Experiment-1

Study of Network devices in detail and connect the computers in Local Area Network

a) Aim: Study of Network Devices in Detail

The following are the various Network Devices used in Computer Networks:

- Repeater
- Hub
- Switch
- Bridge
- Router
- Gate Way
- Brouter
- NIC

1. Repeater:

Functions at Physical Layer. A repeater is an electronic device that receives a signal and retransmits it at a higher level and/or higher power, or onto the other side of an obstruction, so that the signal can cover longer distances. Its job is to regenerate the signal over the same network before the signal becomes too weak or corrupted to extend the length to which the signal can be transmitted over the same network. Repeaters not only amplify the signal but also regenerate it Repeater has two ports, so cannot be used to connect more than two devices.

2. Hub:

An Ethernet hub, (active hub, passive hub, intelligent hub, network hub, repeater hub, hub) or concentrator is a device for connecting multiple twisted pair or fiber optic Ethernet devices together and making them act as a single network segment. Hubs work at the physical layer (layer 1) of the OSI model. The device is a form of multiport repeater. Repeater hubs also participate in collision detection, forwarding a jam signal to all ports if it detects a collision. Hubs cannot filter data, so data packets are sent to all connected devices. In other words, the collision domain of all hosts connected through Hub remains one. Also, they do not have the intelligence to find out the best path for data packets which leads to inefficiencies and wastage.

3. Bridge:

A bridge is a repeater, with add on the functionality of filtering content by reading the MAC addresses of the source and destination. It is also used for interconnecting two LANs working on the same protocol. It has a single input and single output port, thus making it a 2 port device. A network bridge connects multiple network segments at the data link layer (Layer 2) of the OSI model. In Ethernet networks, the term bridge formally means a device that behaves according to the IEEE 802.1D standard. Bridges can analyze incoming data packets to determine if the bridge is able to send the given packet to another segment of the network.

4. Switch:

A network switch or switching hub is a computer networking device that connects network segments. A switch is a multiport bridge with a buffer and a design that can boost its efficiency (a large number of ports imply less traffic) and performance. The term commonly refers to a network bridge that processes and routes data at the data link layer (layer 2) of the OSI model. The switch can perform error checking before forwarding data, which makes it very efficient as it does not forward packets that have errors and forward good packets selectively to the correct

port only. Switches that additionally process data at the network layer (layer 3 and above) are often referred to as Layer 3 switches or multilayer switches.

5. Router:

A router is an electronic device that interconnects two or more computer networks, and selectively interchanges packets of data between them. Each data packet contains address information that a router can use to determine if the source and destination are on the same network, or if the data packet must be transferred from one network to another. Where multiple routers are used in a large collection of interconnected networks, the routers exchange information about target system addresses, so that each router can build up a table showing the preferred paths between any two systems on the interconnected networks.

6. Gate Way:

In a communications network, a network node equipped for interfacing with another network that uses different protocols is called a gateway.

- A gateway may contain devices such as protocol translators, impedance matching devices, rate converters, fault isolators, or signal translators as necessary to provide system interoperability. It also requires the establishment of mutually acceptable administrative procedures between both networks.
- A protocol translation/mapping gateway interconnects networks with different network protocol technologies by performing the required protocol conversions.

7. Brouter:

It is also known as the bridging router is a device that combines features of both bridge and router. It can work either at the data link layer or a network layer. Working as a router, it is capable of routing packets across networks and working as the bridge, it is capable of filtering local area network traffic.

8. NIC:

NIC or network interface card is a network adapter that is used to connect the computer to the network. It is installed in the computer to establish a LAN. It has a unique id that is written on the chip, and it has a connector to connect the cable to it. The cable acts as an interface between the computer and the router or modem. NIC card is a layer 2 device which means that it works on both the physical and data link layers of the network model.

Different Network Devices:

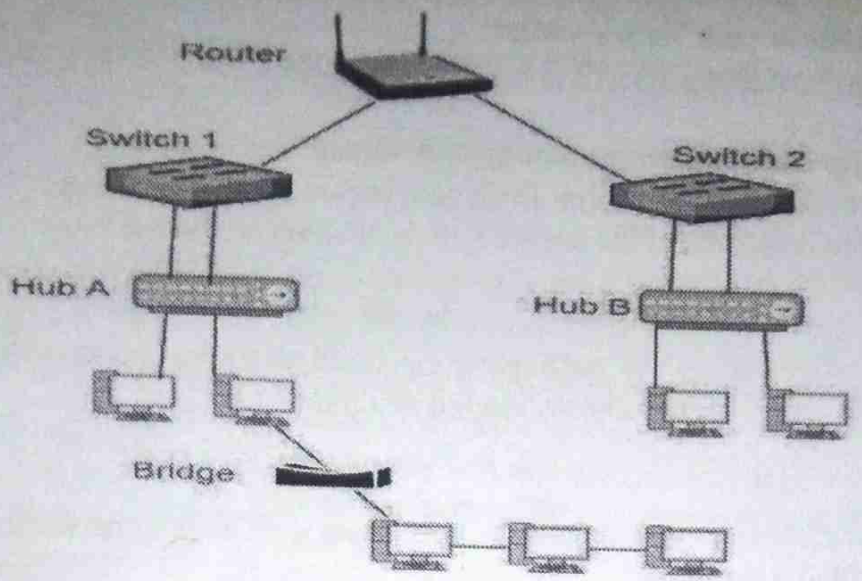


Diagram shows you how to prepare Cross wired connection

RJ45 Pin # (END 1)	Wire Color	Diagram End #1	RJ45 Pin # (END 2)	Wire Color	Diagram End #2
1	White/Orange		1	White/Green	
2	Orange		2	Green	
3	White/Green		3	White/Orange	
4	Blue		4	White/Brown	
5	White/Blue		5	Brown	
6	Green		6	Orange	
7	White/Brown		7	Blue	
8	Brown		8	White/Blue	

Diagram shows you how to prepare straight through wired connection

RJ45 Pin # (END 1)	Wire Color	Diagram End #1	RJ45 Pin # (END 2)	Wire Color	Diagram End #2
1	White/Orange		1	White/Green	
2	Orange		2	Green	
3	White/Green		3	White/Orange	
4	Blue		4	White/Brown	
5	White/Blue		5	Brown	
6	Green		6	Orange	
7	White/Brown		7	Blue	
8	Brown		8	White/Blue	

b) Aim: Connect the computers in Local Area Network.

Procedure: On the host computer

On the host computer, follow these steps to share the Internet connection:

1. Log on to the host computer as Administrator or as Owner.
2. Click Start, and then click Control Panel.

3. Click Network and Internet Connections.
4. Click Network Connections.
5. Right-click the connection that you use to connect to the Internet. For example, if you connect to the Internet by using a modem, right-click the connection that you want under Dial-up / other networks available.
6. Click Properties.
7. Click the Advanced tab.
8. Under Internet Connection Sharing, select - Allow other network users to connect through this computer's Internet connection check box.
9. If you are sharing a dial-up Internet connection, select - Establish a dial-up connection whenever a computer on my network attempts to access the Internet check box if you want to permit your computer to automatically connect to the Internet.
10. Click OK. You'll receive the following message:

> When Internet Connection Sharing is enabled, your LAN adapter will be set to use IP address 192.168.0. 1. Your computer may lose connectivity with other computers on your network. If these other computers have static IP addresses, it is a good idea to set them to obtain their IP addresses automatically. Are you sure you want to enable Internet Connection Sharing?

11. Click Yes. The connection to the Internet is shared to other computers on the local area network (LAN).

The network adapter that is connected to the LAN is configured with a static IP address of 192.168.0. 1 and a subnet mask of 255.255.255.0

On the client computer

To connect to the Internet by using the shared connection, you must confirm the LAN adapter IP configuration, and then configure the client computer. To confirm the LAN adapter IP configuration, follow these steps:

1. Log on to the client computer as Administrator or as Owner.
2. Click Start, and then click Control Panel.
3. Click Network and Internet Connections.
4. Click Network Connections.
5. Right-click Local Area Connection and then click Properties.
6. Click the General tab, click Internet Protocol (TCP/IP) in the connection uses the following items list, and then click Properties.
7. In the Internet Protocol (TCP/IP) Properties dialog box, click Obtain an IP address automatically (if it is not already selected), and then click OK.

Note: You can also assign a unique static IP address in the range of 192.168.0.2 to 254. For example, you can assign the following static IP address, subnet mask, and default gateway:

- IP Address 192.168.31.202
- Subnet mask 255.255.255.0
- Default gateway 192.168.31.1

8. In the Local Area Connection Properties dialog box, click OK.
9. Quit Control Panel.

2)**AIM:** Write a program to implement the data link layer framing methods such as
i) Character stuffing ii)Bit stuffing

DESCRIPTION: Character Stuffing–A byte is stuffed in the message to differentiate from the delimiter. This is also called character-oriented framing or byte stuffing. Bit Stuffing–A pattern of bits of arbitrary length is stuffed in the message to differentiate from the delimiter. This is also called bit - oriented framing.

i)**SOURCE CODE:**

```
#include<stdio.h>
#include<string.h>
int main()
{
  char byts[500],sd,ed;
  printf("Enter characters to be stuffed: ");
  scanf("%s", &byts);getchar();
  printf("Enter Starting Delimiter: ");
  scanf("%c", &sd);getchar();
  printf("Enter Ending Delimiter: ");
  scanf("%c", &ed);
  printf("%c ",sd);
  for(int i=0;i<strlen(byts);i++)
      {
      if(byts[i]==sd || byts[i]==ed)
            printf("%c%c",byts[i],byts[i]);
      else
            printf("%c",byts[i]);
      }
      printf(" %c",ed);
      return 0;
}
```

OUTPUT:

```
Enter characters to be stuffed: goodday
Enter Starting Delimiter: y
Enter Ending Delimiter: o
y gooooddayy o
```

ii)**SOURCE CODE:**

```
#include<stdio.h>
#include<string.h>
void main()
{
      char bits[500];
      int count=0,i;
      printf("Enter the bits to stuffed : ");
      scanf("%s",&bits);
      printf("01111110 ");
      for(i=0;i<strlen(bits);i++)
      {
            if(bits[i]=='1')
                  count++;
            else
                  count=0;
            printf("%c",bits[i]);
            if(count==5)
            {
```

```
                printf("0");
                count=0;
            }
        }
        printf(" 01111110");
}
```

OUTPUT:

```
Enter the bits to stuffed : 10111111001
01111110 101111101001 01111110
```

3)AIM: Write a program to implement data link layer framing method checksum

DESCRIPTION: In checksum error detection scheme, the data is divided into k segments each of m bits. In the sender's end the segments are added using 1's complement arithmetic to get the sum. The sum is complemented to get the checksum. The checksum segment is sent along with the data segments. At the receiver's end, all received segments are added using 1's complement arithmetic to get the sum. The sum is complemented. If the result is zero, the received data is accepted; otherwise discarded.

SOURCE CODE:

```
#include <stdio.h>
void printCheckSum(int* b1,int* b2,int n)
{
        int temp[n],carry=0,i,t;
        for(i=n-1;i>=0;i--)
        {
                t=b1[i]+b2[i]+carry;
                temp[i]=t%2;
                carry=t/2;
        }
        if(carry)
        {
                for(i=n-1;i>=0;i--)
                {
                        t=temp[i]+carry;
                        temp[i]=t%2;
                        carry=t/2;
                }
        }
        //print ans
        printf("1's Sum : ");
        for(i=0;i<n;i++)
        printf("%d",temp[i]);
        printf("\n");
        printf("Checksum: ");
        for(i=0;i<n;i++)
        printf("%d",!temp[i]);
}
int main()
{
        int i,n;
        char dup_bits1[100],dup_bits2[100];
        int bits1[100],bits2[100];
        printf("Enter length of bits:");
        scanf("%d",&n);
        printf("Enter Subnet 1:");
        scanf("%s",&dup_bits1);
        for(i=0;i<n;i++)
        bits1[i]=dup_bits1[i]-'0';
        printf("Enter Subnet 2:");
        scanf("%s",&dup_bits2);
        for(i=0;i<n;i++)
        bits2[i]=dup_bits2[i]-'0';
        printf("Subnet 1: %s\n",dup_bits1);
        printf("Subnet 2: %s\n",dup_bits2);
        printCheckSum(bits1,bits2,n);
```

```
        return 0;
}
```

OUTPUT:

```
Enter length of bits:8
Enter Subnet 1:11100101
Enter Subnet 2:10101111
Subnet 1: 11100101
Subnet 2: 10101111
1's Sum : 10010101
Checksum: 01101010
```

4) AIM: Write a program for Hamming code generation for error detection and correction

DESCRIPTION: In Computer Networks, Hamming code is used for the set of error-correction codes which may occur when the data is moved from the sender to the receiver. The hamming method corrects the error by finding the state at which the error has occurred. Redundant bits are extra binary bits that are generated and added to the information-carrying bits of data transfer to ensure that no bits were lost during the data transfer. The redundancy bits are placed at certain calculated positions to eliminate the errors and the distance between the two redundancy bits is called "Hamming Distance".

SOURCE CODE:

```
#include <stdio.h>
#include <string.h>
#define is_even_parity 1
int binaryTodecimal(char num[])
{
   int i,decimal,mul=0;
   for(decimal=0,i=strlen(num)-1;i>=0;--i,++mul)
   {
      decimal = decimal + (num[i] - 48) * (1 << mul);
   }
        return decimal;
}
char Helper(char lst[])
{
        int count=0,i;
        for(i=0;i<=strlen(lst);i++)
                if(lst[i] == '1')
                        count++;
   if(count%2 != 0)
   {
        if(is_even_parity)
         return '1';
      else
         return '0';
        }
   else
        {
        if(is_even_parity)
         return '0';
      else
         return '1';
        }
}
void GetHammingCode(char d[])
{
        char p1,p2,p4,p8;
        char arr1[10] = {d[0],d[2],d[3],d[5],d[6]};
        p1 = Helper(arr1);
        char arr2[10] = {d[0],d[1],d[3],d[4],d[6]};
   p2 = Helper(arr2);
   char arr3[10] = {d[3],d[4],d[5]};
   p4 = Helper(arr3);
   char arr4[10] = {d[0],d[1],d[2]};
   p8 = Helper(arr4);
   char Hcode[20] = {d[0],d[1],d[2],p8,d[3],d[4],d[5],p4,d[6],p2,p1};
   printf("Hamming Code For %s is %s\n",d,Hcode);
```

```
}
void IsCorrect(char l[11])
{
        char p1,p2,p4,p8;
        int error,i;
        char arr1[10] = {l[0],l[2],l[4],l[6],l[8],l[10]};
        p1 = Helper(arr1);
        char arr2[10] = {l[0],l[1],l[4],l[5],l[8],l[9]};
   p2 = Helper(arr2);
   char arr3[10] = {l[4],l[5],l[6],l[7]};
   p4 = Helper(arr3);
   char arr4[10] = {l[0],l[1],l[2],l[3]};
   p8 = Helper(arr4);
   char arr5[10] = {p8,p4,p2,p1};
   error = binaryTodecimal(arr5);
   if(error == 0)
      printf("Entered Hamming Code is Correct");
   else
   {
      if(l[11-error] == '1')
                        l[11-error] = '0';
               else
                        l[11-error] = '1';
      printf("Entered Hamming Code is Wrong\n");
      printf("Corrected Hamming Code is ");
      for(i=0;i<11;i++)
        printf("%c",l[i]);
   }
}
int main()
{
        char data[10];
        printf("Enter Data :");
        scanf("%s",&data);
        GetHammingCode(data);
        char arr[11] = "10101101110";
        IsCorrect(arr);
}
```

OUTPUT:

```
Enter Data :110010
Hamming Code For 110010 is 11000101
Entered Hamming Code is Wrong
Corrected Hamming Code is 10101001110
```

5) AIM: Write a program to implement on a data set of characters the three CRC polynomials CRC 12,CRC 16 and CRC CCIP

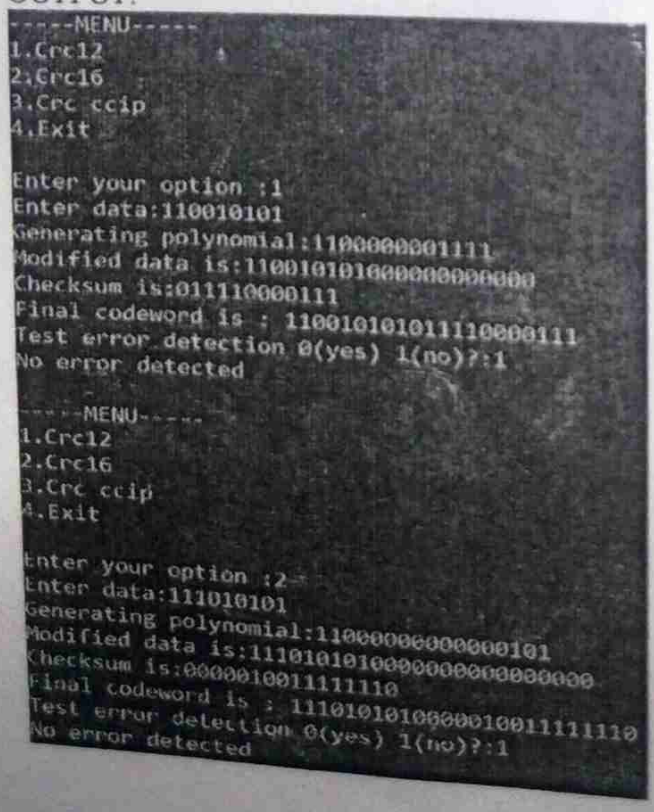
DESCRIPTION:CRC method can detect a single burst of length n, since only one bit per column will be changed, a burst of length n+1 will pass undetected, if the first bit is inverted, the last bit is inverted and all other bits are correct. If the block is badly garbled by a long burst or by multiple shorter burst, the probability that any of the n columns will have the correct parity that is 0.5. so the probability of a bad block being expected when it should not be 2 power(-n). This scheme sometimes is known as Cyclic Redundancy Code.

SOURCE CODE:

```
#include<stdio.h>
#include<string.h>
#define N strlen(g)
char t[28],cs[28],g[28];
int a,e,c,b;
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);
}
int main()
{
        int flag=0;
        do{
                printf("-----MENU ----\n");
                printf("1.Crc12\n2.Crc16\n3.Crc ccip\n4.Exit\n\nEnter your option :");
                scanf("%d",&b);
                switch(b)
                {
                        case 1:strcpy(g,"1100000001111");
                        break;
                        case 2:strcpy(g,"11000000000000101");
                        break;
                        case 3:strcpy(g,"10001000000100001");
                        break;
                        case 4:return 0;
                }
                printf("Enter data:");
                scanf("%s",t);
                printf("Generating polynomial:%s\n",g);
```

```
                t[e]='0';
            printf("Modified data is:%s\n",t);
            crc();
            printf("Checksum is:%s\n",cs);
            for(e=a;e<a+N-1;e++)
                t[e]=cs[e-a];
            printf("Final codeword is : %s\n",t);
            printf("Test error detection 0(yes) 1(no)?:");
            scanf("%d",&e);
            if(e==0)
            {
                do{
                printf("Enter the position where error is to be inserted:");
                scanf("%d",&e);
                }
                while(e==0||e>a+N-1);
                t[e-1]=(t[e-1]=='0')?'1':'0';
                printf("Erroneous data:%s\n",t);
            }
            crc();
            for(e=0;(e<N-1)&&(cs[e]!='1');e++);
            if(e<N-1)
                printf("Error detected\n\n");
            else
                printf("No error detected\n\n");
        }while(flag!=1);
}
```

OUTPUT:



```
-----MENU-----
1.Crc12
2.Crc16
3.Crc ccip
4.Exit

Enter your option :3
Enter data:10101110
Generating polynomial:10001000000100001
Modified data is:10101110000000000000000
Checksum is:01010100001001000
Final codeword is : 10101110010101000001001000
Test error detection 0(yes) 1(no)?:1
No error detected

-----MENU-----
1.Crc12
2.Crc16
3.Crc ccip
4.Exit

Enter your option :4
```

6) AIM: Write a program to implement Sliding Window protocol for Goback N

DESCRIPTION: Go – Back – N protocol provides for sending multiple frames before receiving the acknowledgment for the first frame. The frames are sequentially numbered and a finite number of frames. The maximum number of frames that can be sent depends upon the size of the sending window. If the acknowledgment of a frame is not received within an agreed upon time period, all frames starting from that frame are retransmitted.

SOURCE CODE:

```
#include<stdio.h>
int main()
{
	int windowsize,sent=0,ack,i;
	printf("Enter window size :");
	scanf("%d",&windowsize);
	while(1)
	{
		for(i=0;i<windowsize;i++)
		{
			printf("Frame %d has been transmitted.\n",sent);
			sent++;
			if(sent == windowsize)
				break;
		}
		printf("\nPlease enter the last Acknowledgement received :");
		scanf("%d",&ack);
		if(ack == windowsize)
			break;
		else
			sent = ack;
	}
	return 0;
}
```

OUTPUT:

```
Enter window size :8
Frame 0 has been transmitted.
Frame 1 has been transmitted.
Frame 2 has been transmitted.
Frame 3 has been transmitted.
Frame 4 has been transmitted.
Frame 5 has been transmitted.
Frame 6 has been transmitted.
Frame 7 has been transmitted.

Please enter the last Acknowledgement received :4
Frame 4 has been transmitted.
Frame 5 has been transmitted.
Frame 6 has been transmitted.
Frame 7 has been transmitted.

Please enter the last Acknowledgement received :7
Frame 7 has been transmitted.

Please enter the last Acknowledgement received :8
```

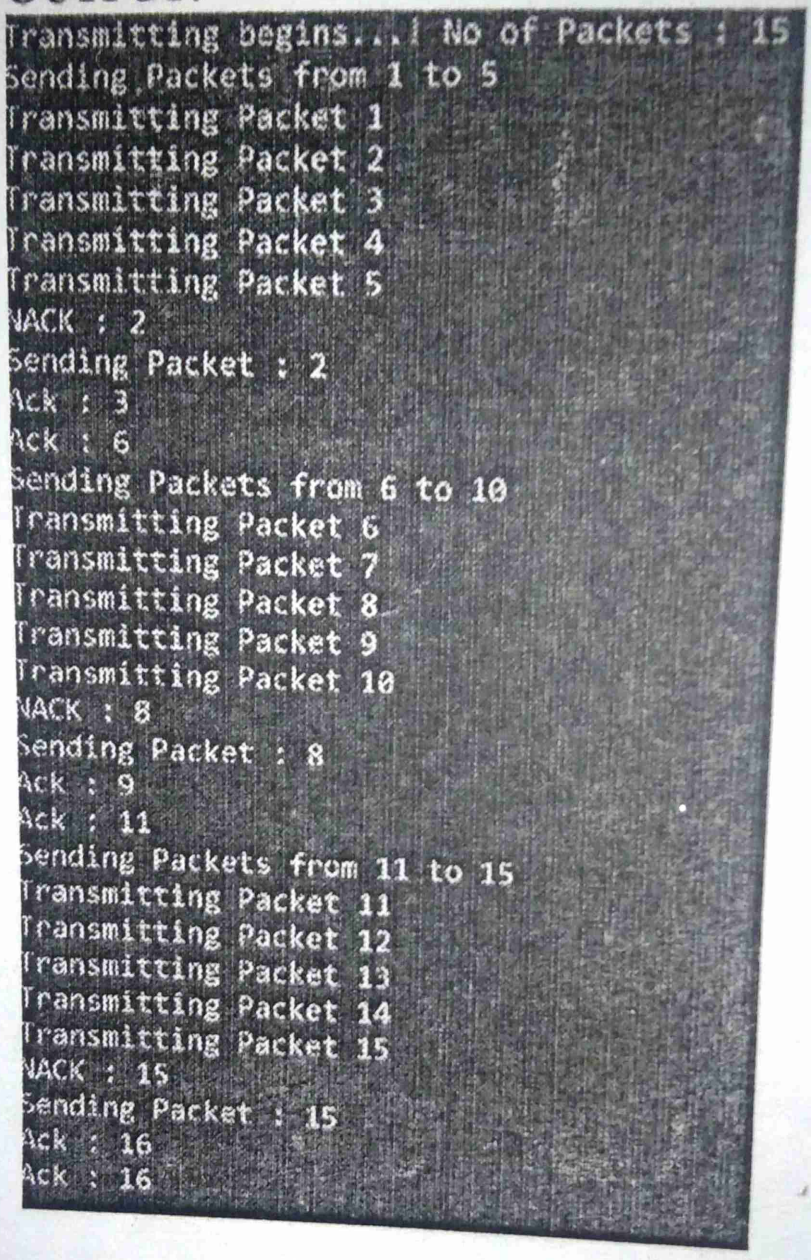
7) **AIM:** Write a program to implement Sliding Window Protocol for Selective repeat

DESCRIPTION: Selective Repeat protocol provides for sending multiple frames depending upon the availability of frames in the sending window, even if it does not receive acknowledgement for any frame in the interim. The maximum number of frames that can be sent depends upon the size of the sending window. Here, only the erroneous or lost frames are retransmitted, while the good frames are received and buffered. It uses two windows of equal size: a sending window that stores the frames to be sent and a receiving window that stores the frames receive by the receiver. The size is half the maximum sequence number of the frame.

SOURCE CODE:

```
#include <stdio.h>
#include<stdlib.h>
#define no_of_packets 15
#define window_size 5
int main()
{
        int p,i=1,a,w,nac,ack;
        a=no_of_packets;
        w=window_size;
        printf("Transmitting begins...! No of Packets : %d\n",a);
        while(i<=a)
        {
                printf("Sending Packets from %d to %d\n",i,w+i-1);
                for(p=i;p<w+i;p++)
                        printf("Transmitting Packet %d\n",p);
                nac = i+rand()%w;
                if(nac==i)
                {
                        printf("Ack : %d\n",w+i);
                        i=i+w;
                        continue;
                }
                printf("NACK : %d\n",nac);
                printf("Sending Packet : %d\n",nac);
                printf("Ack : %d\n",nac+1);
                printf("Ack : %d\n",i+w);
                i = i + w;
        }
        return 0;
}
```

OUTPUT:



```
Transmitting begins...! No of Packets : 15
Sending Packets from 1 to 5
Transmitting Packet 1
Transmitting Packet 2
Transmitting Packet 3
Transmitting Packet 4
Transmitting Packet 5
NACK : 2
Sending Packet : 2
Ack : 3
Ack : 6
Sending Packets from 6 to 10
Transmitting Packet 6
Transmitting Packet 7
Transmitting Packet 8
Transmitting Packet 9
Transmitting Packet 10
NACK : 8
Sending Packet : 8
Ack : 9
Ack : 11
Sending Packets from 11 to 15
Transmitting Packet 11
Transmitting Packet 12
Transmitting Packet 13
Transmitting Packet 14
Transmitting Packet 15
NACK : 15
Sending Packet : 15
Ack : 16
Ack : 16
```

8) **AIM:** Write a program to implement Stop and Wait Protocol

DESCRIPTION: Here stop and wait means, whatever the data that sender wants to send, he sends the data to the receiver. After sending the data, he stops and waits until he receives the acknowledgment from the receiver. It is a data-link layer protocol which is used for transmitting the data over the noiseless channels. It provides unidirectional data transmission which means that either sending or receiving of data will take place at a time. It provides flow-control mechanism but does not provide any error control mechanism. The idea behind the usage of this frame is that when the sender sends the frame then he waits for the acknowledgment before sending the next frame.

SOURCE CODE:

```
#include<stdio.h>
#include<stdlib.h>
int main()
{
        int i,n,r,a;
        n=5;
        printf("The No of Packets are : %d\n",n);
        for(i=1;i<=n;i++)
        {
                printf("The Packet Sent is %d\n",i);
                r=rand()%2;
                if(r==1)
                {
                        a = rand()%2;
                        if(a==1)
                        {
                                printf("Ack number : %d\n",i+1);
                        }
                        else
                        {
                                printf("NACK number : %d\n",i+1);
                                i--;
                        }
                }
                else
                {
                        printf("Time Out..! Resend Packet\n");
                        i--;
                }
        }
}
```

OUTPUT:

```
The No of Packets are : 5
The Packet Sent is 1
Ack number : 2
The Packet Sent is 2
Time Out..! Resend Packet
The Packet Sent is 2
Time Out..! Resend Packet
The Packet Sent is 2
NACK number : 3
The Packet Sent is 2
Time Out..! Resend Packet
The Packet Sent is 2
Time Out..! Resend Packet
The Packet Sent is 2
Time Out..! Resend Packet
The Packet Sent is 2
Time Out..! Resend Packet
The Packet Sent is 2
Ack number : 3
The Packet Sent is 3
Ack number : 4
The Packet Sent is 4
Ack number : 5
The Packet Sent is 5
NACK number : 6
The Packet Sent is 5
NACK number : 6
The Packet Sent is 5
NACK number : 6
The Packet Sent is 5
Time Out..! Resend Packet
The Packet Sent is 5
NACK number : 6
The Packet Sent is 5
Time Out..! Resend Packet
The Packet Sent is 5
NACK number : 6
The Packet Sent is 5
Time Out..! Resend Packet
The Packet Sent is 5
Ack number : 6
```

9) AIM: Write a program for congestion control using leaky bucket algorithm

DESCRIPTION: A state occurring in network layer when the message traffic is so heavy that it slows down network response time is called congestion. In leaky bucket algorithm, when host wants to send packet, packet is thrown into the bucket. The bucket leaks at a constant rate, meaning the network interface transmits packets at a constant rate. Bursty traffic is converted to a uniform traffic by the leaky bucket. In practice the bucket is a finite queue that outputs at a finite rate.

SOURCE CODE:

```
#include<stdio.h>
int main()
{
        int no_of_queries, storage, output_pkt_size;
        int input_pkt_size, bucket_size, size_left;
        storage = 0;
        no_of_queries = 4;
        bucket_size = 10;
        input_pkt_size = 4;
        output_pkt_size = 1;
        for(int i=0; i<no_of_queries;i++)
        {
                size_left = bucket_size - storage;
                if(input_pkt_size <= size_left)
                {
                        storage += input_pkt_size;
                        printf("Buffer size: %d Out of bucket size: %d\n", storage, bucket_size);
                }
                else
                {
                        printf("Packet loss: %d\n", (input_pkt_size-(size_left)));
                        storage=bucket_size;
                        printf("Buffer size: %d out of bucket size: %d\n", storage, bucket_size);
                }
                storage -= output_pkt_size;
        }
        return 0;
}
```

OUTPUT:

```
Buffer size: 4 Out of bucket size: 10
Buffer size: 7 Out of bucket size: 10
Buffer size: 10 Out of bucket size: 10
Packet loss: 3
Buffer size: 10 out of bucket size: 10
```

10) AIM: Write a program to implement Dijkstra's algorithm to compute the Shortest path through a graph

DESCRIPTION: Dijkstra's Algorithm basically starts at the node that you choose (the source node) and it analyzes the graph to find the shortest path between that node and all the other nodes in the graph. The algorithm keeps track of the currently known shortest distance from each node to the source node and it updates these values if it finds a shorter path. Once the algorithm has found the shortest path between the source node and another node, that node is marked as "visited" and added to the path. The process continues until all the nodes in the graph have been added to the path.

SOURCE CODE:

```
#include<limits.h>
#include<stdio.h>
#include<stdbool.h>
// Number of vertices in the graph
#define V 9
int minDistance(int dist[], bool sptSet[])
{
        int min=INT_MAX,min_index;
        for(int v=0;v<V;v++)
                if(sptSet[v]==false && dist[v]<=min)
                        min=dist[v],min_index=v;
        return min_index;
}
void printSolution(int dist[])
{
        printf("Vertex \t\t Distance from Source\n");
        for(int i=0;i<V;i++)
                printf("%d \t\t %d\n",i,dist[i]);
}
void dijkstra(int graph[V][V],int src)
{
        int dist[V];
        bool sptSet[V];
        for(int i=0;i<V;i++)
                dist[i]=INT_MAX,sptSet[i]=false;
        dist[src]=0;
        for(int count=0;count<V-1;count++)
        {
                int u=minDistance(dist,sptSet);
                sptSet[u]=true;
                for(int v=0;v<V;v++)
                        if(!sptSet[v] && graph[u][v] && dist[u]!=INT_MAX
                                && dist[u]+graph[u][v]<dist[v])
                                dist[v]=dist[u]+graph[u][v];
        }
        printSolution(dist);
}
int main()
{
        int graph[V][V]={{0,4,0,0,0,0,0,8,0},{4,0,8,0,0,0,0,11,0},
                                        {0,8,0,7,0,4,0,0,2},{0,0,7,0,9,14,0,0,0},
                                        {0,0,0,9,0,10,0,0,0},{0,0,4,14,10,0,2,0,0},
                                        {0,0,0,0,0,2,0,1,6},{8,11,0,0,0,0,1,0,7},
                                        {0,0,2,0,0,0,6,7,0}};
        dijkstra(graph,0);
```

```
    return 0;
}
```

OUTPUT:

```
Vertex                  Distance from Source
0                       0
1                       4
2                       12
3                       19
4                       21
5                       11
6                       9
7                       8
8                       14
```

11) AIM: Write a program to implement Distance vector routing algorithm by obtaining routing table at each node(Take an example subnet graph with weights indicating delay between nodes).

DESCRIPTION: In DVR, each router maintains a routing table. It contains only one entry for each router. It contains two parts – a preferred outgoing line to use for that destination and an estimate of time (delay). Tables are updated by exchanging the information with the neighbor's nodes. Each router knows the delay in reaching its neighbors (Ex – send echo request).Routers periodically exchange routing tables with each of their neighbors. It compares the delay in its local table with the delay in the neighbor's table and the cost of reaching that neighbor. If the path via the neighbor has a lower cost, then the router updates its local table to forward packets to the neighbor.

SOURCE CODE:

```
#include<stdio.h>
struct node
{
   unsigned dist[20];
   unsigned from[20];
}rt[10];
int main()
{
   int  costmat[20][20];
   int nodes,i,j,k,count=0;
   printf("Enter the number of nodes :");
   scanf("%d",&nodes);
   printf("Enter the cost matrix :\n");
   for(i=0;i<nodes;i++)
   {
      for(j=0;j<nodes;j++)
      {
         scanf("%d",&costmat[i][j]);
         costmat[i][i]=0;
         rt[i].dist[j]=costmat[i][j];
         rt[i].from[j]=j;
      }
   }
   do
   {
      count=0;
      for(i=0;i<nodes;i++)
      for(j=0;j<nodes;j++)
      for(k=0;k<nodes;k++)
      if(rt[i].dist[j]>costmat[i][k]+rt[k].dist[j])
      {
         rt[i].dist[j]=rt[i].dist[k]+rt[k].dist[j];
         rt[i].from[j]=k;
         count++;
      }
   }while(count!=0);
   for(i=0;i<nodes;i++)
   {
      printf("\nFor router %d :\n",i+1);
      for(j=0;j<nodes;j++)
            {
         printf("  Node %d via %d Distance %d\n",j+1,rt[i].from[j]+1,rt[i].dist[j]);
      }
   }
```

```
    return 0;
}
```

OUTPUT:

```
Enter the number of nodes :3
Enter the cost matrix :
0 2 7
2 0 1
7 1 0

For router 1 :
    Node 1 via 1 Distance 0
    Node 2 via 2 Distance 2
    Node 3 via 2 Distance 3

For router 2 :
    Node 1 via 1 Distance 2
    Node 2 via 2 Distance 0
    Node 3 via 3 Distance 1

For router 3 :
    Node 1 via 2 Distance 3
    Node 2 via 2 Distance 1
    Node 3 via 3 Distance 0
```

12) AIM: Write a program to implement Broadcast tree by taking subnet of hosts.

DESCRIPTION: This technique is widely used because it is simple and easy to understand. The idea this algorithm is to build a graph of the subnet with each node of the graph representing a router and arc of the graph representing a communication line. To choose a route between a given pair of routers algorithm just finds the broadcast between them on the graph

SOURCE CODE:

```
#include<stdio.h>
struct ed
{
        int v1,v2,w;
}
edj[20],temp;
int main()
{
        int i,j,n=0,s,d,par[20],s1,d1;
        printf("Enter no of edges :");
        scanf("%d",&n);
        for(i=0;i<n;i++)
        {
                printf("Enter the node1,node2,Weight :");
                scanf("%d %d %d",&edj[i].v1,&edj[i].v2,&edj[i].w);
                par[i]=0;
        }
        for(i=0;i<n;i++)
        {
                for(j=0;j<=i;j++)
                        if(edj[j].w>edj[i].w)
                        {
                                temp=edj[i];
                                edj[i]=edj[j];
                                edj[j]=temp;
                        }
        }
        printf("\nENTERED VALUES\n");
        for(i=0;i<n;i++)
        printf("%d %d %d\n",edj[i].v1,edj[i].v2,edj[i].w);
        printf("\nBROADCAST TREE FOR THE GIVEN GRAPH\n");
        for(i=0;i<n;i++)
        {
                s=edj[i].v1;
                d=edj[i].v2;
                s1=s;d1=d;
                while(par[s1]>0)
                        s1=par[s1];
                while(par[d1]>0)
                        d1=par[d1];
                if(s1!=d1)
                {
                        par[d]=s;
                        printf("%d %d %d\n",s,d,edj[i].w);
                }
        }
}
```

OUTPUT:

```
Enter no of edges :4
Enter the node1,node2,Weight :4 6 2
Enter the node1,node2,Weight :3 5 7
Enter the node1,node2,Weight :2 4 1
Enter the node1,node2,Weight :6 3 5

ENTERED VALUES
2  4  1
4  6  2
6  3  5
3  5  7

BROADCAST TREE FOR THE GIVEN GRAPH
2  4  1
4  6  2
6  3  5
3  5  7
```