PRACTICAL:- 1

AIM:- Study of basic network command and Network configuration commands. Ping, Traceroute, Ipconfig, Pathping, NSlookup, Netstat, Arp.

ANSWER:-

(ATTATCH SCREESHOTS AFTER EXECUTING EACH COMMAND IN PRACTICAL: 1.)

1. ping command:-

The PING is a virtual command line utility available on any operating system which tests if a networked device is reachable or not by using the special protocol called Internet Control Message Protocol with the help of request packet and reply packet.

2. tracert/traceroute command:-

The TRACEROUTE is useful to record the internet route between two distanced computer. Additionally, it helps us to find where the more transfer-time is consumed in the internal network.

3. netstat command:-

The NETSTAT command informs the users on which ports and addresses the corresponding connections are running and which ports are open for tasks. In conclusion, it delivers the basic statistics on all network activities.

4. arp command:-

The ARP command is used to view, display or modify the information in an Address Resolution Protocol (ARP) table. Further, it helps us to find out the duplicate IP addresses and invalid entries in an ARP table.

5. nslookup command:-

The NSLOOKUP is a network administration tool which is used to get the information from Domain Name System and used to troubleshoot DNS related problems. Also, it helps us to obtain IP address mapping by querying it.

6. ipconfig:-

The IPCONFIG is used to manage the assigned IP address of the computer. It displays the currently assigned IP address, subnet mask and default gateway addresses of the computer.

PRACTICAL:- 2

AIM:- List different types of network cables. Create understanding of straight through and cross over cable using twisted-pair cable and RJ-45 connector.

ANSWER:-

Different types of network cables :

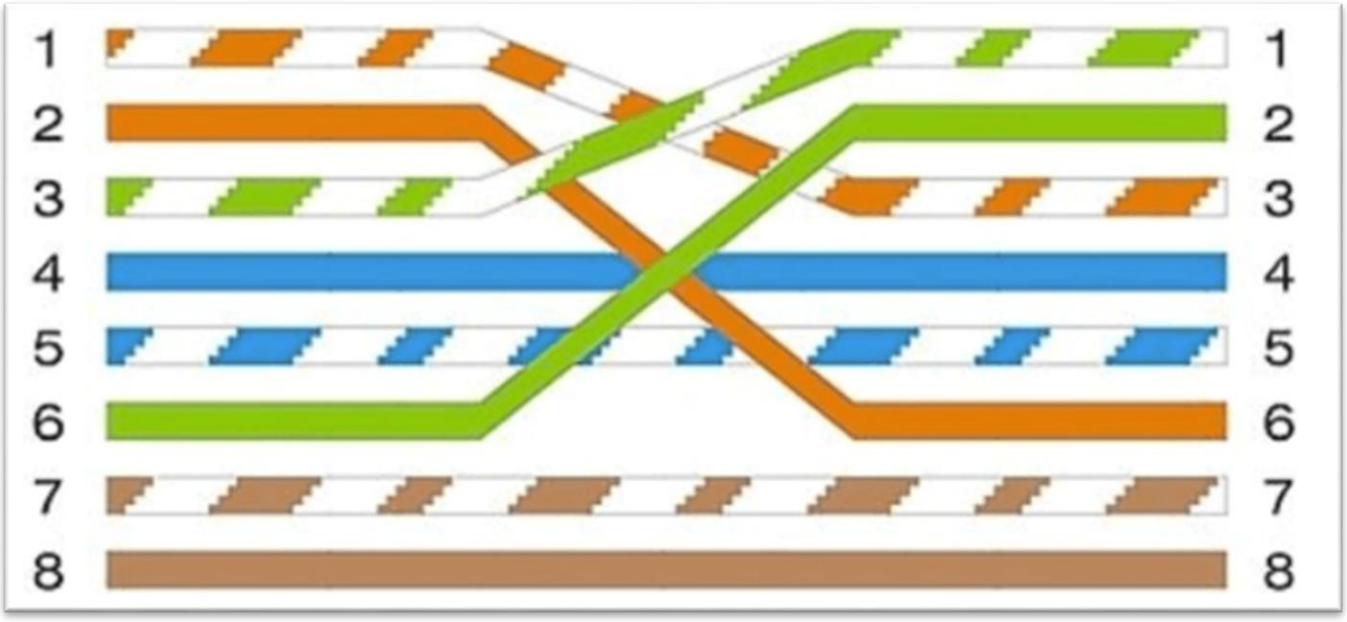
1. Console Cable
2. Copper Straight Through
3. Copper Cross-Over
4. Fiber Optic
5. Phone Cable
6. Coaxial Cable
7. Serial DCE and DTE

Straight Through Cable :

- Straight through cable is a type of CAT5 with RJ-45 connectors at each end, and each has the same pin out.
- Basically, the RJ45 connector is an Ethernet cable used for high speed wired connections between two devices, mainly used for data transmission.
- This type of cable is used in LAN (Local Area Network) and it uses the same color code throughout the LAN for consistency.
- The straight through cable is used to connect a computer or a network hub such as router.
- One can also use the straight through cable to connect a computer to a cable or LAN port.

Cross Over Cable :

- A crossover cable is a type of CAT5 used to connect two or more computing devices, mostly of the same types. E.g., two computers.
- The crossover cables are very much similar to the normal Ethernet cables with the slight difference of the order in which the wires are arranged.
- For instance, in this picture, the pin 1 is crossed with pin 3 and pin 2 is crossed with pin 6.



- When we want to establish the direct connection between two computing devices, we connect them with the crossover cable using Ethernet ports.

In conclusion, the straight through cables are mainly used for connecting the unlike devices whereas the crossover cables are mostly used for connecting like devices.

PRACTICAL:- 3

AIM:- Work on Classful Addressing in IPv4, Network Address, Broadcast Address in each Class.

ANSWER:-

Classful Addressing in IPv4 :

- In the classful addressing concept the available address space of IPv4 is divided into five classes namely A, B, C, D and E.
- The IPv4 addresses are expressed using the binary notation or dotted decimal notation or hexadecimal notation.
- The IPv4 addresses are represented using the 32 bit address.
- In IPv4 addresses of class A, B, C the first part of the address is considered as the Network id and the second part is called the host id.
- In class A the net id is defined by the first byte of the address and the rest of bytes defines the host id.
- In class B, the first two bytes of the address defines the network address and the rest two bytes defines the host id.
- In class C, the first three bytes defines the network address and the last byte defines the host id.
- However, this concept is replaced with the classless addressing.

Network Address :

- A network address is any logical or physical address that uniquely distinguishes a network node or device over a telecommunication network.
- It includes the several forms such as IP (Internet Protocol) address, MAC (Media Access Control) address and host address.
- The network address is always unique from the individual devices. For instance, the Wi-Fi of a computer and the LAN (Local Area Network) has the separate network addresses.
- The network address is a part of an IP address in a numeric way. For example, in the IP address 103.101.102.5, the network address is 103.101.102.

Broadcast Address :

- The broadcast address is a special Internet Protocol address used to transmit message and data packets to network systems.
- The successful data packet transmission is verified by the Network Administrators via broadcast addresses.
- When IP classes were designed, certain IP addresses were reserved for specific tasks and the broadcast addressing was designed to facilitate message broadcasting for all network devices.

PRACTICAL:- 4

AIM:- An organization is having size of 10 employees. The PC of all the employees are connected with each other in a single network using a switch. Create the topology and configure the devices in such a way that messages can be sent to each system using cisco packet tracer.

ANSWER:-

Topology :

- Topology defines the structure of the network of how all the components are interconnected to each other.

Star Topology :

- Star topology is an arrangement of the network in which every node is connected to the central hub, switch or a central computer.
- The central computer is known as a server, and the peripheral devices attached to the server are known as clients.
- The star topology is the most popular topology I network implementation.

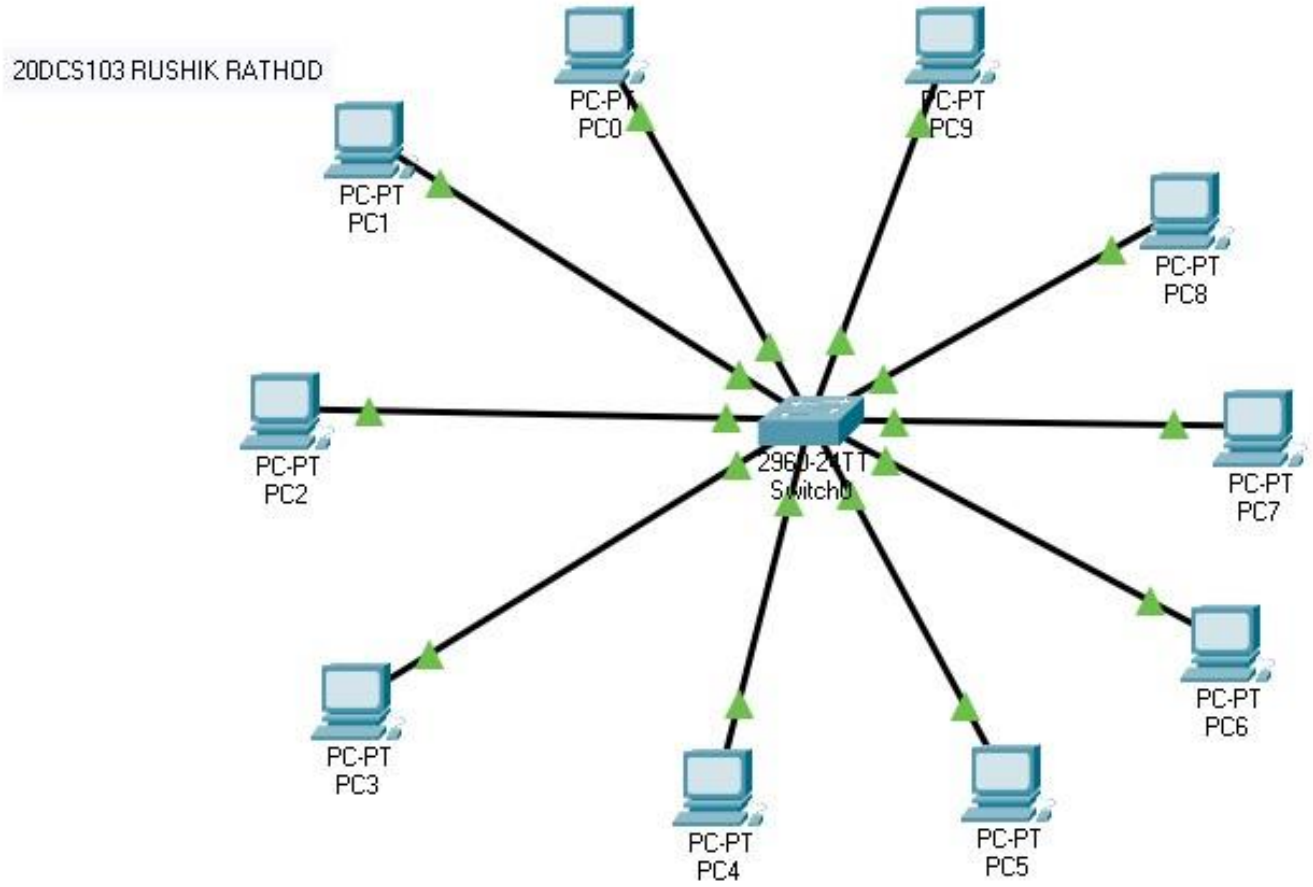
Advantages :

- Troubleshooting is easy
- Network control features can be easily implemented
- Failure in one cable does not affect the entire network
- Tools are cost effective
- High data speed

Disadvantages :

- If the central hub or switch goes down, then all the connected nodes will not be able to communicate with each other.
- Sometimes cable routing becomes difficult when a significant amount of routing is required.

Star Topology implementation in Cisco Packet Tracer :



PRACTICAL:- 5

AIM:- Bank of Baroda at Changa has implemented the loan department. All the computers of loan department are connected in closed loop format. Create the topology and configure the devices to analyze the network in cisco packet tracer.

ANSWER:-

Topology :

- Topology defines the structure of the network of how all the components are interconnected to each other.

Ring Topology :

- In the Ring topology, each device is linked to only its immediate neighbors either physically or logically.
- The node that receives the message from the previous computer will retransmit to the next node.
- The data flows in one direction, i.e., it is unidirectional.
- The data flows in a single loop continuously known as an endless loop.
- The data in a ring topology flow in a clockwise direction.
- The token passing is the most common access method of the ring topology, in which the token is passed from one node to another node.

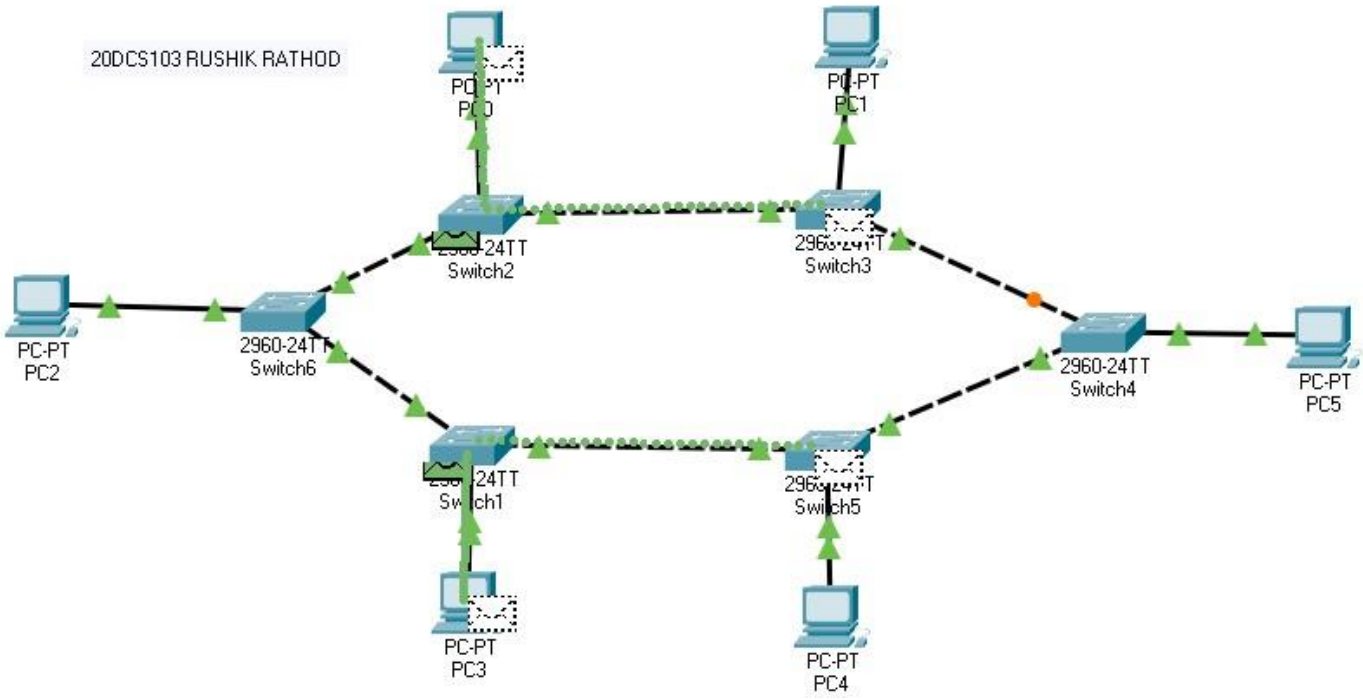
Advantages :

- Faulty device can be removed easily.
- Product availability.
- Installation cost is very low.
- More reliable because the communication system is not dependent on the single host computer.

Disadvantage :

- Difficult to determine the cable faults.
- The breakdown in one station leads to the failure of the overall network.
- It will slow down the network, if the new devices are added.
- The data communication is delayed, when the number of nodes increases.

Ring Topology implementation in Cisco Packet Tracer :



PRACTICAL:- 6

AIM:- An organization has configured all the systems in such a way that each system, has the direct connection to other system. Create the topology and analyze the network in cisco packet tracer.

ANSWER:-

Topology :

- Topology defines the structure of the network of how all the components are interconnected to each other.

Mesh Topology :

- Mesh technology is an arrangement of the network in which computers are interconnected with each other through various redundant connections.
- It does not contain the switch, hub or any central computer which acts as a central point of communication.
- The mesh topology is mainly used for WAN (Wide Area Network) implementations where communication failures are a critical concern.

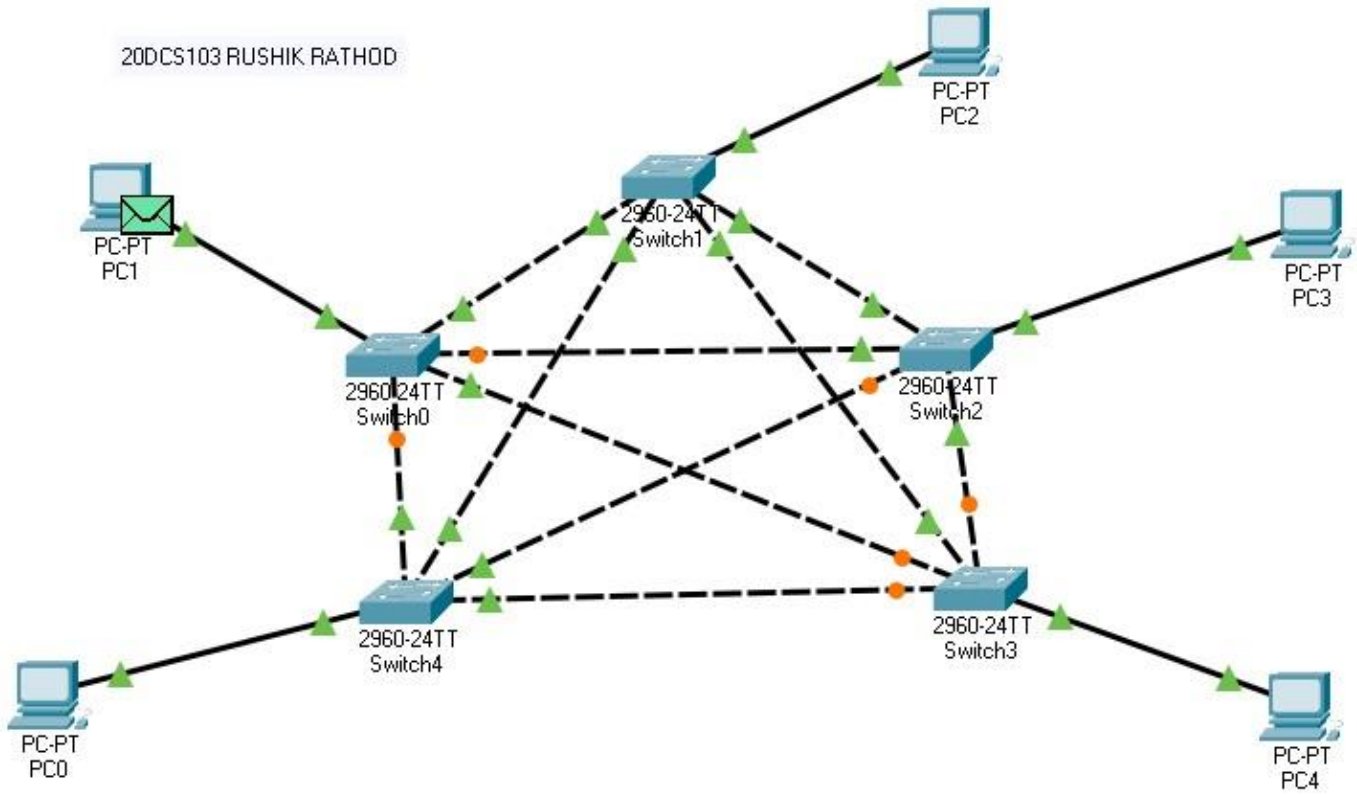
Advantages :

- If any link breakdown, it will not affect the other connections.
- Communication is very fast.
- Adding new devices would not disrupt the communication between other devices.

Disadvantages :

- Cost is very high.
- Difficult to maintain and manage.
- Low efficiency due to redundant connection.

Mesh Topology implementation in Cisco Packet Tracer :



PRACTICAL:- 7

AIM:- Bank of Baroda has implemented the new environment in which all the departments i.e. loan, cash, check is connected in a bus topology. The structure of Loan department is in closed loop format while the Cash department is in star topology. Create and configure the network architecture of bank in cisco packet tracer.

ANSWER:-

Topology :

- Topology defines the structure of the network of how all the components are interconnected to each other.

Hybrid Topology :

- A hybrid topology is a kind of network topology that is a combination of two or more network topologies, such as mesh topology, bus topology, and ring topology.
- Its usage and choice are dependent on its deployments and requirements like the performance of the desired network, and the number of computers, their location.

Types of hybrid topologies :

1. Star-Ring hybrid topology:

- The star topology and ring topology are used to create the structure of a star topology.
- Through a ring topology, two or more-star topologies are linked with the help of a wired connection. In the original ring topology, the data reaches a connecting node in this type of star topology.
- The method of data flow is unidirectional or bidirectional.

- In the original ring topology, the bidirectional method of data flow provides the surety that there is no effect on the whole network of data flow if one node of the original ring topology gets fails.

2. Star-Bus hybrid topology:

- A star-based bus topology is constructed by combining the two kinds of topologies that are star topology and bus topology.
- The bus topology allows two or more-star topologies to be linked to each other through wire connection.
- The original bus topology interrelates the distinct star topologies as it offers a backbone structure. That means it provides a wired connection.

3. Hierarchical network topology:

- The structure of hierarchical network topology, also known as a network tree topology, is designed like a hierarchical tree.
- Its minimum level like two to a maximum level, and the maximum is called to the root or parent node.
- The next level of the structure of the hierarchical network topology includes a child node, which returns the child node as level three.
- Thus, except for the top-level nodes, every node provides a maximum parent node as they are at a required level. The nodes at the minimum level, peripheral nodes function like a parent for other nodes. These kinds of a node are called as leaf nodes.

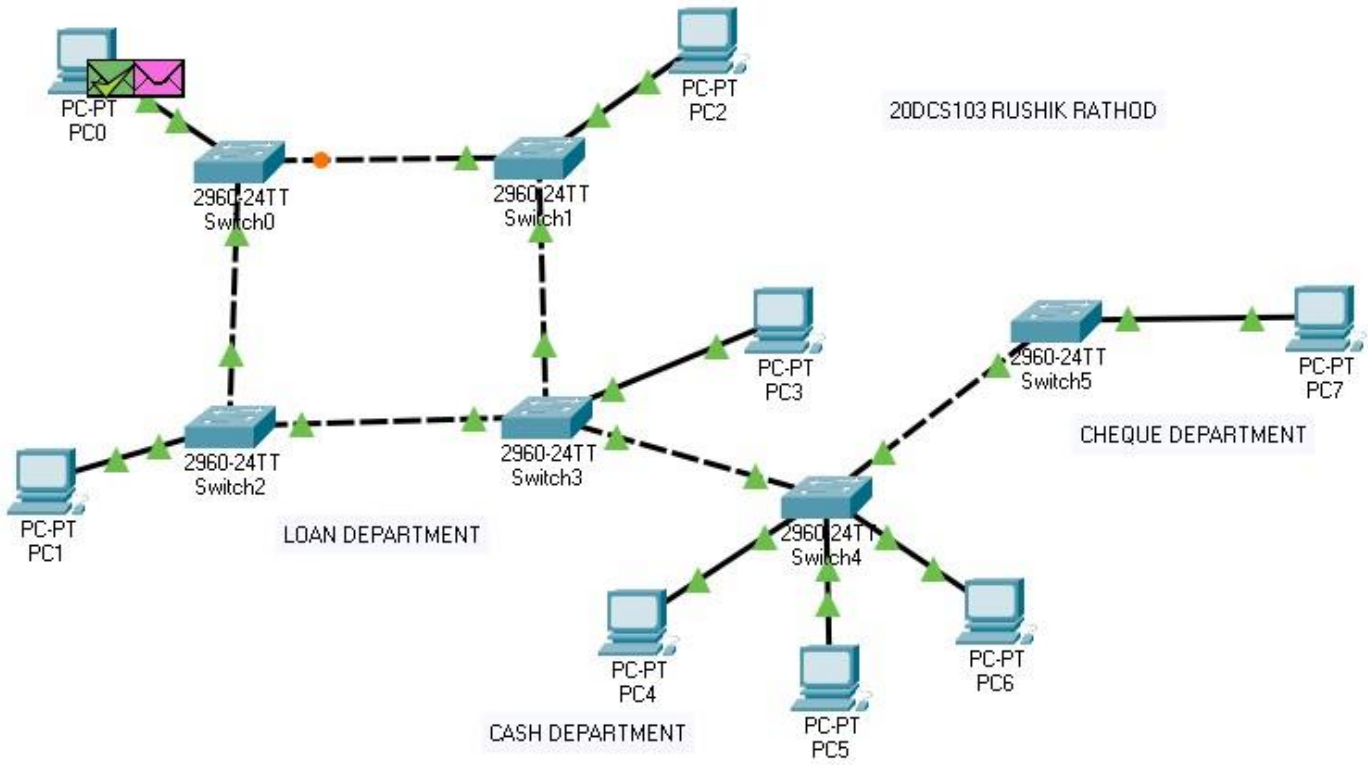
Advantages :

- It is more reliable as it has better fault tolerance.
- If a node gets damaged between the network, it is possible in this network to singled out the damaged node from rest of the network.
- Without disturbing existing architecture, it is very easy to extend the network size with the latest addition of new elements.

Disadvantages :

- Difficult to create and manage.
- Installation and configuration need to be very accurate.
- Most expensive.

Hybrid Topology implementation in Cisco Packet Tracer :



PRACTICAL:- 8

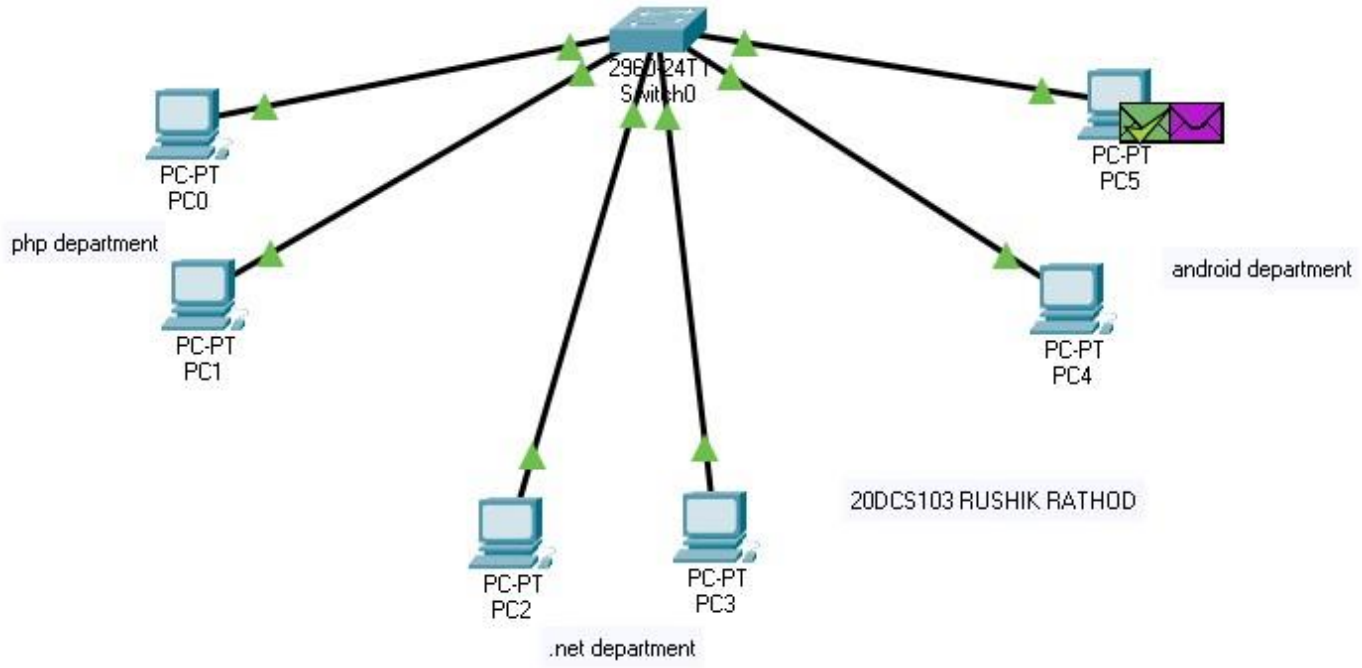
AIM:- An organization works on IT projects. It has mainly 3 departments i.e. php, .net and android. CEO of that organization wants to configure a single network but virtually divided into 3 department in such a way that the packets can travel or broadcasted within the same department only. Demonstrate the configuration of such network in cisco packet tracer.

ANSWER:-

Virtual LAN :

- Virtual LAN (VLAN) is a concept in which we can divide the devices logically on layer 2 (data link layer).
- Generally, layer 3 devices divides broadcast domain but broadcast domain can be divided by switches using the concept of VLAN.
- A broadcast domain is a network segment in which if a device broadcast a packet then all the devices in the same broadcast domain will receive it.
- The devices in the same broadcast domain will receive all the broadcast packet but it is limited to switches only as routers don't forward out the broadcast packet.
- To forward out the packets to different VLAN (from one VLAN to another) or broadcast domain, inter VLAN routing is needed. Through VLAN, different small size sub networks are created which are comparatively easy to handle.

VLAN (Virtual Local Area Network) implementation in Cisco Packet Tracer :



PRACTICAL:- 9

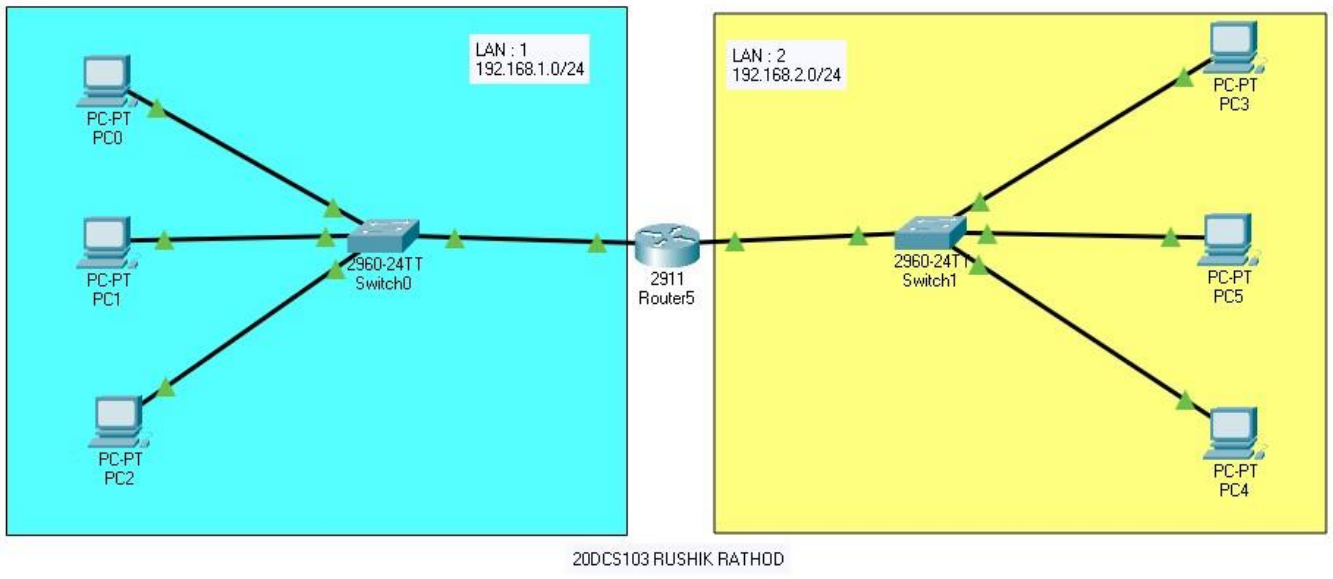
AIM:- Demonstrate the simple network configuration with a router that connects two local area network (LAN) segments using cisco packet tracer.

ANSWER:-

Router :

- A router is a device that connects two or more packet-switched networks or subnetworks.
- It serves two primary functions: managing traffic between these networks by forwarding data packets to their intended IP addresses, and allowing multiple devices to use the same Internet connection.
- There are several types of routers, but most routers pass data between LANs (Local Area Network) and WANs (Wide Area Network).
- A router assigns IP addresses to each device on the network and facilitates a shared Internet connection between all the connected devices.

Two network configuration with one router and it's implementation in Cisco Packet Tracer :



PRACTICAL:- 10

AIM:- Configure the client server architecture to access the resource from HTTP Server using the domain name. Also configure the DHCP server to provide IP addresses to the PCs connected in a network using cisco packet tracer.

ANSWER:-

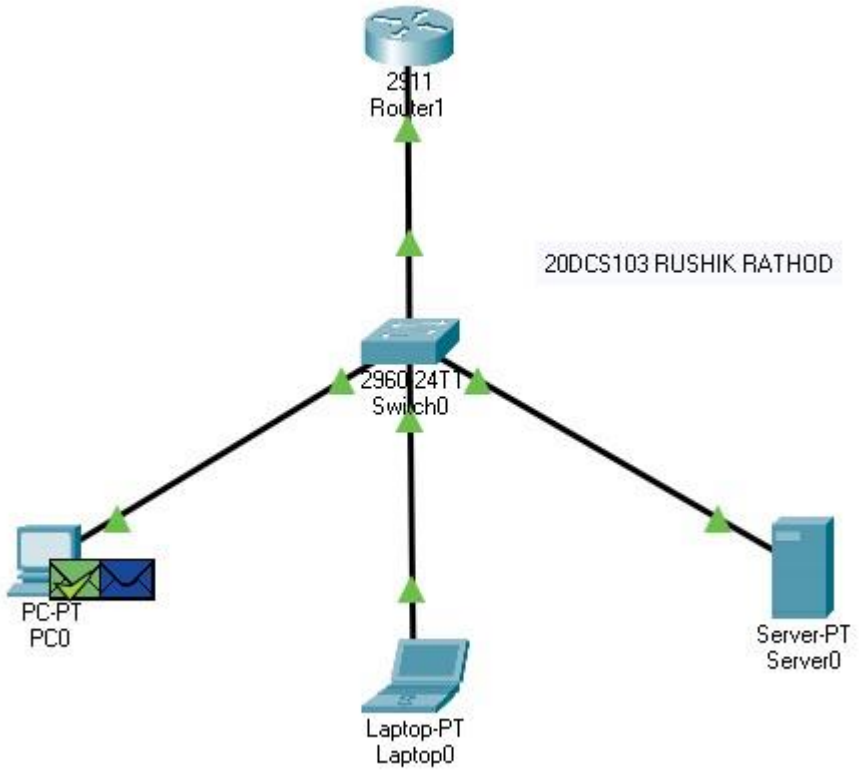
DHCP (Dynamic Host Configuration Protocol):

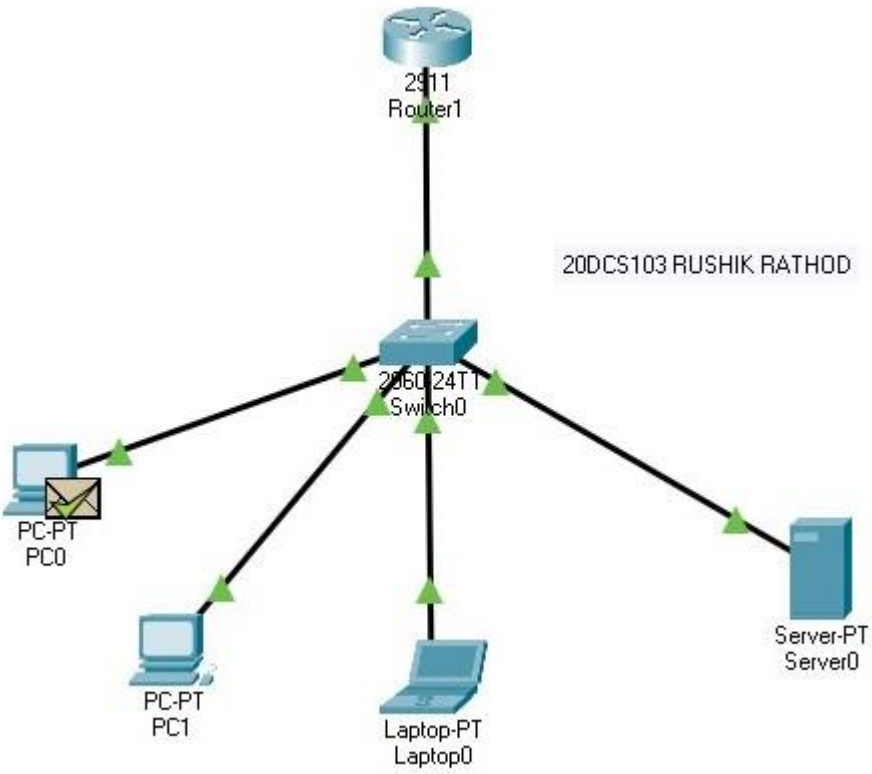
- A DHCP Server is a network server that automatically provides and assigns IP addresses, default gateways and other network parameters to client devices.
- It relies on the standard protocol known as Dynamic Host Configuration Protocol or DHCP to respond to broadcast queries by clients.
- A DHCP server automatically sends the required network parameters for clients to properly communicate on the network.
- Without it, the network administrator has to manually set up every client that joins the network, which can be cumbersome, especially in large networks.
- DHCP servers usually assign each client with a unique dynamic IP address, which change when the client's lease for that IP address has expired.

HTTP (Hyper Text Transfer Protocol):

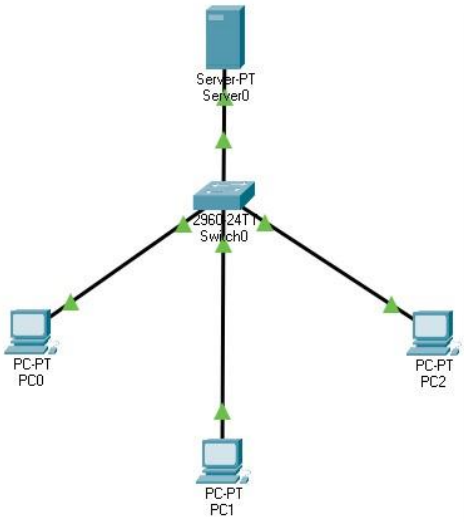
- The communications protocol used to connect to Web servers on the Internet or on a local network.
- The primary function of HTTP is to establish a connection with the server and send HTML pages back to the user's browser.
- It is also used to download data from the server either to the browser or to any requesting application that uses HTTP.

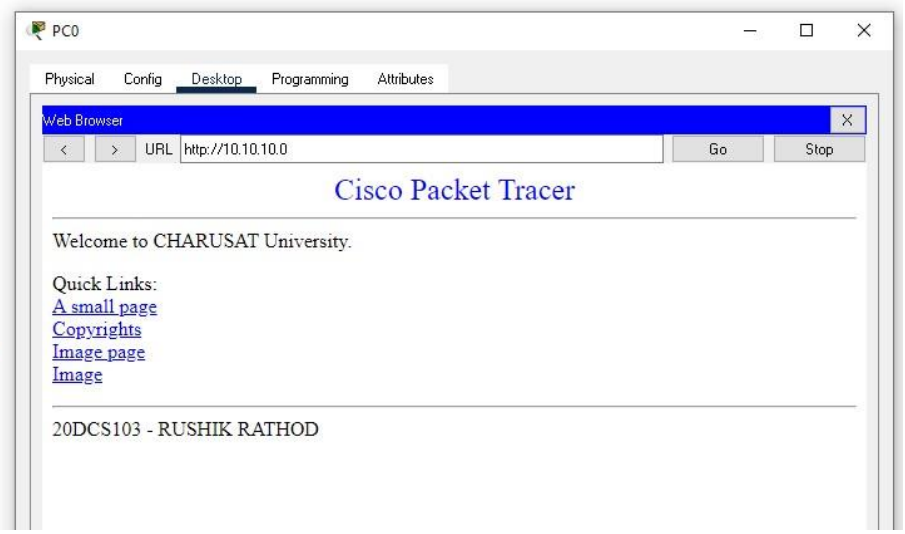
Implementation of DHCP server in Cisco Packet Tracer :





Implementation of HTTP server in Cisco Packet Tracer :





PRACTICAL:- 11

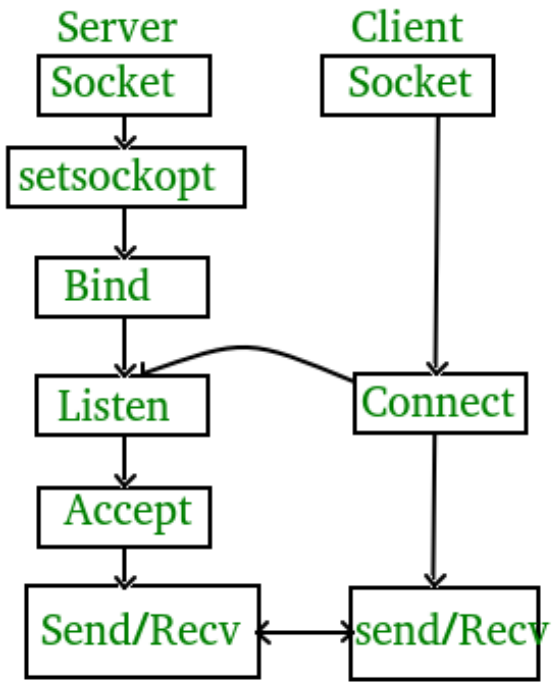
AIM:- Implement Client-server mechanism using socket programing in C.

ANSWER:-

Socket Programming:

- Socket programming is a way of connecting two nodes on a network to communicate with each other.
- One socket(node) listens on a particular port at an IP, while other socket reaches out to the other to form a connection.
- Server forms the listener socket while client reaches out to the server.

State diagram for server and client model:



How to create a socket ?

int sockfd = socket(domain, type, protocol)

sockfd:

- socket descriptor, an integer (like a file-handle)

domain:

- integer, communication domain e.g., AF_INET (IPv4 protocol) , AF_INET6 (IPv6 protocol)

type:

- communication type
- SOCK_STREAM: TCP(reliable, connection oriented)
- SOCK_DGRAM: UDP(unreliable, connectionless)

protocol:

- Protocol value for Internet Protocol(IP), which is 0. This is the same number which appears on protocol field in the IP header of a packet.(man protocols for more details)

setsockopt:

- This helps in manipulating options for the socket referred by the file descriptor sockfd.

bind:

- After creation of the socket, bind function binds the socket to the address and port number specified in addr(custom data structure).

listen:

- It puts the server socket in a passive mode, where it waits for the client to approach the server to make a connection.
- The backlog, defines the maximum length to which the queue of pending connections for sockfd may grow.
- If a connection request arrives when the queue is full, the client may receive an error with an indication of ECONNREFUSED.

accept:

- It extracts the first connection request on the queue of pending connections for the listening socket, sockfd, creates a new connected socket, and returns a new file descriptor referring to that socket.
- At this point, connection is established between client and server, and they are ready to transfer data.

Source Code (Server Side):

```
// Server side
#include <unistd.h>
#include <stdio.h>
#include <sys/socket.h>
#include <stdlib.h>
#include <netinet/in.h>
#include <string.h>
#define PORT 8080

int main(int argc, char const *argv[])
{
    int server_fd, new_socket, valread;
    struct sockaddr_in address;
    int opt = 1;
    int addrlen = sizeof(address);
    char buffer[1024] = {0};
    char *hello = "Hello from server";
```

```
    // Creating socket file descriptor
    if ((server_fd = socket(AF_INET, SOCK_STREAM, 0)) == 0)
    {
        perror("socket failed");
        exit(EXIT_FAILURE);
    }

    // Forcefully attaching socket to the port 8080
    if (setsockopt(server_fd, SOL_SOCKET, SO_REUSEADDR | SO_REUSEPORT, &opt,
sizeof(opt)))
    {
        perror("setsockopt");
        exit(EXIT_FAILURE);
    }

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

    // Forcefully attaching socket to the port 8080
    if (bind(server_fd, (struct sockaddr *)&address, sizeof(address))<0)
    {
        perror("bind failed");
        exit(EXIT_FAILURE);
    }

    if (listen(server_fd, 3) < 0)
    {
        perror("listen");
        exit(EXIT_FAILURE);
    }

    if ((new_socket = accept(server_fd, (struct sockaddr *)&address,
(socklen_t*)&addrlen))<0)
    {
        perror("accept");
        exit(EXIT_FAILURE);
    }
```

```
    valread = read( new_socket , buffer, 1024);
    printf("%s\n",buffer );
    send(new_socket , hello , strlen(hello) , 0 );
    printf("Hello message sent\n");
    printf("\n20DCS103 - RUSHIK RATHOD");
    return 0;
}
```

Source Code (Client Side):

```
// Client side
#include <stdio.h>
#include <sys/socket.h>
#include <arpa/inet.h>
#include <unistd.h>
#include <string.h>
#define PORT 8080

int main(int argc, char const *argv[])
{
    int sock = 0, valread;
    struct sockaddr_in serv_addr;
    char *hello = "Hello from client";
    char buffer[1024] = {0};

    if ((sock = socket(AF_INET, SOCK_STREAM, 0)) < 0)
    {
        printf("\n Socket creation error \n");
        return -1;
    }

    serv_addr.sin_family = AF_INET;
    serv_addr.sin_port = htons(PORT);
```

```
    // Convert IPv4 and IPv6 addresses from text to binary form
    if(inet_pton(AF_INET, "127.0.0.1", &serv_addr.sin_addr)<=0)
    {
        printf("\nInvalid address/ Address not supported \n");
        return -1;
    }

    if (connect(sock, (struct sockaddr *)&serv_addr, sizeof(serv_addr)) < 0)
    {
        printf("\nConnection Failed \n");
        return -1;
    }

    send(sock , hello , strlen(hello) , 0 );
    printf("Hello message sent\n");
    valread = read( sock , buffer, 1024);
    printf("%s\n",buffer );
    printf("\n20DCS103 - RUSHIK RATHOD");
    return 0;
}
```

PRACTICAL:- 12

AIM:- Implement cyclic redundancy check in c to understand error handling at data link layer.

ANSWER:-

Source code:

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

void main()
{
   int i, j, keyLength, msgLength;
   char data[100], key[30], temp[30], quotient[100], rem[30], key1[30];

   printf("\nEnter the data : ");
   gets(data);

   printf("\nEnter a key : ");
   gets(key);

   keyLength = strlen(key);
   msgLength = strlen(data);

   strcpy(key1, key);

   for (i = 0; i < keyLength - 1; i++)
   {
      data[msgLength + i] = '0';
   }
   for (i = 0; i < keyLength - 1; i++)
   {
      data[msgLength + i] = '0';
   }
```

```
for (i = 0; i < keyLength; i++)
{
   temp[i] = data[i];
}

for (i = 0; i < msgLength; i++)
{
   quotient[i] = temp[0];

   if (quotient[i] == '0')
   {
      for (j = 0; j < keyLength; j++)
      {
         key[j] = '0';
      }
   }
   else
   {
      for (j = 0; j < keyLength; j++)
      {
         key[j] = key1[j];
      }
   }

   for (j = keyLength - 1; j > 0; j--)
   {
      if (temp[j] == key[j])
      {
         rem[j - 1] = '0';
      }
      else
      {
         rem[j - 1] = '1';
      }
   }
   rem[keyLength - 1] = data[i + keyLength];
   strcpy(temp, rem);
}
```

```
    strcpy(rem, temp);

    printf("\nQuotient : ");
    for (i = 0; i < msgLength; i++)
    {
       printf("%c", quotient[i]);
    }

    printf("\n\nRemainder : ");
    for (i = 0; i < keyLength - 1; i++)
    {
       printf("%c", rem[i]);
    }

    printf("\n\nCode word transmitted to the receiver : ");
    for (i = 0; i < msgLength; i++)
    {
       printf("%c", data[i]);
    }

    for (i = 0; i < keyLength - 1; i++)
    {
       printf("%c", rem[i]);
    }
    printf("\n\n20DCS103 - RUSHIK RATHOD\n\n");
}
```

Output:

```
Enter the data : 1101011011

Enter a key : 10011

Quotient : 1100001010

Remainder : 1110

Code word transmitted to the receiver : 11010110111110

20DCS103 - RUSHIK RATHOD

PS E:\DCN Practical SHP\Practical_12>
```

Thank You !