B.M.S. COLLEGE OF ENGINEERING BENGALURU
Autonomous Institute, Affiliated to VTU

Lab Record

Computer Networks – 23CS5PCCON

Submitted in partial fulfillment for the 5th Semester Laboratory

Bachelor of Engineering
in
Computer Science and Engineering

Submitted by:

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(1BM23CS091)

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August 2025-December 2025

B.M.S. COLLEGE OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the Computer Networks (23CS5PCCON) laboratory has been carried out by DHRUHI ATYKAR (1BM23CS091) during the 5th Semester August 2025-December 2025.

Signature of the Faculty Incharge:

Sarala D V
Assistant Professor

Department of Computer Science and Engineering

Table of Contents

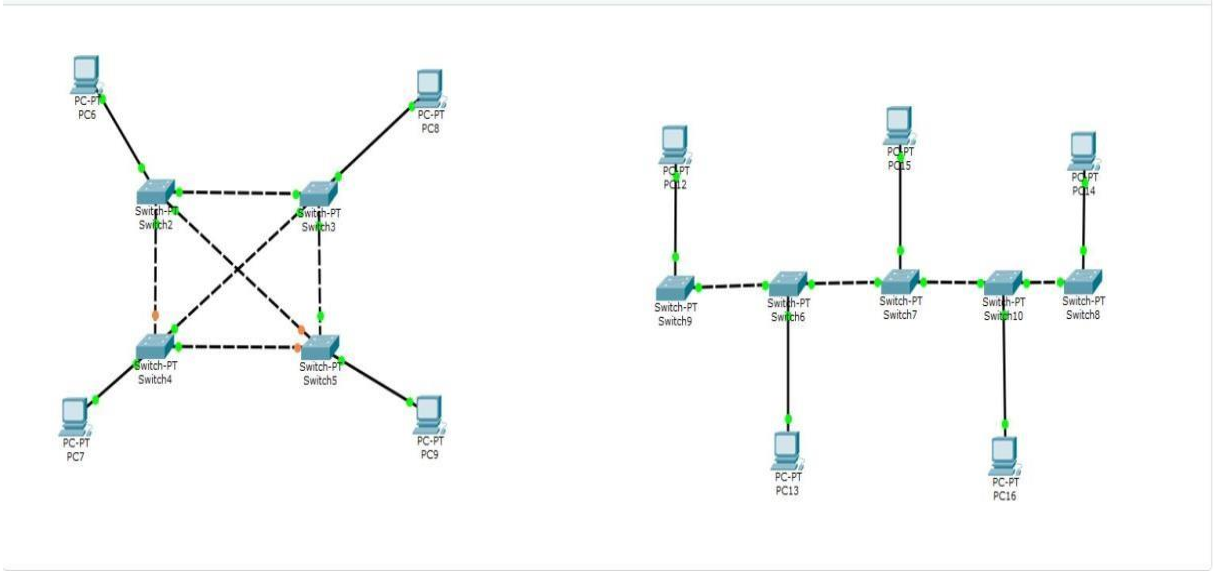
PART - A	
Serial No.	**Name of Experiment**
1.	Create a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices and demonstrate ping messages.
2.	Configure DHCP within a LAN and outside LAN.
3.	Configure Web Server, DNS within a LAN.
4.	Configure IP address to routers in packet tracer. Explore the following messages: ping responses, destination unreachable, request timed out, reply.
5.	Configure default route, static route to the Router.
6.	Configure RIP routing Protocol in Routers.
7.	Configure OSPF routing protocol.
8.	To construct a VLAN and make the PC's communicate among a VLAN.
9.	To construct a WLAN and make the nodes communicate wirelessly.
10.	Demonstrate the TTL/ Life of a Packet.
11.	To understand the operation of TELNET by accessing the router in the server room from a PC in the IT office.
12.	To construct a simple LAN and understand the concept and operation of Address Resolution Protocol (ARP).

PART – B	
Serial No.	**Name of Experiment**
1.	Write a program for congestion control using Leaky bucket algorithm.
2.	Using TCP/IP sockets, write a client-server program to make the client send the file name and the server to send back the contents of the requested file if present.
3.	Using UDP sockets, write a client-server program to make the client send the file name and the server to send back the contents of the requested file if present.
4.	Write a program for error detecting code using CRC-CCITT (16-bits).

PART - A

Program 1: Create a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices and demonstrate ping messages.

Network diagram:

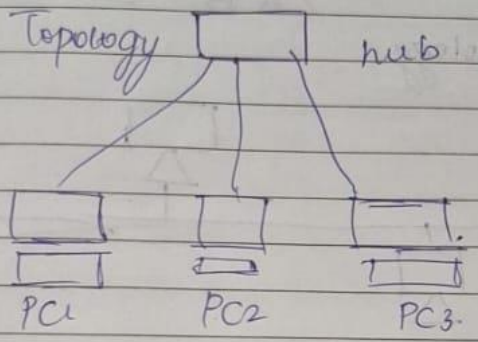


Configuration:

LAB-1

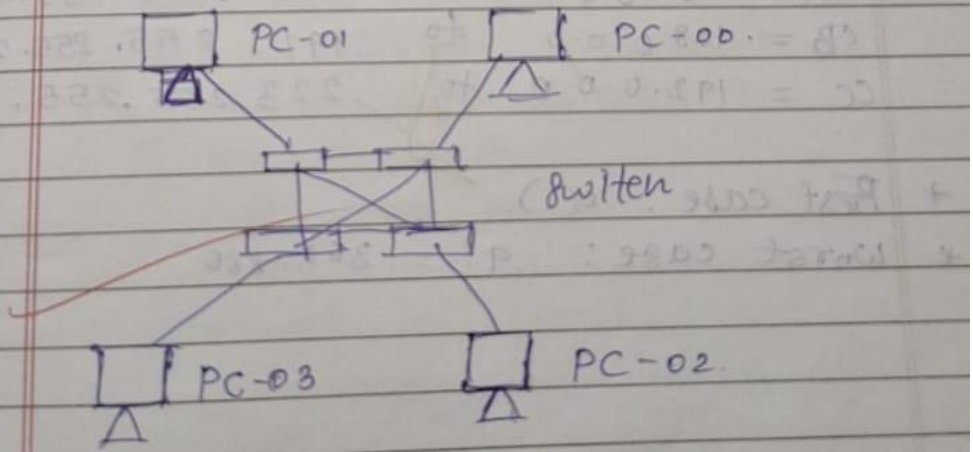
1. Create a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices and demonstrate a ping message.

* Hub Topology



Devices	IP Address
PC0	192.168.1.1
PC1	192.168.1.2
PC2	192.168.1.3

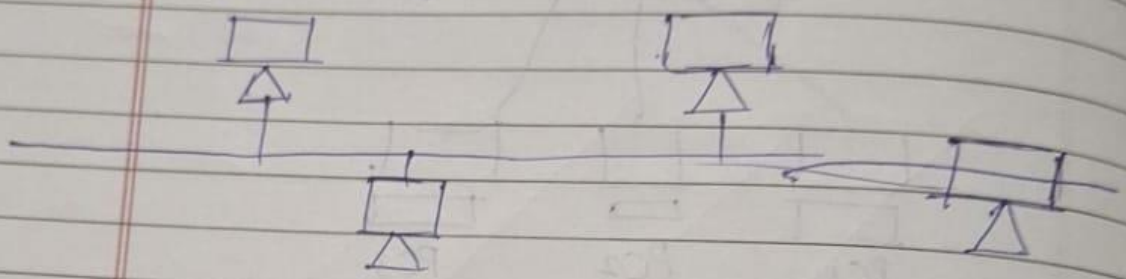
* Mesh Topology



Devices	IP Address
PC-00	192.168.1.1
PC-01	192.168.1.2
PC-02	192.168.1.3
PC-03	192.168.1.4

∠AB - 2

* Bus topology



Devices	IP Address
PC-00	192.168.1.5
PC 01	192.168.1.6
PC 02	192.168.1.7
PC 03	192.168.1.8

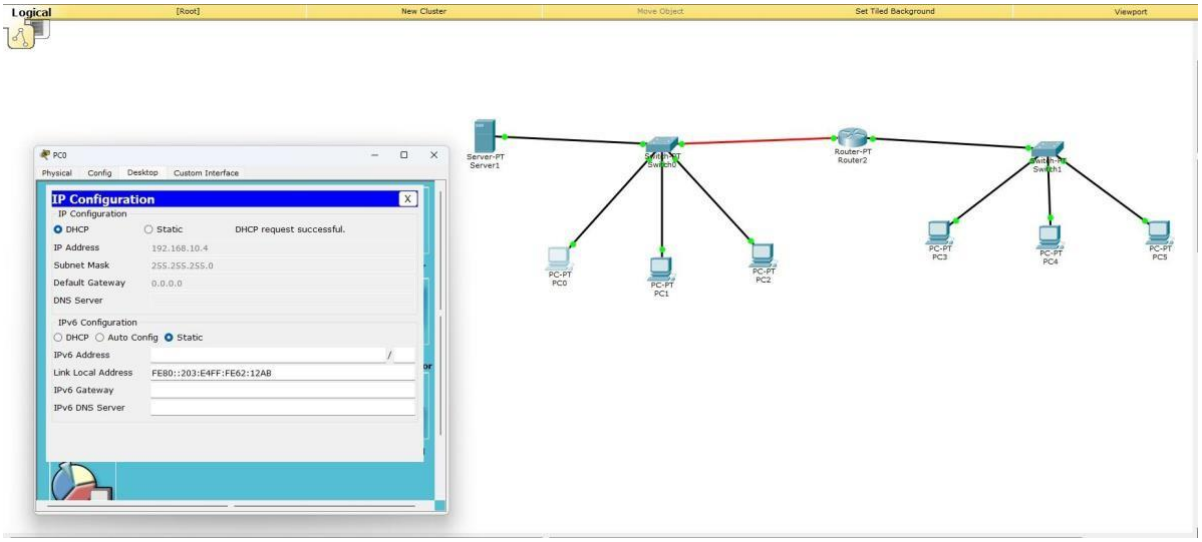
Subnet

CA = 1.0.0.0 to 126.255.255.255
CB = 128.0.0.0 to 191.255.255.255
CC = 192.0.0.0 to 223.255.255.255

* Best case: O(1)
* Worst case: 91 = 362,880

Program 2: Configure DHCP within a LAN and outside LAN.

Network diagram:



Configuration:

Q) Configure ~~DHCP within a lan & outside a lan.~~

Q) Configure DHCP with a LAN & outside a LAN

IP addrss : 192.168.10.2

Subnet Mask: 255.0.0.0

Default Gateway : 0.0.0.0

(3) Enter

enable

conft

int Fa0/0

ip addrss 192.168.10.1 255.255.255.0

no shutdown

do write memory

int Fa1/0

ip addrss 192.168.20.1 255.255.255.0

ip helper-addrss 192.168.10.2

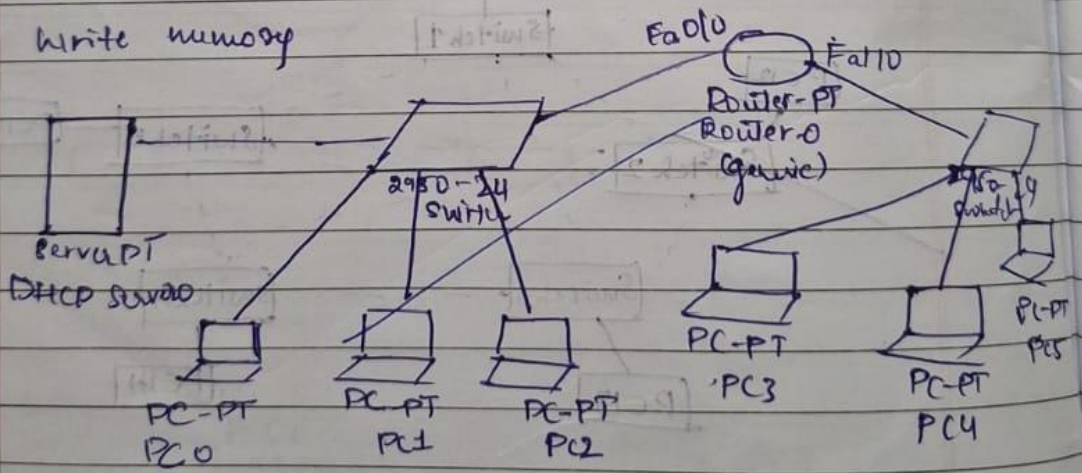
no shutdown

do write memory

exit

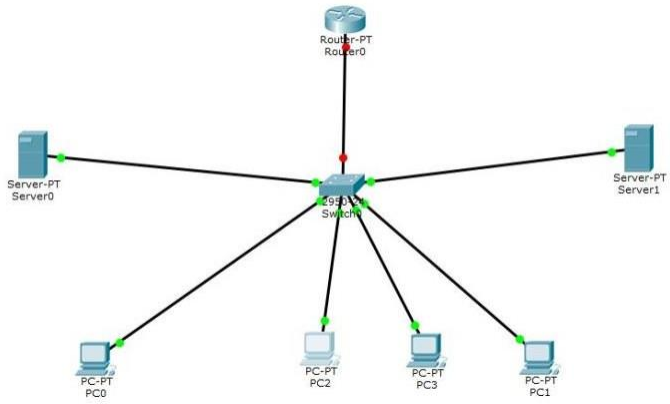
exit

write memory



Program 3: Configure Web Server, DNS within a LAN.

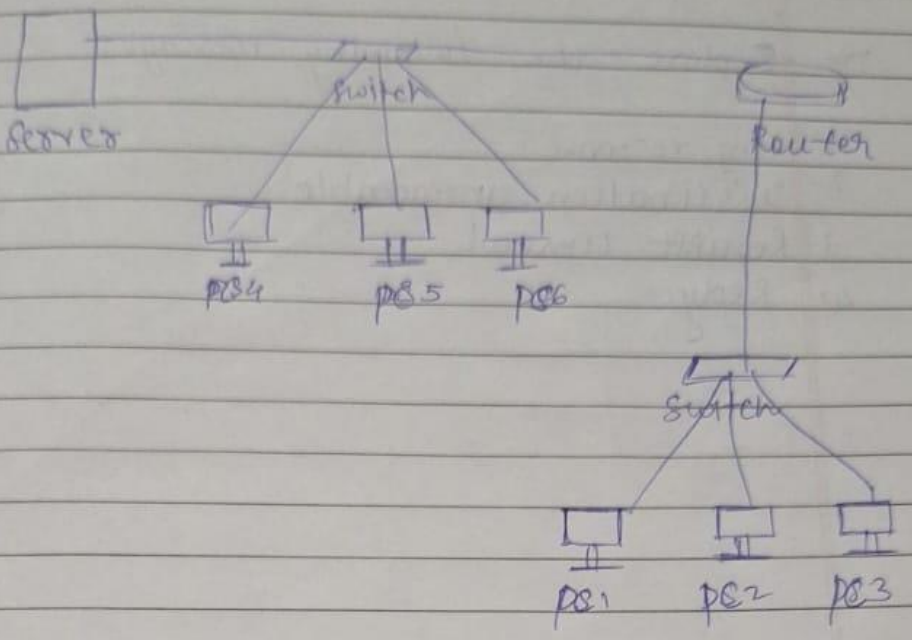
Network diagram:



Configuration:

LAB 3

3. Configure DHCP with a



* Route

CLI

Router > enable

config t

int FA 0/0

ip address 192.168.10.1.
255.255.255.0

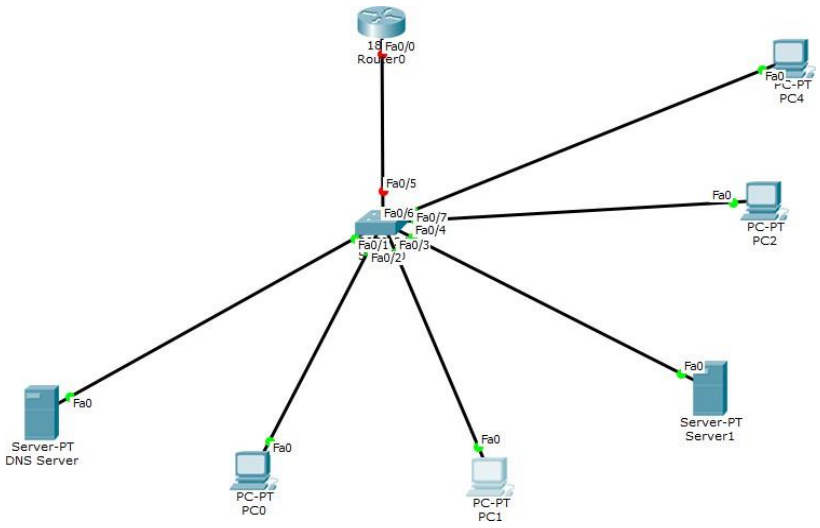
no shutdown

do write memory

exit

Program 4: Configure IP address to routers in packet tracer. Explore the following messages: ping responses, destination unreachable, request timed out, reply.

Network diagram:



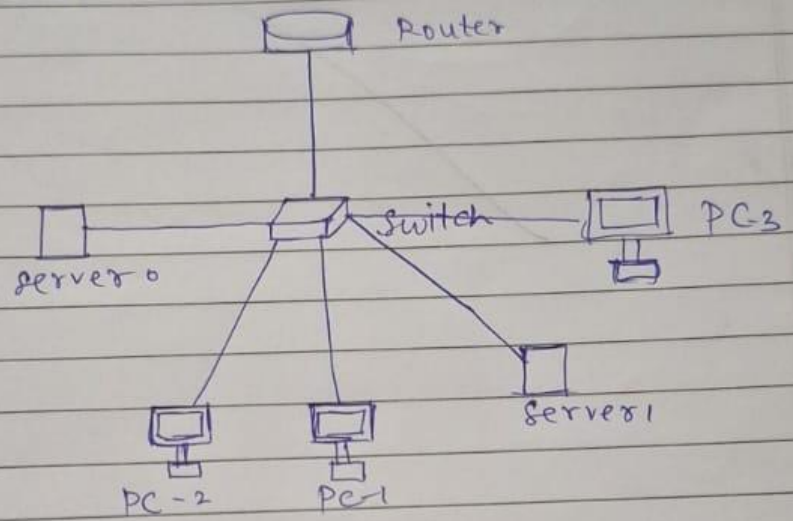
Configuration:

Bafna Gold
Date: Page:

CN Lab - 4

* Configure IP address
Explore the following messages.

1. Ping response
2. Destination unreachable
3. Request timeout
4. Reply



1. DNS Server
   - Service DNS
     name: www.letslearn.com
     address: 192.168.1.2
     type: record → Add

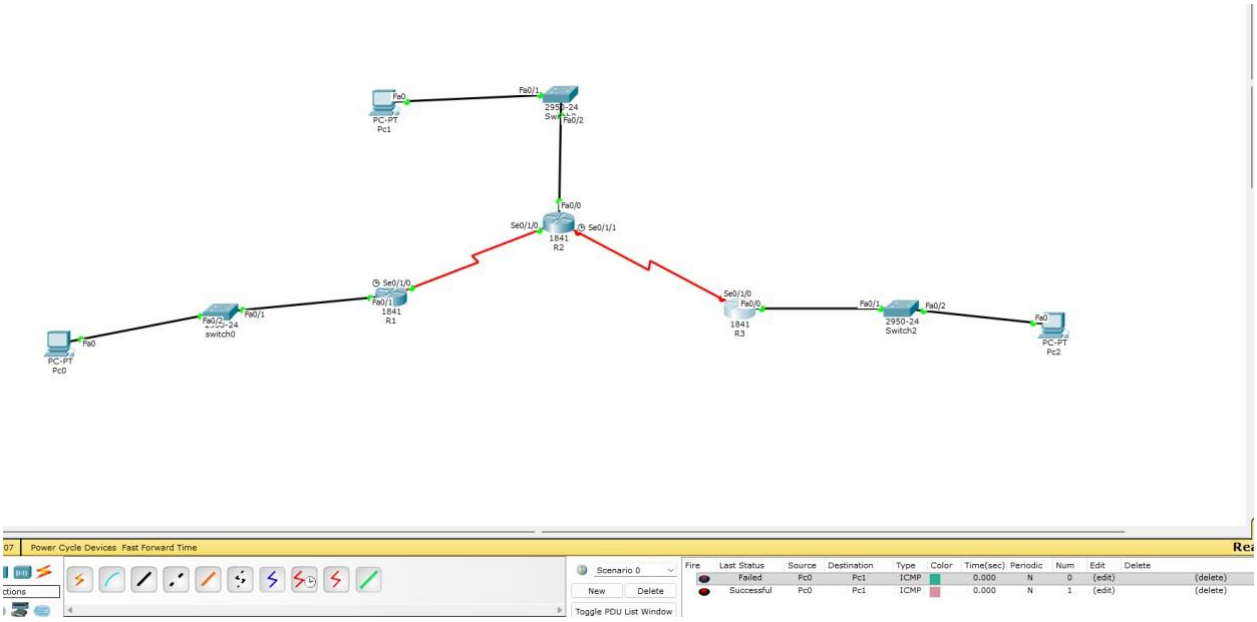
↳ services → HTTP
helloworld.html → edit → change message

IP configuration of PC 0

PC0	IP address
PC0	192.168.1.2
PC1	192.168.1.5
PC2	192.168.1.6

Program 5: Configure default route, static route to the Router.

Network diagram:



Configuration:

17/9/25

LAB-5.

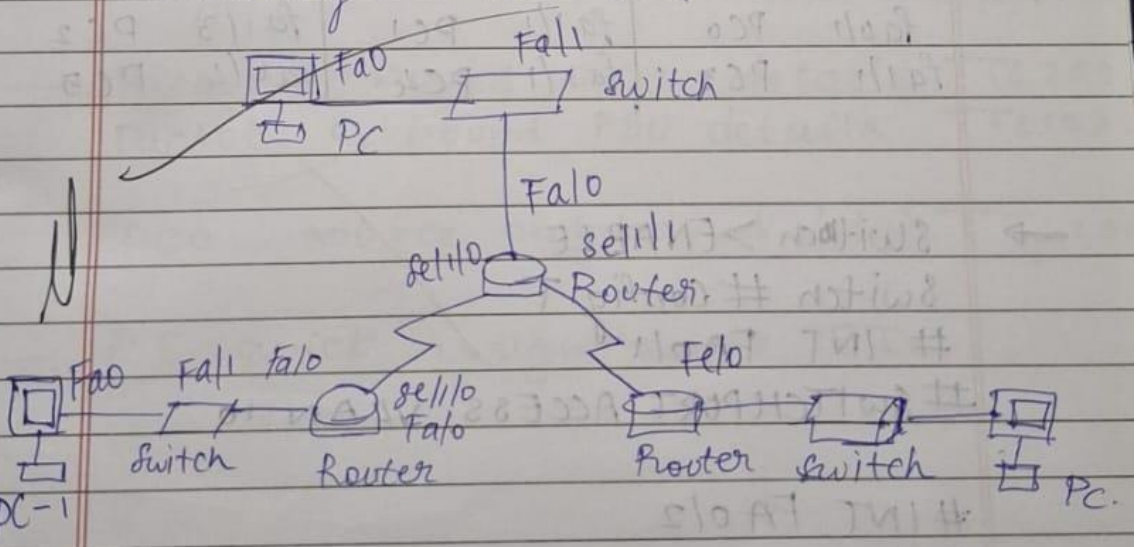
Bafna Gold

* Configure IP V4 static and default routing

* Router > enable
Router # config t
int s0/1/0
ip address 172.16.1.1 255.255.255.252
no shutdown

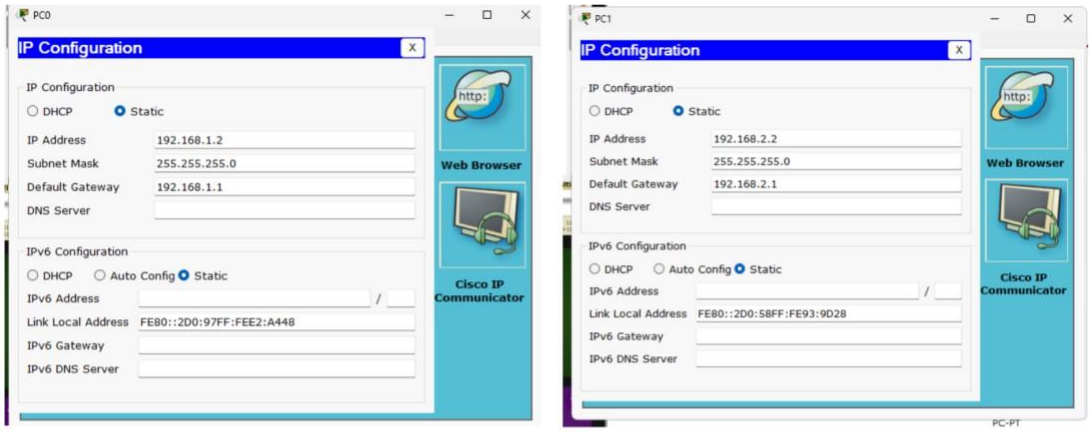
exit
int Fa0/0
ip address 152.169.10.1 255.255.255.0
no shutdown
state to up.

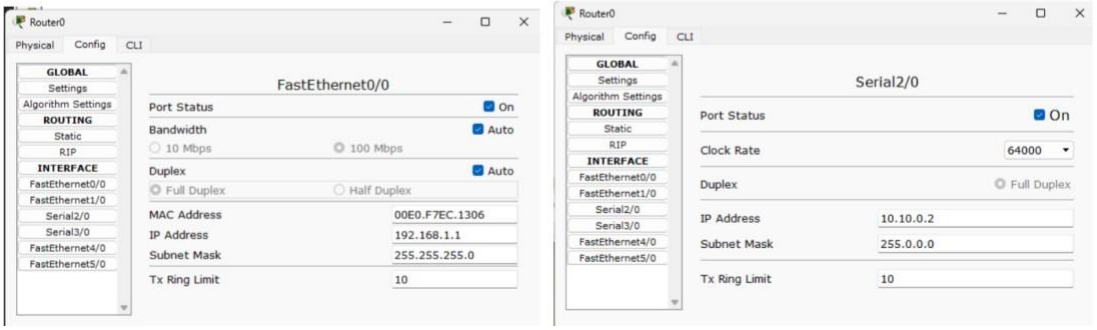
Router (config) # hostname r3
r3 (config) # int s0/1/0

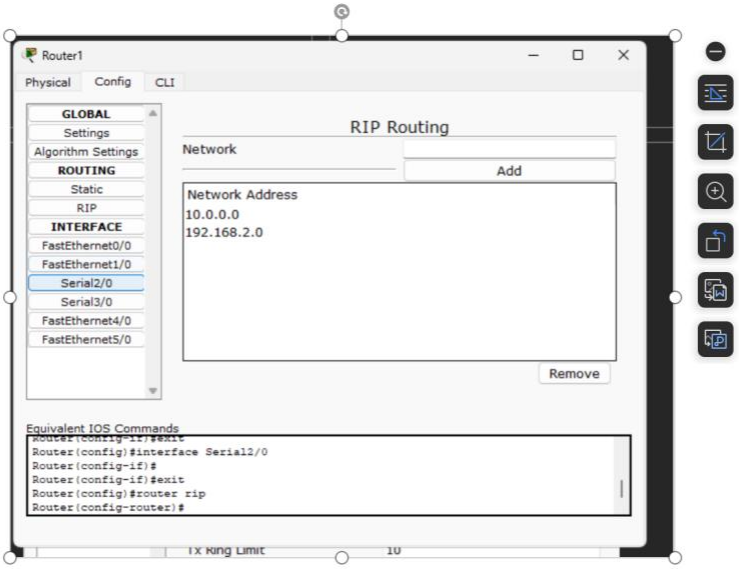


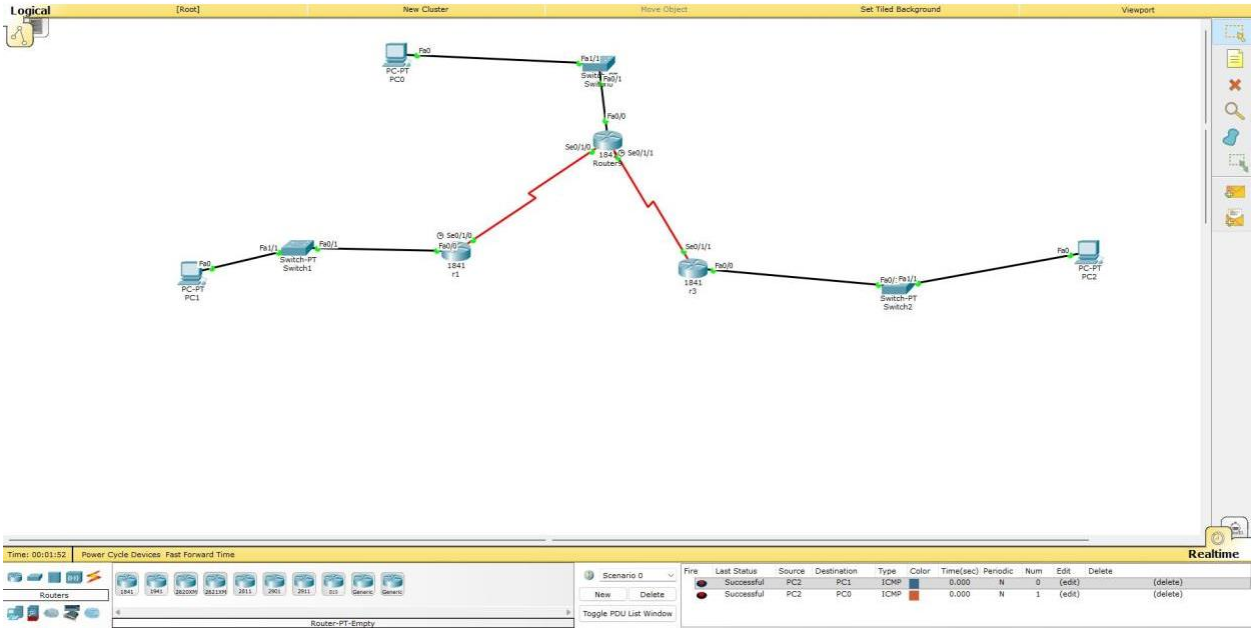
Program 6: Configure RIP routing Protocol in Routers.

Network diagram:





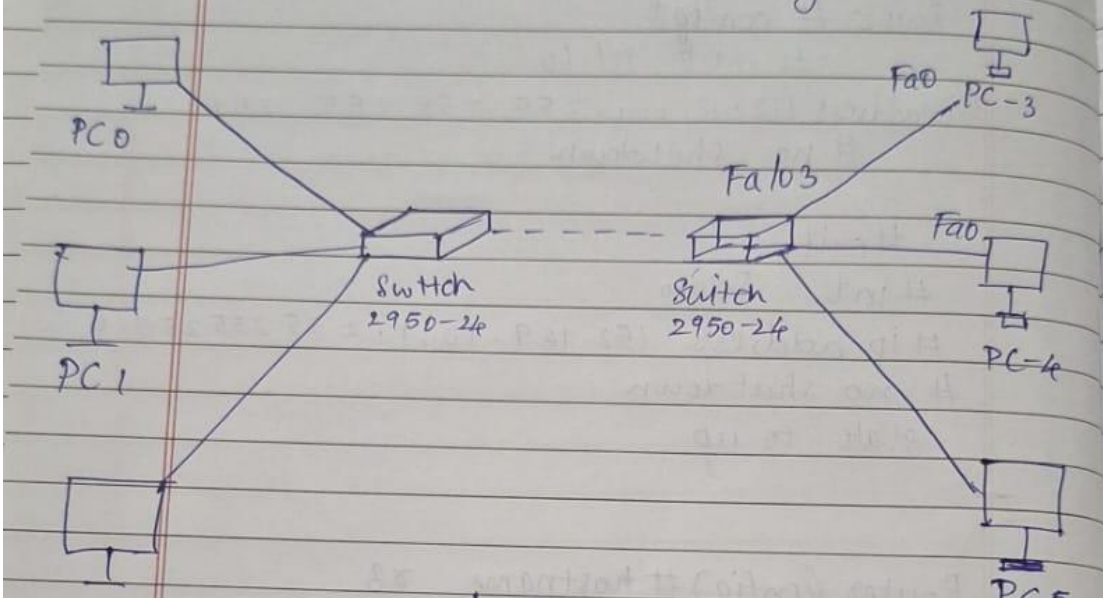




Configuration:

* LAB - 6

— To construct a VLAN and make the PC's communication among VLAN.



VLAN 10		VLAN 20		VLAN 30	
fa0/1	PC0	fa1/1	PC1	fa1/3	PC2
fa1/1	PC3	fa2/1	PC4	fa1/4	PC5

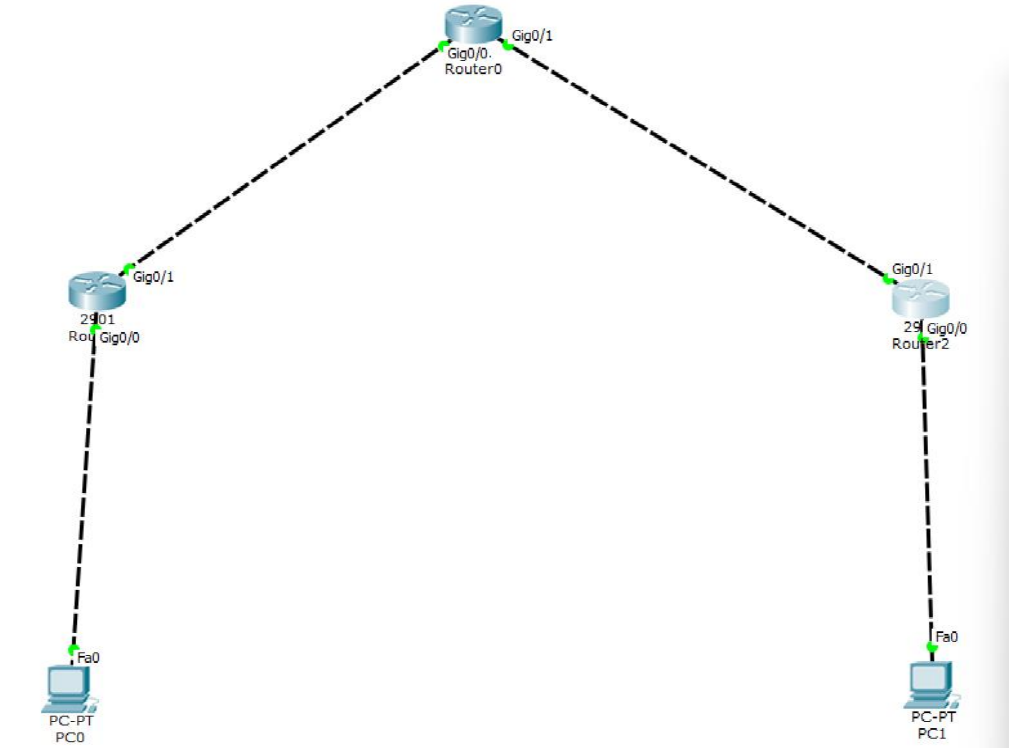
→ Switch >ENABLE
Switch # Config T
INT FA0/1
SWITCHPORT ACCESS VLAN 10

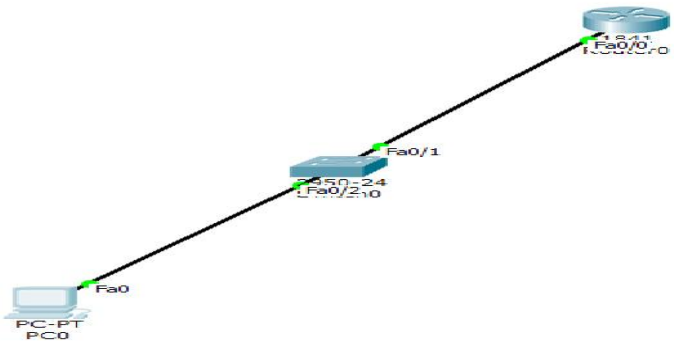
INT FA0/2
SWITCHPORT ACCESS VLAN 20

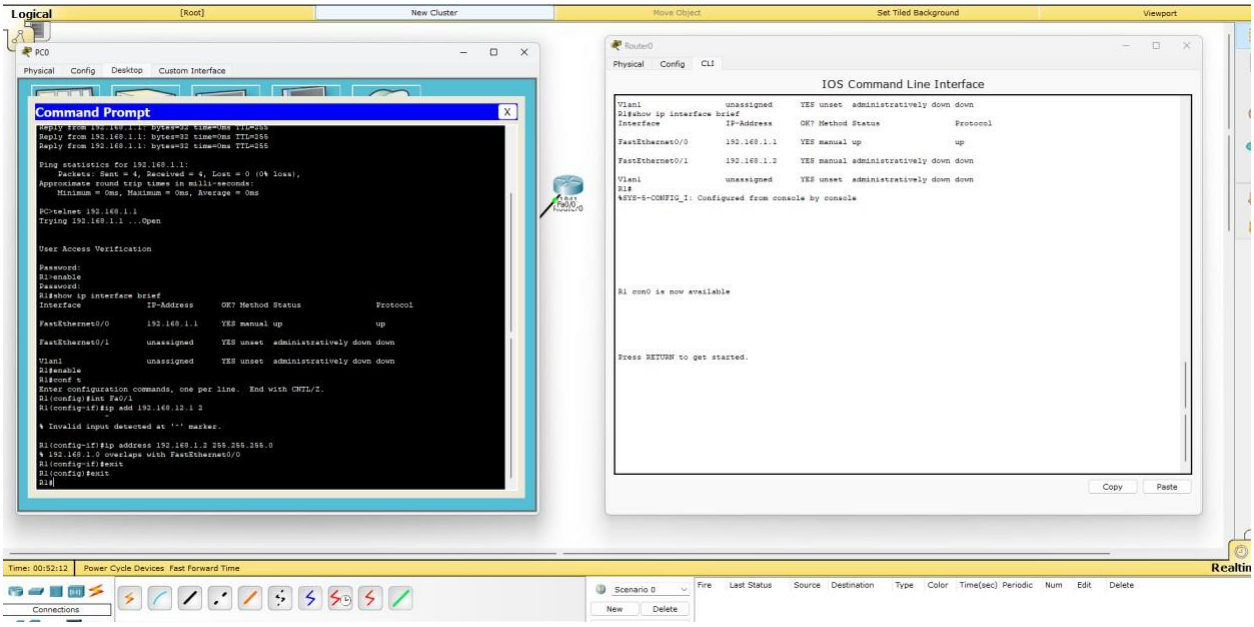
INT FA0/3
SWITCHPORT ACCESS VLAN 30

Program 7: Configure OSPF routing protocol.

Network diagram:

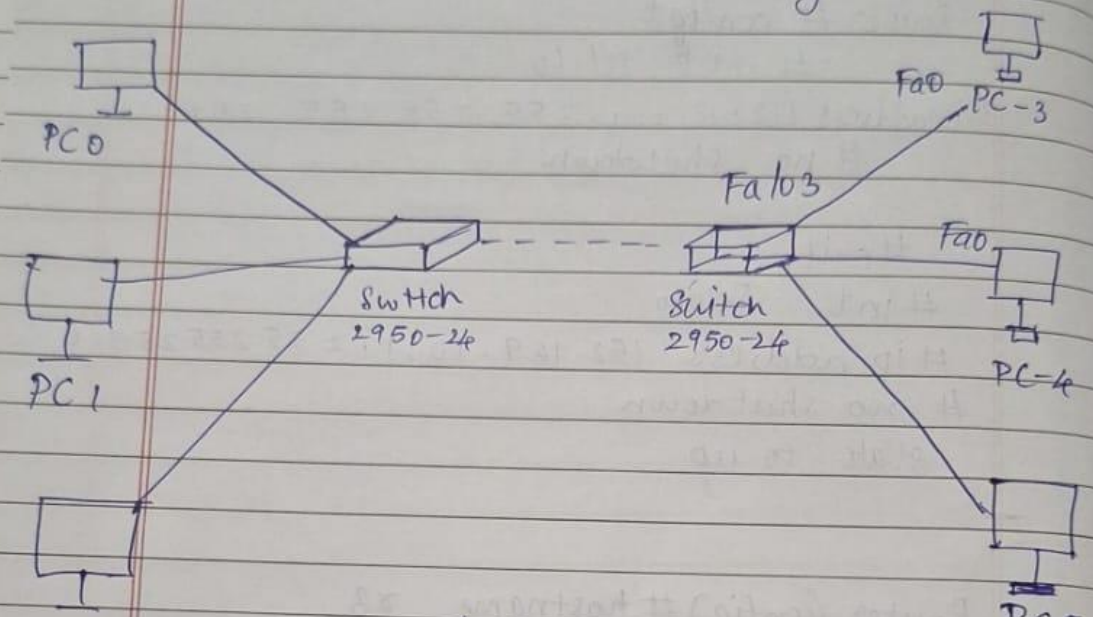





Logical
[Root]
New Cluster
Move Object
Set Tiled Background
Viewport
PC0
Physical
Config
Desktop
Custom Interface
Command Prompt
Reply from 192.168.1.1: bytes=32 time=0ms TTL=255
Reply from 192.168.1.1: bytes=32 time=0ms TTL=255
Reply from 192.168.1.1: bytes=32 time=0ms TTL=255
Ping statistics for 192.168.1.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
PC>telnet 192.168.1.1
Trying 192.168.1.1 ...Open
User Access Verification
Password:
R1>enable
Password:
R1#show ip interface brief
Interface IP-Address OK? Method Status Protocol
FastEthernet0/0 192.168.1.1 YES manual up up
FastEthernet0/1 unassigned YES unset administratively down down
Vlan1 unassigned YES unset administratively down down
R1#enable
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#int fa0/1
R1(config-if)#ip add 192.168.12.1 2
% Invalid input detected at '^' marker.
R1(config-if)#ip address 192.168.1.2 255.255.255.0
% 192.168.1.0 overlaps with FastEthernet0/0
R1(config-if)#exit
R1(config)#exit
R1#
Router0
Physical
Config
CLI
IOS Command Line Interface
Vlan1 unassigned YES unset administratively down down
R1#show ip interface brief
Interface IP-Address OK? Method Status Protocol
FastEthernet0/0 192.168.1.1 YES manual up up
FastEthernet0/1 192.168.1.2 YES manual administratively down down
Vlan1 unassigned YES unset administratively down down
R1#
%SYS-5-CONFIG_I: Configured from console by console
R1 con0 is now available
Press RETURN to get started.
Copy
Paste
Time: 00:52:12
Power Cycle Devices
Fast Forward Time
Realtime
Connections
Scenario 0
New
Delete
Fire
Last Status
Source
Destination
Type
Color
Time(sec)
Periodic
Num
Edit
Delete

LAB - 6

— To construct a VLAN and make the PC's communication among VLAN.



VLAN 10	VLAN 20	VLAN 30
fa0/1 PC0	fa1/1 PC1	fa1/3 PC2
fa1/1 PC3	fa2/1 PC4	fa1/4 PC5

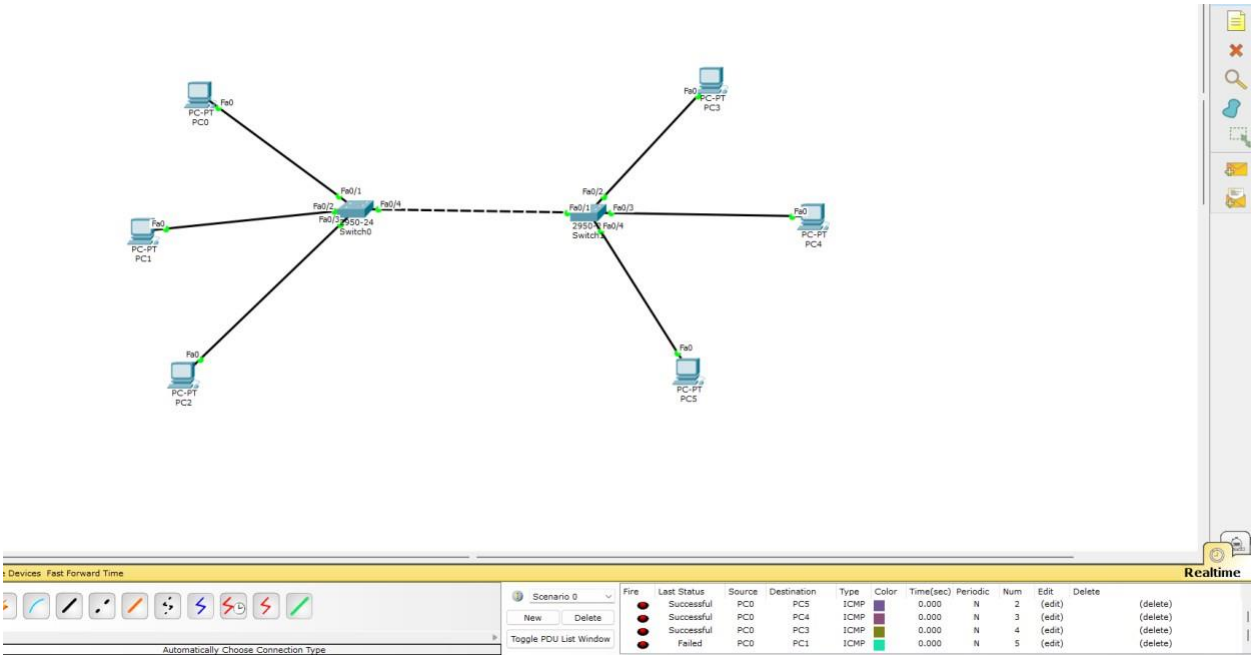
→ Switch >ENABLE
Switch # Config T
INT FA0/1
SWITCHPORT ACCESS VLAN 10

INT FA0/2
SWITCHPORT ACCESS VLAN 20

INT FA0/3
SWITCHPORT ACCESS VLAN 30

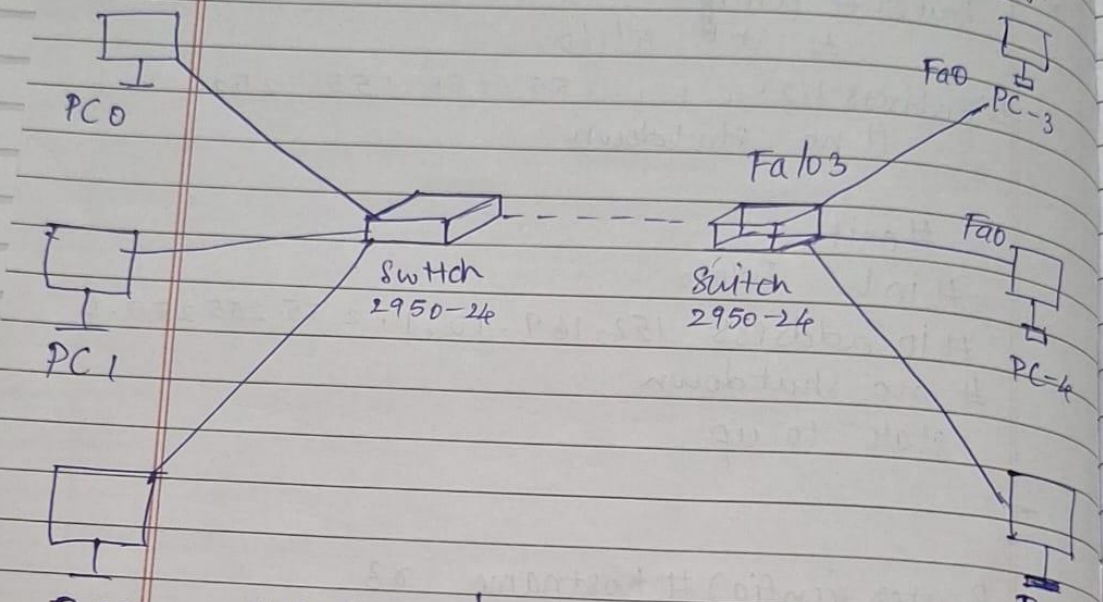
Program 8: To construct a VLAN and make the PC's communicate among a VLAN.

Network diagram:



Configuration:

— To construct a VLAN and make the PC's communication among VLAN.



VLAN 10		VLAN 20		VLAN 30	
fa0/1	PC0	fa1/1	PC1	fa1/3	PC2
fa1/1	PC3	fa2/1	PC4	fa1/4	PC5

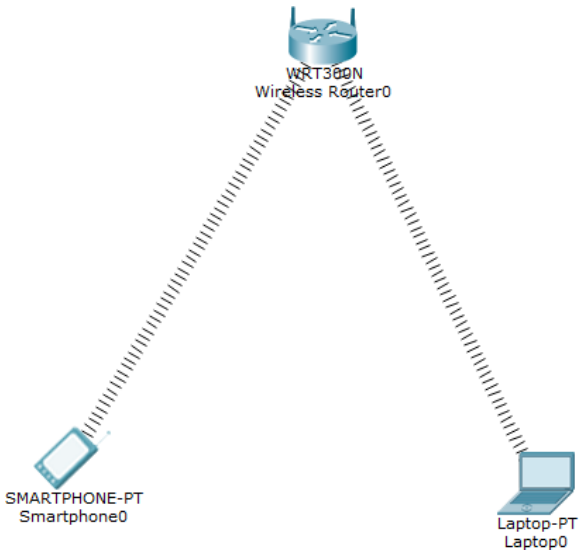
→ Switch >ENABLE
Switch # Config T
INT FA0/1
SWITCHPORT ACCESS VLAN 10

INT FA0/2
SWITCHPORT ACCESS VLAN 20

INT FA0/3
SWITCHPORT ACCESS VLAN 30

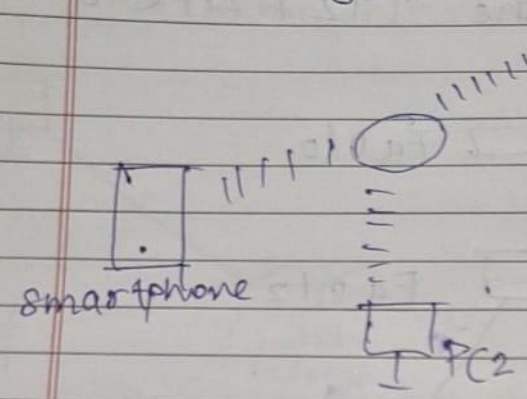
Program 9: To construct a WLAN and make the nodes communicate wirelessly.

Network diagram:



Configuration:

* To construct a WLAN and make the nodes communicate wirelessly.

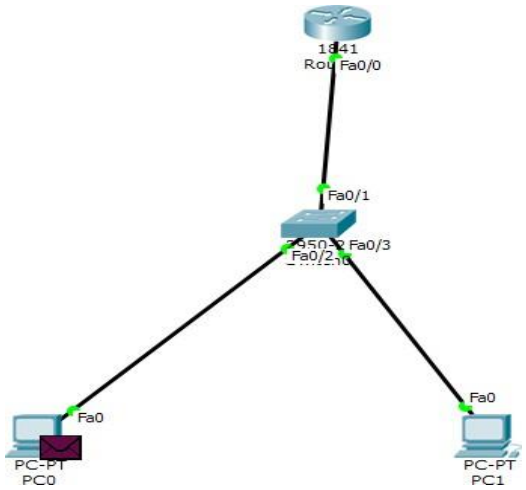


Config → wireless → SSID → DS/E Pass to connect the devices some process

Click on laptop
Turn wireless
Connect to network
Select SSID

Program 10: Demonstrate the TTL/ Life of a Packet.

Network diagram:



Configuration

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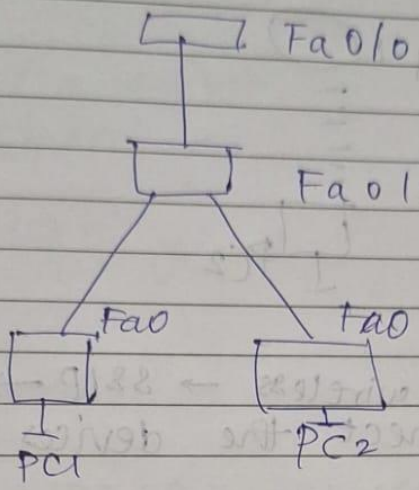
SWITCH PORT MODE TRUNK.

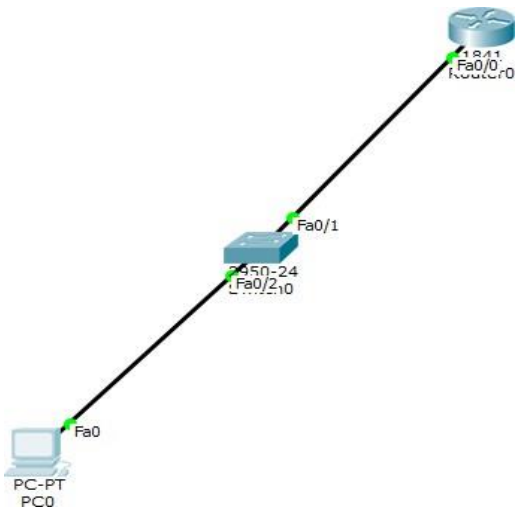
* Demonstrate the TTL / Life of a packet:



- Ping PC0 to PC1 successful
- Packet inbound PDU details TTL 255
  Packet outbound PDU details TTL 128
- PC0 source out bound details TTL 255
- PT quick assign route TTL

Program 11: To understand the operation of TELNET by accessing the router in the server room from a PC in the IT office.

Network diagram:

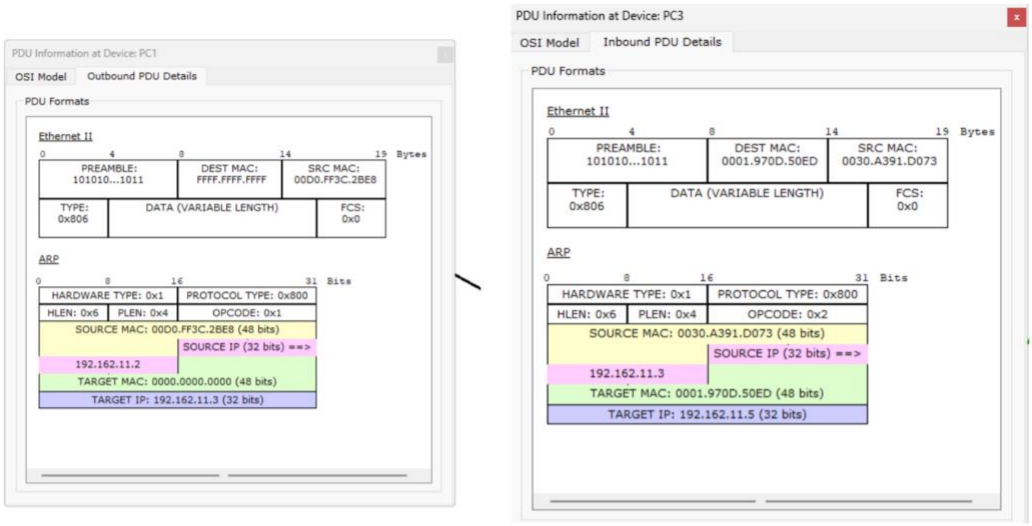


Configuration:

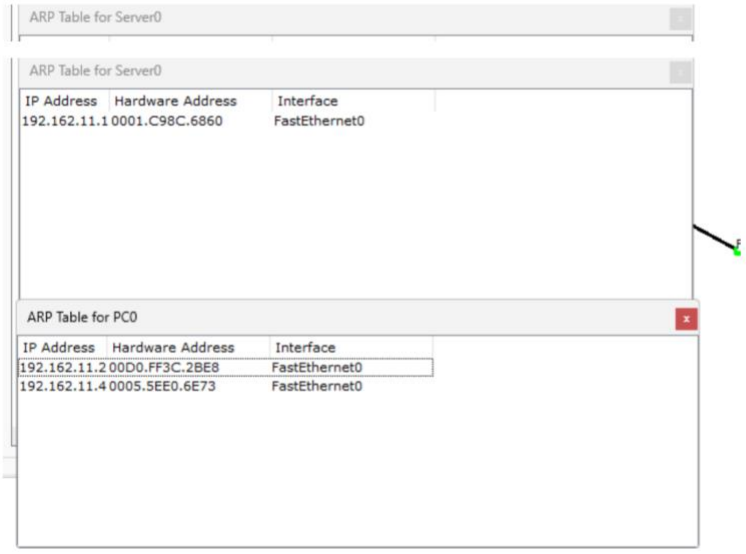
Program 12: To construct simple LAN and understand the concept and operation of Address Resolution Protocol (ARP).

Network diagram:

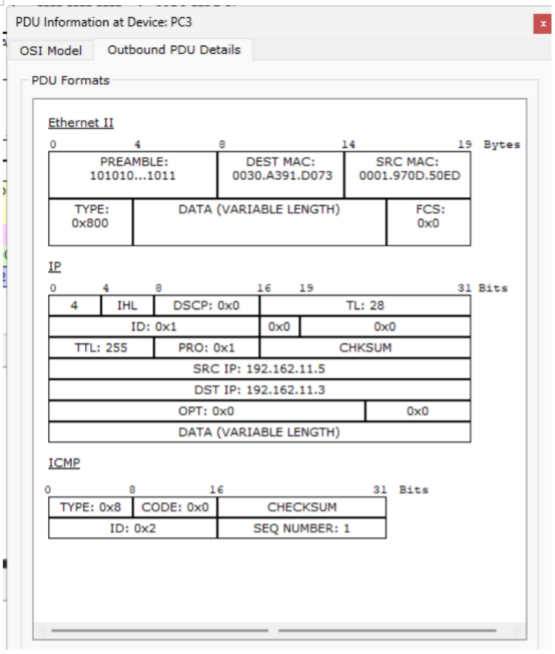
ARP



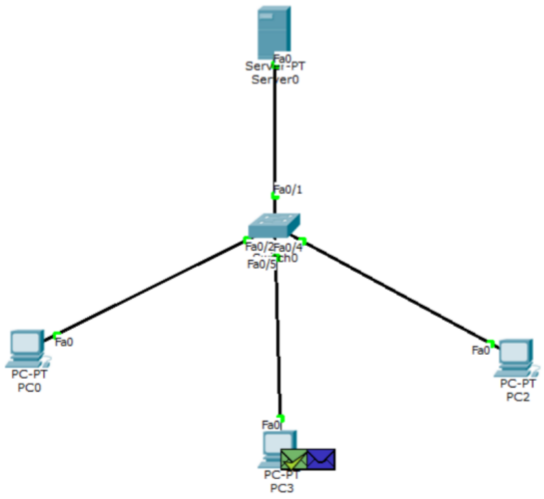
THE MAC ADDRESS before and after encrypting and sending



ARP table of pc0 and server after sending a simple PDU

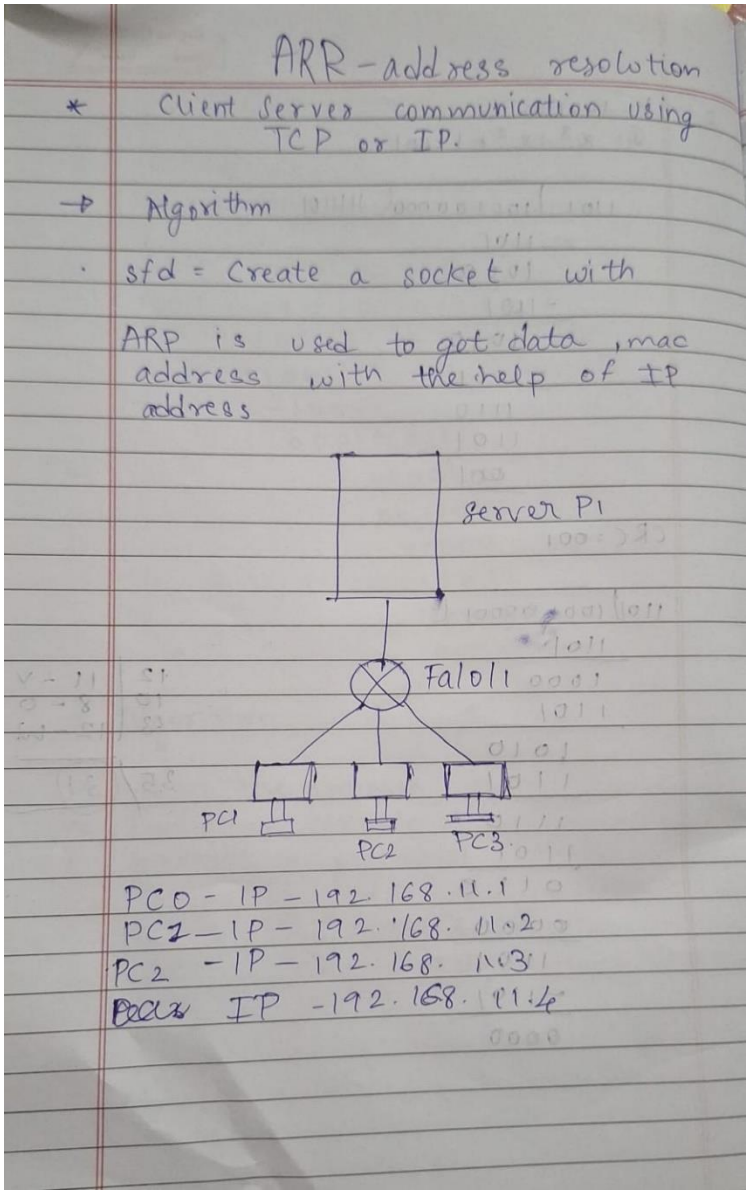


The address of sent one



topology

Configuration:



PART - B

Program 1: Write a program for congestion control using Leaky bucket algorithm.

Code:

```
#include <stdio.h>
int min(int x, int y)
{
   return (x < y) ? x : y;
}
int main()
{
```

```
    int drop = 0, mini, nsec, cap, count = 0, i, inp[25], process;
    printf("Enter the bucket size:\n");
    scanf("%d", &cap);
    printf("Enter the processing rate:\n");
    scanf("%d", &process);
    printf("Enter the number of seconds you want to simulate:\n");
    scanf("%d", &nsec);
    for (i = 0; i < nsec; i++)
    {
        printf("Enter the size of the packet entering at %d sec:\n", i + 1);
        scanf("%d", &inp[i]);
    }
    printf("\n Second | Packet received | Packet sent | Packet left | Dropped\n");
    printf("-----------------------------------------\n");
    for (i = 0; i < nsec; i++)
{
        printf("Enter the size of the packet entering at %d sec:\n", i + 1);
        scanf("%d", &inp[i]);
    }

    printf("\n Second | Packet received | Packet sent | Packet left | Dropped\n");
    printf("-----------------------------------------\n");

    for (i = 0; i < nsec; i++)
    {
        count += inp[i];

        if (count > cap)
        {
            drop = count - cap;
            count = cap;
        }

        printf("%6d | %15d |", i + 1, inp[i]);

        mini = min(count, process);
        printf(" %11d |", mini);

        count -= mini;
        printf(" %12d | %7d\n", count, drop);

        drop = 0;
    }
    // Process remaining packets after all seconds
    for (; count != 0; i++)
    {
  if (count > cap)
        {
```

```
            drop = count - cap;
            count = cap;
        }

        printf("%6d | %15d |", i + 1, 0);

        mini = min(count, process);
        printf(" %11d |", mini);

        count -= mini;
        printf(" %12d | %7d\n", count, drop);
    }

    return 0;
}
```

Output:

Program 2: Using TCP/IP sockets, write a client-server program to make the client send the file name and the server to send back the contents of the requested file if present.

Code:

```
#include <stdio.h>

#include <stdlib.h>

#include <string.h>

#include <sys/types.h>

#include <sys/socket.h>

#include <netinet/in.h>

#include <netdb.h>


int main(int argc, char *argv[])

{

    int sockfd, portno, n;

    struct sockaddr_in serv;
```

```
    struct hostent *server;
    char buffer[256];
    char c[20000];

    if (argc < 3) {
        printf("Error: insufficient arguments.\n");
        printf("Usage: %s <hostname> <port>\nExample: %s 127.0.0.1 7777\n",
argv[0], argv[0]);
        exit(1);
    }

    portno = atoi(argv[2]);

    // Create socket
    sockfd = socket(AF_INET, SOCK_STREAM, 0);
    if (sockfd < 0) {
        perror("Error opening socket");
        exit(1);
    }

    // Get server by name/IP
    server = gethostbyname(argv[1]);
    if (server == NULL) {
        fprintf(stderr, "Error: no such host.\n");
        exit(1);
    }
```

```
    // Zero out the structure
    bzero((char *)&serv, sizeof(serv));
    serv.sin_family = AF_INET;
    bcopy((char *)server->h_addr, (char *)&serv.sin_addr.s_addr, server->h_length);
    serv.sin_port = htons(portno);

    // Connect to server
    if (connect(sockfd, (struct sockaddr *)&serv, sizeof(serv)) < 0) {
        perror("Error connecting");
        exit(1);
    }

    printf("Enter the file path (complete path): ");
    scanf("%s", buffer);

    // Send filename to server
    n = write(sockfd, buffer, strlen(buffer));
    if (n < 0) {
        perror("Error writing to socket");
        exit(1);
    }

    bzero(c, sizeof(c));
    printf("Reading file contents from server...\n");

    // Read file contents
```

```
    n = read(sockfd, c, sizeof(c) - 1);
    if (n < 0) {
        perror("Error reading from socket");
        exit(1);
    }

    printf("\nClient: Display content of %s\n----------------------------------\n",
buffer);
    fputs(c, stdout);
    printf("\n---------------------------------------\n");

    close(sockfd);
    return 0;
}
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <netinet/in.h>

int main(int argc, char *argv[])
{
    int sockfd, newsockfd, portno, len, n;
    char buffer[256], c[2000], cc[20000];
    struct sockaddr_in serv, cli;
```

```
FILE *fd;

if (argc < 2) {
    printf("Error: no port number provided.\n");
    printf("Usage: %s <port>\nExample: %s 7777\n", argv[0], argv[0]);
    exit(1);
}

// Create socket
sockfd = socket(AF_INET, SOCK_STREAM, 0);
if (sockfd < 0) {
    perror("Error opening socket");
    exit(1);
}

// Initialize server address structure
bzero((char *)&serv, sizeof(serv));
portno = atoi(argv[1]);
serv.sin_family = AF_INET;
serv.sin_addr.s_addr = INADDR_ANY;
serv.sin_port = htons(portno);

// Bind socket
if (bind(sockfd, (struct sockaddr *)&serv, sizeof(serv)) < 0) {
    perror("Error on binding");
    close(sockfd);
    exit(1);
```

```
}

// Listen for incoming connections
listen(sockfd, 5);
len = sizeof(cli);
printf("Server: waiting for connection on port %d...\n", portno);

// Accept a client
newsockfd = accept(sockfd, (struct sockaddr *)&cli, (socklen_t *)&len);
if (newsockfd < 0) {
    perror("Error on accept");
    close(sockfd);
    exit(1);
}

// Read filename from client
bzero(buffer, 255);
n = read(newsockfd, buffer, 255);
if (n < 0) {
    perror("Error reading from socket");
    close(newsockfd);
    close(sockfd);
    exit(1);
}

printf("Server received filename: %s\n", buffer);
```

```
    // Try to open the file
    fd = fopen(buffer, "r");
    if (fd != NULL) {
        printf("Server: file '%s' found, reading and sending...\n", buffer);
        bzero(cc, sizeof(cc));
        while (fgets(c, sizeof(c), fd) != NULL) {
            strcat(cc, c);
        }
        fclose(fd);

        // Send file content to client
        n = write(newsockfd, cc, strlen(cc));
        if (n < 0)
            perror("Error writing to socket");
        else
            printf("File transfer complete.\n");
    } else {
        printf("Server: file not found.\n");
        n = write(newsockfd, "Error: file not found.\n", 24);
        if (n < 0)
            perror("Error writing to socket");
    }

    close(newsockfd);
    close(sockfd);
    return 0;
}
```

Output:

Program 3: Using UDP sockets, write a client-server program to make the client send the file name and the server to send back the contents of the requested file if present.

Code:

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
#include <arpa/inet.h>

#define PORT 8080
#define MAXLINE 1024

int main() {
    int sockfd;
    char buffer[MAXLINE];
    struct sockaddr_in servaddr, cliaddr;
    socklen_t len;
    ssize_t n;

    // Create UDP socket
    if ((sockfd = socket(AF_INET, SOCK_DGRAM, 0)) < 0) {
        perror("socket creation failed");
        exit(EXIT_FAILURE);
```

```
    }

    memset(&servaddr, 0, sizeof(servaddr));
    memset(&cliaddr, 0, sizeof(cliaddr));

    // Server info
    servaddr.sin_family = AF_INET;
    servaddr.sin_addr.s_addr = INADDR_ANY;
    servaddr.sin_port = htons(PORT);

    // Bind socket to the port
    if (bind(sockfd, (const struct sockaddr *)&servaddr, sizeof(servaddr)) < 0) {
        perror("bind failed");
        close(sockfd);
        exit(EXIT_FAILURE);
    }

    printf("UDP Server is running on port %d...\n", PORT);

    len = sizeof(cliaddr);

    // Receive filename from client
    n = recvfrom(sockfd, (char *)buffer, MAXLINE, 0, (struct sockaddr *)&cliaddr,
&len);
    buffer[n] = '\0';
    printf("Client requested file: %s\n", buffer);
```

```
    FILE *fp = fopen(buffer, "r");
    if (fp == NULL) {
        char *msg = "File not found!";
        sendto(sockfd, msg, strlen(msg), 0, (struct sockaddr *)&cliaddr, len);
        printf("File not found, message sent to client.\n");
    } else {
        // Read and send file content
        while (fgets(buffer, MAXLINE, fp) != NULL) {
            sendto(sockfd, buffer, strlen(buffer), 0, (struct sockaddr *)&cliaddr, len);
        }
        fclose(fp);
        printf("File sent successfully.\n");
    }

    close(sockfd);
    return 0;
}
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
#include <arpa/inet.h>

#define PORT 8080
#define MAXLINE 1024

int main() {
```

```
    int sockfd;
    char buffer[MAXLINE];
    struct sockaddr_in servaddr;
    socklen_t len;

    // Create UDP socket
    if ((sockfd = socket(AF_INET, SOCK_DGRAM, 0)) < 0) {
        perror("socket creation failed");
        exit(EXIT_FAILURE);
    }

    memset(&servaddr, 0, sizeof(servaddr));

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

    printf("Enter the filename to request: ");
    fgets(buffer, MAXLINE, stdin);
    buffer[strcspn(buffer, "\n")] = '\0';  // remove newline

    // Send filename to server
    sendto(sockfd, buffer, strlen(buffer), 0, (const struct sockaddr *)&servaddr,
sizeof(servaddr));

    printf("Request sent. Waiting for file content...\n\n");
```

```
    len = sizeof(servaddr);

    // Receive file contents
    ssize_t n;
    while ((n = recvfrom(sockfd, buffer, MAXLINE, 0, (struct sockaddr
*)&servaddr, &len)) > 0) {
        buffer[n] = '\0';
        printf("%s", buffer);
        if (n < MAXLINE - 1) break;  // assume end of file
    }

    printf("\n\nFile transfer complete.\n");

    close(sockfd);
    return 0;
}
```

Output:

Program 4: Write a program for error detecting code using CRC-CCITT (16-bits).

Code:

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

int main()
```

```
{
    char rem[50], a[50], s[50], c, msj[50], gen[30];
    int i, genlen, t, j, flag = 0, k, n;

    printf("Enter the generator polynomial:\n");
    fgets(gen, sizeof(gen), stdin);
    gen[strcspn(gen, "\n")] = '\0';  // remove newline if present
    printf("Generator polynomial (CRC-CCITT): %s\n", gen);

    genlen = strlen(gen);
    k = genlen - 1;

    printf("Enter the message:\n");
    fgets(msj, sizeof(msj), stdin);
    msj[strcspn(msj, "\n")] = '\0';  // remove newline

    n = strlen(msj);

    // Append k zeros to the message
    for (i = 0; i < n; i++)
        a[i] = msj[i];
    for (i = 0; i < k; i++)
        a[n + i] = '0';
    a[n + k] = '\0';

    printf("\nMessage polynomial appended with zeros:\n");
    puts(a);
```

```
// Division (XOR)
for (i = 0; i < n; i++)
{
    if (a[i] == '1')
    {
        t = i;
        for (j = 0; j <= k; j++)
        {
            if (a[t] == gen[j])
                a[t] = '0';
            else
                a[t] = '1';
            t++;
        }
    }
}
// Get remainder
for (i = 0; i < k; i++)
    rem[i] = a[n + i];
rem[k] = '\0';
printf("\nChecksum (Remainder):\n");
puts(rem);
// Append checksum to message
printf("\nTransmitted message (with checksum):\n");
for (i = 0; i < n; i++)
    a[i] = msj[i];
```

```
for (i = 0; i < k; i++)
    a[n + i] = rem[i];
a[n + k] = '\0';
puts(a);
// Receiver side
printf("\nEnter the received message:\n");
fgets(s, sizeof(s), stdin);
s[strcspn(s, "\n")] = '\0';  // remove newline
n = strlen(s);
// Division on received message
for (i = 0; i < n - k; i++)
{
    if (s[i] == '1')
    {
        t = i;
        for (j = 0; j <= k; j++, t++)
        {
            if (s[t] == gen[j])
                s[t] = '0';
            else
                s[t] = '1';
        }
    }
}
for (i = 0; i < k; i++)
    rem[i] = s[n - k + i];
rem[k] = '\0';
```

```
    // Check for error
    flag = 0;
    for (i = 0; i < k; i++)
    {
        if (rem[i] == '1')
            flag = 1;
    }
    if (flag == 0)
        printf("\nReceived message is error-free \n");
    else
        printf("\nReceived message contains errors +\n");
    return 0;
}
```

Output: