if the corresponding is adjacent to router A else enter 99:
             B C D E
Enter matrix:1 1 99 99
Enter 1 if the corresponding is adjacent to router B else enter 99:
             A C D E
```

```
Enter matrix:1 99 99 99
Enter 1 if the corresponding is adjacent to router C else enter 99:
            A B D E
Enter matrix:1 99 1 1
Enter 1 if the corresponding is adjacent to router D else enter 99:
            A B C E
Enter matrix:99 99 1 99
Enter 1 if the corresponding is adjacent to router E else enter 99:
            A B C D
Enter matrix:99 99 1 99

Router Table entries for router A
Destination Router: A B C D E
Outgoing Line:      A B C C C
Hop Count:          0 1 1 2 2
Router Table entries for router B
Destination Router: A B C D E
Outgoing Line:      A B A A A
Hop Count:          1 0 2 3 3
Router Table entries for router C
Destination Router: A B C D E
Outgoing Line:      A A C D E
Hop Count:          1 2 0 1 1
Router Table entries for router D
Destination Router: A B C D E
Outgoing Line:      C C C D C
Hop Count:          2 3 1 0 2
Router Table entries for router E
Destination Router: A B C D E
Outgoing Line:      C C C C E
Hop Count:          2 3 1 2 0
```

# Experiment No 4
# TCP Socket

## Problem Statement

Using TCP/IP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.

## Algorithm (Client Side)

1. Start.
2. Create a socket using socket() system call.
3. Connect the socket to the address of the server using connect() system call.
4. Send the filename of required file using send() system call.
5. Read the contents of the file sent by server by recv() system call.
6. Stop.

## Algorithm (Server Side)

1. Start.
2. Create a socket using socket() system call.
3. Bind the socket to an address using bind() system call.
4. Listen to the connection using listen() system call.
5. accept connection using accept()
6. Receive filename and transfer contents of file with client.
7. Stop.

## Program

/*Server*/

```
#include<sys/types.h>
#include<sys/socket.h>
#include<netinet/in.h>
#include<sys/stat.h>
#include<unistd.h>
#include<stdlib.h>
#include<stdio.h>
#include<fcntl.h>

int main()
{
  int cont,create_socket,new_socket,addrlen,fd;
  int bufsize = 1024;
  char *buffer = malloc(bufsize);
  char fname[256];
  struct sockaddr_in address;

  if ((create_socket = socket(AF_INET,SOCK_STREAM,0)) > 0)
    printf("The socket was created\n");

  address.sin_family = AF_INET;
  address.sin_addr.s_addr = INADDR_ANY;
  address.sin_port = htons(15000);

  if (bind(create_socket,(struct sockaddr *)&address,sizeof(address)) ==
0)
    printf("Binding Socket\n");
  listen(create_socket,3);
  addrlen = sizeof(struct sockaddr_in);
  new_socket = accept(create_socket,(struct sockaddr
*)&address,&addrlen);

  if (new_socket > 0)
```

```
     printf("The Client %s is Connected...\n",
             inet_ntoa(address.sin_addr));
  recv(new_socket,fname, 255,0);
  printf("A request for filename %s Received..\n", fname);
  if ((fd=open(fname, O_RDONLY))<0)
    {perror("File Open Failed"); exit(0);}
  while((cont=read(fd, buffer, bufsize))>0) {
     send(new_socket,buffer,cont,0);
  }
  printf("Request Completed\n");
  close(new_socket);
  return close(create_socket);
}
```

/*Client*/

```
#include<sys/socket.h>
#include<sys/types.h>
#include<netinet/in.h>
#include<unistd.h>
#include<stdlib.h>
#include<stdio.h>

int main(int argc,char *argv[])
{
  int create_socket;
  int bufsize = 1024;
  char *buffer = malloc(bufsize);
  char fname[256];
  struct sockaddr_in address;

  if ((create_socket = socket(AF_INET,SOCK_STREAM,0)) > 0)
    printf("The Socket was created\n");
  address.sin_family = AF_INET;
  address.sin_port = htons(15000);
  inet_pton(AF_INET,argv[1],&address.sin_addr);

  if (connect(create_socket,(struct sockaddr *) &address,
              sizeof(address)) == 0)
    printf("The connection was accepted with the server %s...\n",
            argv[1]);
  printf("Enter The Filename to Request : "); scanf("%s",fname);
  send(create_socket, fname, sizeof(fname), 0);
  printf("Request Accepted... Receiving File...\n\n");
  printf("The contents of file are...\n\n");
  while((cont=recv(create_socket, buffer, bufsize, 0))>0) {
    write(1, buffer, cont);
  }
  printf("\nEOF\n");
  return close(create_socket);
}
```

Output (Server)

```
[root@localhost CN Lab] ./s.o
Socket Created..
Binding Socket..
Now Listening for Request..

The Client 127.0.0.1 is trying to connect…
A request for filename alpha received..
Requested completed..
[root@localhost CN Lab]
```

Output (Client)

```
[root@localhost CN Lab] ./c.o 127.0.0.1
Socket Created..
Connetion is accepted by 127.0.0.1 ..
Enter File Name to Request : alpha
Requestion for file alpha.. Request accepted. Receiving file…

The contents of file are :-
This a demo of client server using Sockets
Just for trial.
Now End of file

EOF

[root@localhost CN Lab]
```

# Experiment No 5
# FIFO IPC

## Problem Statement
Implement the above program using as message queues or FIFO as IPC channels.

## Algorithm (Client Side)
1. Start.
2. Open well known server FIFO in write mode.
3. Write the pathname of the file in this FIFO and send the request.
4. Open the client specified FIFO in read mode and wait for reply.
5. When the contents of the file are available in FIFO, display it on the terminal
6. Stop.

## Algorithm (Server Side)
1. Start.
2. Create a well known FIFO using mkfifo()
3. Open FIFO in read only mode to accept request from clients.
4. When client opens the other end of FIFO in write only mode, then read the contents and store it in buffer.
5. Create another FIFO in write mode to send replies.
6. Open the requested file by the client and write the contents into the client specified FIFO and terminate the connection.
7. Stop.

## Program

/*Server*/

```
#include<stdio.h>
#include<unistd.h>
#include<sys/stat.h>
#include<fcntl.h>
#include<string.h>

#define FIFO1 "fifo1"
#define FIFO2 "fifo2"
#define PERMS 0666

char fname[256];

int main() {
  int readfd, writefd, fd;
  ssize_t n;
  char buff[512];
  if (mkfifo(FIFO1, PERMS)<0)
    printf("Cant Create FIFO Files\n");
  if (mkfifo(FIFO2, PERMS)<0)
    printf("Cant Create FIFO Files\n");
  printf("Waiting for connection Request..\n");
  readfd =open(FIFO1, O_RDONLY, 0);
  writefd=open(FIFO2, O_WRONLY, 0);
  printf("Connection Established..\n");
  read(readfd, fname, 255);
  printf("Client has requested file %s\n", fname);
  if ((fd=open(fname,O_RDWR))<0) {
    strcpy(buff,"File does not exist..\n");
    write(writefd, buff, strlen(buff));
  } else {
    while((n=read(fd, buff,512))>0)
      write(writefd, buff, n);
```

```
  }
  close(readfd);  unlink(FIFO1);
  close(writefd);  unlink(FIFO2);
}
```

/*Client*/

```
#include<stdio.h>
#include<unistd.h>
#include<sys/stat.h>
#include<fcntl.h>

#define FIFO1 "fifo1"
#define FIFO2 "fifo2"
#define PERMS 0666

char fname[256];

int main()
{
  ssize_t n;
  char buff[512];
  int readfd,writefd;
  printf("Trying to Connect to Server..\n");
  writefd = open(FIFO1, O_WRONLY, 0);
  readfd  = open(FIFO2, O_RDONLY, 0);
  printf("Connected..\n");
  printf("Enter the filename to request from server: ");
  scanf("%s",fname);
  write(writefd, fname, strlen(fname));
  printf("Waiting for Server to reply..\n");
  while((n=read(readfd,buff,512))>0)
    write(1,buff,n);
  close(readfd);
  close(writefd);
  return 0;
}
```

Output (Server)

```
[root@localhost CN Lab] ./s.o
Waiting for connection Request..
Connection Established..
Client has requested file alpha
[root@localhost CN Lab]
```

Output (Client)

```
[root@localhost CN Lab] ./c.o
Trying to Connect to Server..
Connected..
Enter the filename to request from server: alpha
Waiting for Server to reply..

This a demo of client server using Sockets
Just for trial.
Now End of file

[root@localhost CN Lab]
```

# Experiment No 6
# RSA Algorithm

## Problem Statement
Write a program for simple RSA algorithm to encrypt and decrypt the data.

## Theory
Cryptography has a long and colorful history. The message to be encrypted, known as the plaintext, are transformed by a function that is parameterized by a key. The output of the encryption process, known as the ciphertext, is then transmitted, often by messenger or radio. The enemy, or intruder, hears and accurately copies down the complete ciphertext. However, unlike the intended recipient, he does not know the decryption key and so cannot decrypt the ciphertext easily. The art of breaking ciphers is called **cryptanalysis** the art of devising ciphers (cryptography) and breaking them (cryptanalysis) is collectively known as cryptology.

There are several ways of classifying cryptographic algorithms. They are generally categorized based on the number of keys that are employed for encryption and decryption, and further defined by their application and use. The three types of algorithms are as follows:

1. Secret Key Cryptography (SKC): Uses a single key for both encryption and decryption. It is also known as symmetric cryptography.
2. Public Key Cryptography (PKC): Uses one key for encryption and another for decryption. It is also known as asymmetric cryptography.
3. Hash Functions: Uses a mathematical transformation to irreversibly "encrypt" information

Public-key cryptography has been said to be the most significant new development in cryptography. Modern PKC was first described publicly by Stanford University professor Martin Hellman and graduate student Whitfield Diffie in 1976. Their paper described a two-key crypto system in which two parties could engage in a secure communication over a non-secure communications channel without having to share a secret key.

Generic PKC employs two keys that are mathematically related although knowledge of one key does not allow someone to easily determine the other key. One key is used to encrypt the plaintext and the other key is used to decrypt the ciphertext. The important point here is that it does not matter which key is applied first, but that both keys are required for the process to work. Because pair of keys is required, this approach is also called asymmetric cryptography.

In PKC, one of the keys is designated the public key and may be advertised as widely as the owner wants. The other key is designated the private key and is never revealed to another party. It is straight forward to send messages under this scheme.

The RSA algorithm is named after Ron Rivest, Adi Shamir and Len Adleman, who invented it in 1977. The RSA algorithm can be used for both public key encryption and digital signatures. Its security is based on the difficulty of factoring large integers.

## Algorithm
1. Generate two large random primes, P and Q, of approximately equal size.
2. Compute $N = P \times Q$
3. Compute $Z = (P-1) \times (Q-1)$.
4. Choose an integer $E$, $1 < E < Z$, such that GCD $(E, Z) = 1$
5. Compute the secret exponent $D$, $1 < D < Z$, such that $E \times D \equiv 1 \pmod{Z}$
6. The public key is $(N, E)$ and the private key is $(N, D)$.

Note: The values of $P$, $Q$, and $Z$ should also be kept secret.
The message is encrypted using public key and decrypted using private key.

## An example of RSA encryption
1. Select primes $P$=11, $Q$=3.

2. $N = P \times Q = 11 \times 3 = 33$
   $Z = (P-1) \times (Q-1) = 10 \times 2 = 20$
3. Lets choose $E=3$
   Check GCD($E$, $P$-1) = GCD(3, 10) = 1 (i.e. 3 and 10 have no common factors except 1),
   and check GCD($E$, $Q$-1) = GCD(3, 2) = 1
   therefore GCD($E$, $Z$) = GCD(3, 20) = 1
4. Compute $D$ such that $E \times D \equiv 1 \pmod{Z}$
   compute $D = E^{\wedge -1} \bmod Z = 3^{\wedge -1} \bmod 20$
   find a value for $D$ such that $Z$ divides (($E \times D$)-1)
   find $D$ such that 20 divides 3D-1.
   Simple testing (D = 1, 2, ...) gives D = 7
   Check: ($E \times D$)-1 = 3.7 - 1 = 20, which is divisible by $Z$.
5. Public key = ($N$, $E$) = (33, 3)
   Private key = ($N$, $D$) = (33, 7).

Now say we want to encrypt the message m = 7,
Cipher code = $M^{\wedge E} \bmod N$
$= 7^{\wedge 3} \bmod 33$
$= 343 \bmod 33$
$= 13.$
Hence the ciphertext c = 13.

To check decryption we compute Message' = $C^{\wedge D} \bmod N$
$= 13^{\wedge 7} \bmod 33$
$= 7.$

Note that we don't have to calculate the full value of 13 to the power 7 here. We can make use of the fact that a = bc mod n = (b mod n).(c mod n) mod n so we can break down a potentially large number into its components and combine the results of easier, smaller calculations to calculate the final value.

Program

```
#include <stdio.h>
#include <string.h>
#include <conio.h>
#include <math.h>

int mult(unsigned int x, unsigned int y, unsigned int n) {
  unsigned long int k=1;
  int j;
  for (j=1; j<=y; j++) k = (k * x) % n;
  return (unsigned int) k;
}

void main () {
  char msg[100];
  unsigned int pt[100], ct[100], n, d, e, p, q, i;
  printf("Enter message : "); gets(msg);
  //strcpy(pt, msg);
  for(i=0;i<strlen(msg);i++)
   pt[i]=msg[i];
  n = 253; d = 17; e = 13;
  printf("\nCT = ");
  for(i=0; i<strlen(msg); i++) ct[i] = mult(pt[i], e,n);
  for(i=0; i<strlen(msg); i++) printf("%d ", ct[i]);
  printf("\nPT = ");
  for(i=0; i<strlen(msg); i++) printf("%c", pt[i]);
  for(i=0; i<strlen(msg); i++) pt[i] = mult(ct[i], d,n) ;
}
```

Output

```
Enter message : alpha
CT = 113 3 129 213 113
PT = alpha
```

# Experiment No 7
# Hamming Codes

## Problem Statement

Write a program for Hamming Code generation for error detection and correction

## Theory

Hamming codes are used for detecting and correcting single bit errors in transmitted data. This requires that 3 parity bits (check bits) be transmitted with every 4 data bits. The algorithm is called A(7, 4) code, because it requires seven bits to encode 4 bits of data.

**Eg:**

| Bit String | Parity Bit | Verification |
|---|---|---|
| 000 | 0 | 0 + 0 + 0 + 0 = 0 |
| 001 | 1 | 0 + 0 + 1 + 1 = 0 |
| 010 | 1 | 0 + 1 + 0 + 1 = 0 |
| 011 | 0 | 0 + 1 + 1 + 0 = 0 |
| 100 | 1 | 1 + 0 + 0 + 1 = 0 |
| 101 | 0 | 1 + 0 + 1 + 0 = 0 |
| 110 | 0 | 1 + 0 + 1 + 0 = 0 |
| 111 | 1 | 1 + 1 + 1 + 1 = 0 |

**Parity types:**

**Even: -** Even number of 1's is present, i.e. the modulo 2 sum of the bits is 0.

**Odd: -** Odd number of 1's is present, i.e. the modulo 2 sum of the bits is 1.

Given data bits D1, D2, D3 and D4, A (7, 4) Hamming code may define parity bits P1, P2 and P3 as,

$$P1=D2+D3+D4$$
$$P2=D1+D3+D4$$
$$P3=D1+D2+D4$$

There are 4 equations for a parity bit that may be used in Hamming codes,

$$P4=D1+D2+D3$$

Valid Hamming codes may use any 3 of the above 4 parity bit definitions. Valid Hamming codes may also place the parity bits in any location within the block of 7 data and parity bits.

One method for transferring 4 bits of data into a 7 bit Hamming code word is to use a 4x7 generate matrix [G] defined to be the 1x4 vector [D1 D2 D3 D4].

Its possible to create a 4x7 generator matrix [G] such that the product modulo 2 of d and [G] (D[G]) is the desired 1x7 Hamming code word.

For example each data bits can be represented with in a column vector as follows.

$$D1=\begin{vmatrix}1\\0\\0\\0\end{vmatrix} \quad D2=\begin{vmatrix}0\\1\\0\\0\end{vmatrix} \quad D3=\begin{vmatrix}0\\0\\1\\0\end{vmatrix} \quad D4=\begin{vmatrix}0\\0\\0\\1\end{vmatrix}$$

And represent each parity bit with a column vector continuing a 1 in the row corresponding to each data bit included in the computation and a zero in all other rows.

$$P1=\begin{vmatrix}0\\1\\1\\1\end{vmatrix} \quad P2=\begin{vmatrix}1\\0\\1\\1\end{vmatrix} \quad P3=\begin{vmatrix}1\\1\\0\\1\end{vmatrix}$$

And

$$G=\begin{vmatrix} 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 \end{vmatrix}$$

P1 P2 P3 D1 D2 D3 D4

## Encoding

The process to encode the data value 1010 using the Hamming code defined by the G matrix is as follows: -

$$[1010]\begin{vmatrix} 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 \end{vmatrix}$$

$$= \begin{vmatrix} (1*0)+(0*1)+(1*1)+(0*1) \\ (1*1)+(0*0)+(1*1)+(0*1) \\ (1*1)+(0*1)+(1*0)+(0*1) \\ (1*1)+(0*0)+(1*0)+(0*0) \\ (1*0)+(0*1)+(1*0)+(0*0) \\ (1*0)+(0*0)+(1*1)+(0*0) \\ (1*0)+(0*0)+(1*0)+(0*1) \end{vmatrix} = \begin{vmatrix} 0+0+1+0 \\ 1+0+1+0 \\ 1+0+0+0 \\ 1+0+0+0 \\ 0+0+0+0 \\ 0+0+1+0 \\ 0+0+0+0 \end{vmatrix} = \begin{vmatrix} 1 \\ 0 \\ 1 \\ 1 \\ 0 \\ 1 \\ 0 \end{vmatrix}$$

Therefore 1010 encodes into 1011010. Equivalent Hamming codes represented by different generator matrices will produce different results.

## Decoding

The first step is to check the parity bits to determine if there is an error. Arithmetically, parity may be checked as follows: -

P1 = D2+D3+D4 = 0+1+1 = 0
P2 = D1+D3+D4 = 1+1+1 = 1
P3 = D1+D2+D4 = 1+0+1 = 0

Parity may also be validated by using matrix operation. A 3x7 parity check matrix [H] may be constructed such that row 1 contains $1^s$ in the position of the first parity bits and all the data bits that are included in its parity calculation. Using this, matrix [H] may be defined as follows: -

$$H=\begin{vmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 \end{vmatrix}$$

$3^{rd}$ Bit Parity

$2^{nd}$ Bit Parity

$1^{st}$ Bit Parity

Multiplying the 3x7 matrix [H] by a 7x1 matrix representing the encoded data produces a 3x1 matrix called the **Syndrome**.

If the syndrome is all 0's the encoded data is error free. If the syndrome has a non-zero value, flipping the encoded bit that is in the position of the column matching the syndrome will result in a valid code word.

Ex: -

Suppose the data received is 1011011,
Then

$$\begin{vmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 \end{vmatrix} \begin{vmatrix} 1 \\ 0 \\ 1 \\ 1 \\ 0 \\ 1 \\ 1 \end{vmatrix} = \begin{vmatrix} (1*1)+(0*0)+(0*1)+(0*1)+(1*0)+(1*1)+(1*1) \\ (0*1)+(1*0)+(0*1)+(1*1)+(0*0)+(1*1)+(1*1) \\ (0*1)+(0*0)+(1*1)+(1*1)+(1*0)+(0*1)+(1*1) \end{vmatrix} = \begin{vmatrix} \mathbf{1} \\ \mathbf{1} \\ \mathbf{1} \end{vmatrix}$$

Looking back at the matrix [H] the 7th column is all 1s so the 7th bit is the bit that **has an error.**

Program

```
#include<iostream.h>
#include<conio.h>
#include<stdlib.h>
#include<stdio.h>

char data[5];
int encoded[8], edata[7], syndrome[3];
int hmatrix[3][7]= { 1,0,0,0,1,1,1,
                     0,1,0,1,0,1,1,
                     0,0,1,1,1,0,1};

char gmatrix[4][8]={ "0111000", "1010100", "1100010", "1110001"};

void main() {
  int i,j;
  clrscr();
  cout<<"Hamming Code --- Encoding\n";
  cout<<"Enter 4 bit data : ";
  cin>>data;

  cout<<"Generator Matrix\n";
  for(i=0;i<4;i++) cout<<"\t"<<gmatrix[i]<<"\n";

  cout<<"Encoded Data : ";
  for(i=0;i<7;i++) {
    for(j=0;j<4;j++)
      encoded[i]+=((data[j]- '0')*(gmatrix[j][i]- '0'));
    encoded[i]=encoded[i]%2;
    cout<<encoded[i]<<" ";
  }
  cout<<"\nHamming code --- Decoding\n";
  cout<<"Enter Encoded bits as received : ";
  for(i=0;i<7;i++) cin>>edata[i];

  for(i=0;i<3;i++) {
    for(j=0;j<7;j++)
      syndrome[i]=syndrome[i]+(edata[j]*hmatrix[i][j]);
    syndrome[i]=syndrome[i]%2;
  }

  for(j=0;j<7;j++)
```

```
    if ((syndrome[0]==hmatrix[0][j])&&(syndrome[1]==hmatrix[1][j])&&
      (syndrome[2]==hmatrix[2][j]))
      break;
  if(j==7)
    cout<<"Data is error free!!\n";
  else {
    cout<<"Error received at bit number "<<j+1<<" of the data\n";
    edata[j]=!edata[j];
    cout<<"The Correct data Should be : ";
    for(i=0;i<7;i++) cout<<edata[i]<<" ";
    }
  }
}
```

## Output

```
Hamming Code --- Encoding
Enter 4 bit data : 1 0 1 0
Generator Matrix
        0111000
        1010100
        1100010
        1110001
Encoded Data : 1 0 1 1 0 1 0
Hamming code --- Decoding
Enter Encoded bits as received : 1 0 1 1 0 1 1
Error received at bit number 7 of the data
The Correct data Should be : 1 0 1 1 0 1 0

Hamming Code --- Encoding
Enter 4 bit data : 1 0 1 0
Generator Matrix
        0111000
        1010100
        1100010
        1110001
Encoded Data : 1 0 1 1 0 1 0
Hamming code --- Decoding
Enter Encoded bits as received : 1 0 1 1 0 1 0
Data is error free!!
```

# Experiment No 8
# Leaky Bucket

## Problem Statement
Write a program for congestion control using Leaky bucket algorithm.

## Theory
The congesting control algorithms are basically divided into two groups: open loop and closed loop. Open loop solutions attempt to solve the problem by good design, in essence, to make sure it does not occur in the first place. Once the system is up and running, midcourse corrections are not made. Open loop algorithms are further divided into ones that act at source versus ones that act at the destination.

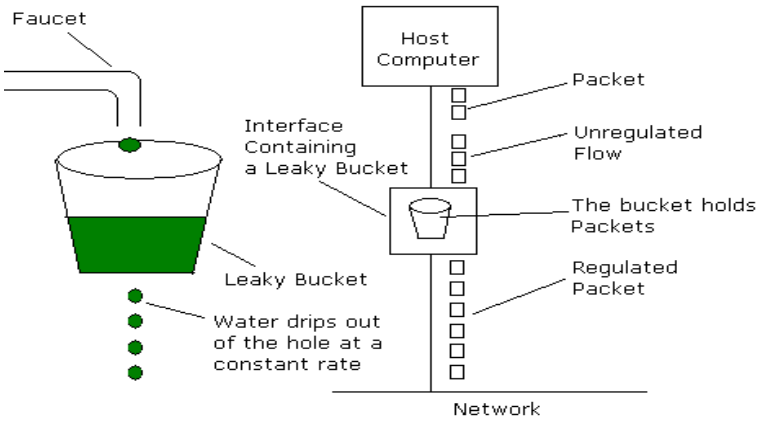
In contrast, closed loop solutions are based on the concept of a feedback loop if there is any congestion. Closed loop algorithms are also divided into two sub categories: explicit feedback and implicit feedback. In explicit feedback algorithms, packets are sent back from the point of congestion to warn the source. In implicit algorithm, the source deduces the existence of congestion by making local observation, such as the time needed for acknowledgment to come back.

The presence of congestion means that the load is (temporarily) greater than the resources (in part of the system) can handle. For subnets that use virtual circuits internally, these methods can be used at the network layer.

Another open loop method to help manage congestion is forcing the packet to be transmitted at a more predictable rate. This approach to congestion management is widely used in ATM networks and is called **traffic shaping**.

The other method is the leaky bucket algorithm. Each host is connected to the network by an interface containing a leaky bucket, that is, a finite internal queue. If a packet arrives at the queue when it is full, the packet is discarded. In other words, if one or more process are already queued, the new packet is unceremoniously discarded. This arrangement can be built into the hardware interface or simulate d by the host operating system. In fact it is nothing other than a single server queuing system with constant service time.

The host is allowed to put one packet per clock tick onto the network. This mechanism turns an uneven flow of packet from the user process inside the host into an even flow of packet onto the network, smoothing out bursts and greatly reducing the chances of congestion.




## Program

```
#include<iostream.h>
#include<dos.h>
#include<stdlib.h>
#define bucketSize 512

void bktInput(int a,int b) {
```

```
  if(a>bucketSize)
    cout<<"\n\t\tBucket overflow";
  else {
    delay(500);
    while(a>b){
      cout<<"\n\t\t"<<b<<" bytes outputted.";
      a-=b;
      delay(500);
    }
    if (a>0) cout<<"\n\t\tLast "<<a<<" bytes sent\t";
    cout<<"\n\t\tBucket output successful";
  }
}

void main() {
  int op, pktSize;
  randomize();
  cout<<"Enter output rate : "; cin>>op;
  for(int i=1;i<=5;i++){
    delay(random(1000));
    pktSize=random(1000);
    cout<<"\nPacket no "<<i<<"\tPacket size = "<<pktSize;
    bktInput(pktSize,op);
  }
}
```

## Output

```
Enter output rate : 100

Packet no 0  Packet size = 3
                Bucket output successful
                Last 3 bytes sent
Packet no 1  Packet size = 33
                Bucket output successful
                Last 33 bytes sent
Packet no 2  Packet size = 117
                Bucket output successful
                100 bytes outputted.
                Last 17 bytes sent
Packet no 3  Packet size = 95
                Bucket output successful
                Last 95 bytes sent
Packet no 4  Packet size = 949
                Bucket overflow
```

# Viva Questions

1. What are functions of different layers?
2. Differentiate between TCP/IP Layers and OSI Layers
3. Why header is required?
4. What is the use of adding header and trailer to frames?
5. What is encapsulation?
6. Why fragmentation requires?
7. What is MTU?
8. Which layer imposes MTU?
9. Differentiate between flow control and congestion control.
10. Differentiate between Point-to-Point Connection and End-to-End connections.
11. What are protocols running in different layers?
12. What is Protocol Stack?
13. Differentiate between TCP and UDP.
14. Differentiate between Connectionless and connection oriented connection.
15. Why frame sorting is required?
16. What is meant by subnet?
17. What is meant by Gateway?
18. What is an IP address?
19. What is MAC address?
20. Why IP address is required when we have MAC address?
21. What is meant by port?
22. What are ephemerical port number and well known port numbers?
23. What is a socket?
24. What are the parameters of socket()?
25. Describe bind(), listen(), accept(),connect(), send() and recv().
26. What are system calls? Mention few of them.
27. What is IPC? Name three techniques.
28. Explain mkfifo(), open(), close() with parameters.
29. What is meant by file descriptor?
30. What is meant by traffic shaping?
31. How do you classify congestion control algorithms?
32. Differentiate between Leaky bucket and Token bucket.
33. How do you implement Leaky bucket?
34. How do you generate busty traffic?
35. What is the polynomial used in CRC-CCITT?
36. What are the other error detection algorithms?
37. What is difference between CRC and Hamming code?
38. Why Hamming code is called 7,4 code?
39. What is odd parity and even parity?
40. What is meant by syndrome?
41. What is generator matrix?
42. What is spanning tree?
43. Where Pirm's algorithm does finds its use in Networks?
44. Differentiate between Prim's and Kruskal's algorithm.
45. What are Routing algorithms?
46. How do you classify routing algorithms? Give examples for each.
47. What are drawbacks in distance vector algorithm?
48. How routers update distances to each of its neighbor?
49. How do you overcome count to infinity problem?
50. What is cryptography?
51. How do you classify cryptographic algorithms?
52. What is public key?
53. What is private key?
54. What are key, ciphertext and plaintext?
55. What is simulation?
56. What are advantages of simulation?

57. Differentiate between Simulation and Emulation.
58. What is meant by router?
59. What is meant by bridge?
60. What is meant by switch?
61. What is meant by hub?
62. Differentiate between route, bridge, switch and hub.
63. What is ping and telnet?
64. What is FTP?
65. What is BER?
66. What is meant by congestion window?
67. What is BSS?
68. What is incoming throughput and outgoing throughput?
69. What is collision?
70. How do you generate multiple traffics across different sender-receiver pairs?
71. How do you setup Ethernet LAN?
72. What is meant by mobile host?
73. What is meant by NCTUns?
74. What are dispatcher, coordinator and nctunsclient?
75. Name few other Network simulators
76. Differentiate between logical and physical address.
77. Which address gets affected if a system moves from one place to another place?
78. What is ICMP? What are uses of ICMP? Name few.
79. Which layer implements security for data?

# Guidelines For installation of NCTUns Network Simulator

- Follow the following steps carefully,
- Please don't skip any steps that have been mentioned below

1. Install any Linux with kernel 2.6.9 (PCQ Linux 2004 is exception)
   Recommended → RED HAT LINUX ENTERPRISE EDITION
2. After installation Boot into Linux as root.
3. Copy the .tgz installation file of NCTUns that you got from college to the folder */bin/local*
   Please don't change any folder name in this folder that is created after unzipping the above file. Don't even change the Case of the folder that is created
4. Now unzip the .tgz file by opening the terminal and changing the directory to */bin/local* by the command :-
   *[root@localhost ~] cd /bin/local*

   To unzip use the following command:-
   *[root@localhost local] tar xvzf [the file name].tar*

   (Note there is no '-' before xvzf)
   This will create a folder called NCTUns in the directory /bin/local...

5. Now disable the Secure Linux option by running the following command :-
   ***[root@localhost local]*** *vi /etc/selinux/config*

   When the file opens, there is a line similar to -- SELINUX=enforcing
   Change the "*enforcing*" to "*disabled*" (Note without quotes)

6. From the directory */bin/local* change the current working directory to *NCTUns* by following command :-
   ***[root@localhost local]*** *cd NCTUns*

7. Now from here execute the installation shell script that will do the required compilations and settings for you:-
   ***[root@localhost local]*** *./install.sh*

   During this part it will ask for installation of tunnel files. Please type yes and Enter to continue

8. If the installation is successful, it will display the success message at the end. Now restart your computer. You will find a new entry in GRUB Menu *"NCTUns kernel login*". Boot into Linux using this entry.
9. Log in as *root*. Now you have to modify any *.bash_profile* file
   ***[root@localhost ~]*** *vi .bash_profile*

   The Content of file should look like as follows.

```
# .bash_profile

# Get the aliases and function

if [ -t ~/.bashrc ]; then
      . ~/.bashrc
fi

# User specified environment variables and startup programs

PATH=$PATH:$HOME/bin:/usr/local/nctuns/bin
export LD_LIBRARY_PATH=/usr/local/nctuns/lib
```

```
export NCTUNSHOME=/usr/local/nctuns

export PATH
export USERNAME
```

If it's not like above, change it to look like above.

10. Now save this file and log off and then log on again.
11. Create another user account.
12. before using simulator, please execute the following command
    ***[root@localhost ~]*** *iptables -F*
13. Run the simulator using three commands where each command should be executed in different window.
    ***[root@localhost ~]*** *dispatcher*
    ***[root@localhost ~]*** *coordinator*
    ***[root@localhost ~]*** *nctunsclient*

14. In the NCTUns window Settings → Dispatcher. Provide the username and password of the user account u created in step 11. Then Click OK.