VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“JnanaSangama”, Belgaum -590014, Karnataka.

LAB REPORT on

COMPUTER NETWORKS

Submitted by

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in partial fulfilment for the award of the degree of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

B.M.S. COLLEGE OF ENGINEERING

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(Autonomous Institution under VTU)

B. M. S. College of Engineering,

Bull Temple Road, Bangalore 560019

(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled "**COMPUTER NETWORKS**" carried out by **Keshav Somani (1BM20CS072),** who is bonafide student of **B.M. S. College of Engineering.** It is in partial fulfilment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2022. The Lab report has been approved as it satisfies the academic requirements in respect of a **Computer Networks- (20CS5PCCON)** work prescribed for the said degree.

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BMSCE, Bengaluru	BMSCE, Bengaluru

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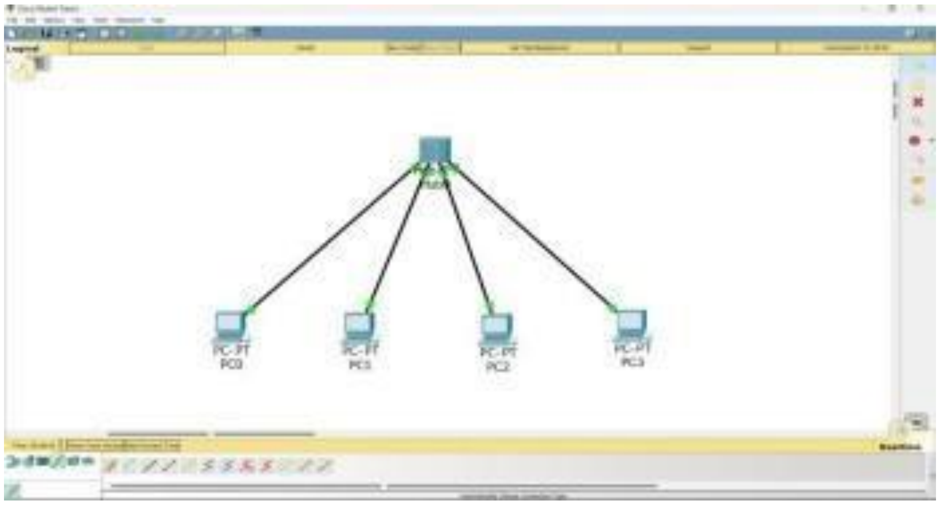
Cycle-1 Experiment No 1

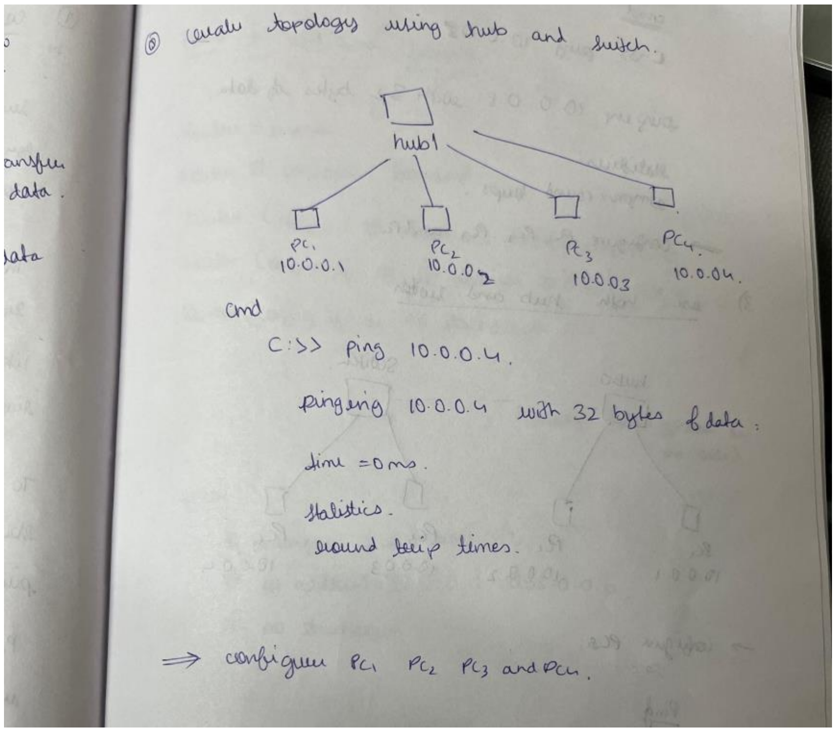
Aim of the program

Creating a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices.

Hub Topology



Procedure



① create topology using hub and switch.

hub1

PC1 10.0.0.1

PC2 10.0.0.2

PC3 10.0.0.3

PC4. 10.0.0.4.

cmd

C:>> ping 10.0.0.4.

pinging 10.0.0.4 with 32 bytes of data:

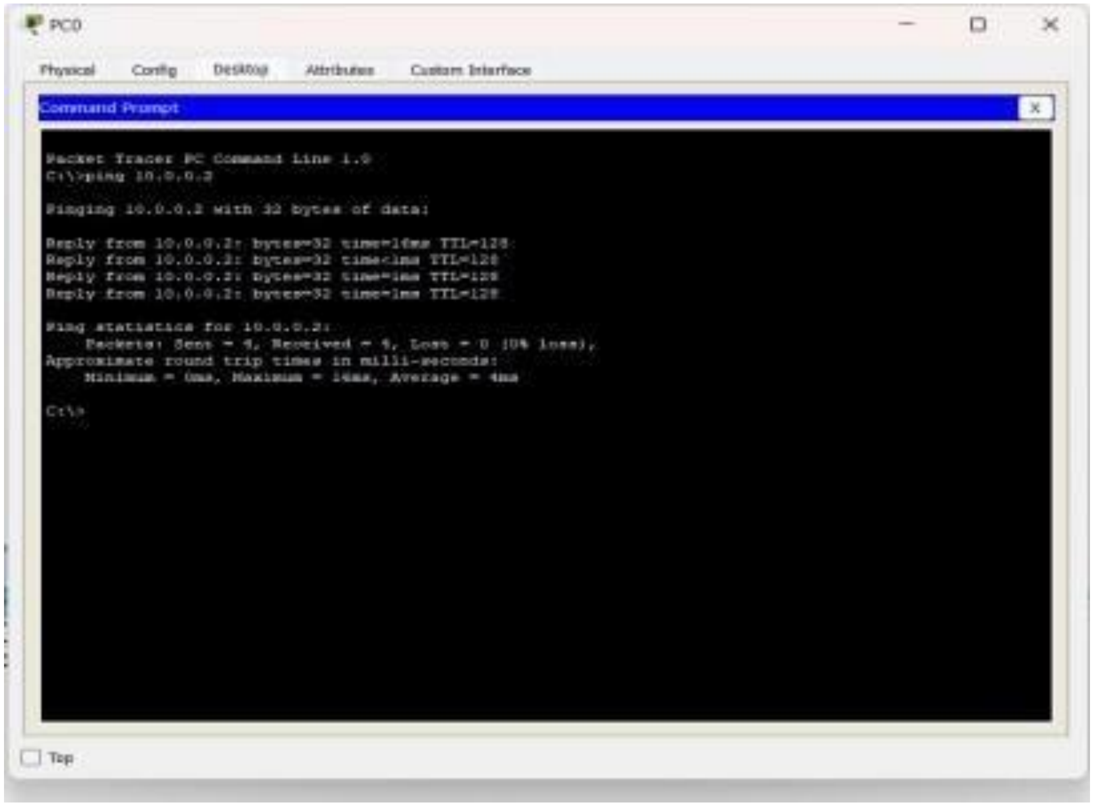
time =0ms.

statistics.

round trip times.

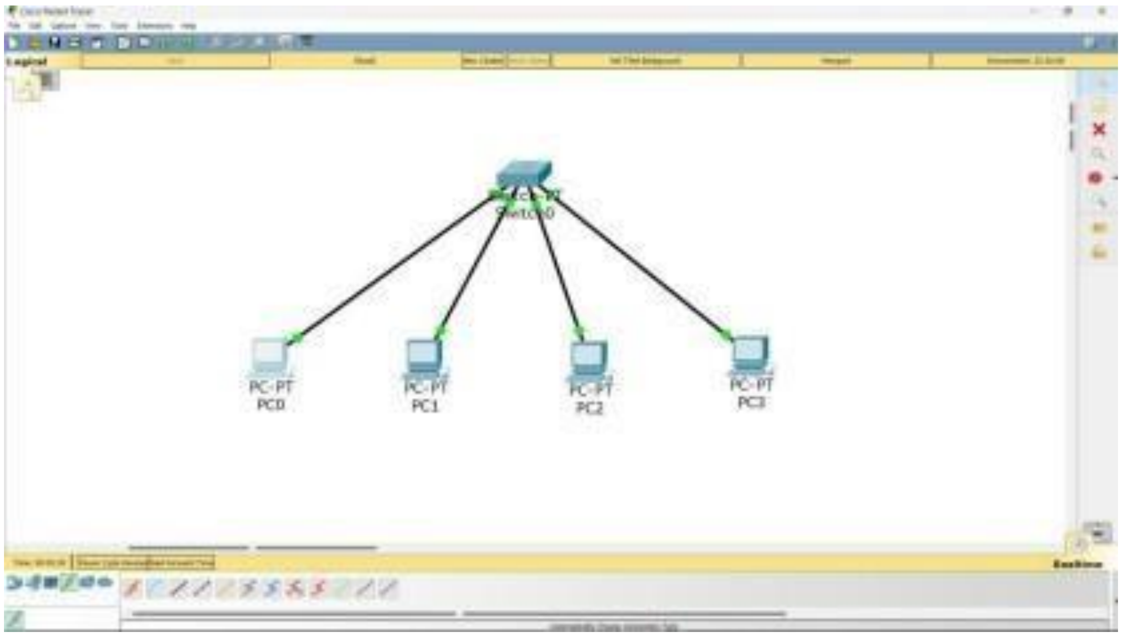
⇒ configure PC1 PC2 PC3 and PC4.

Output



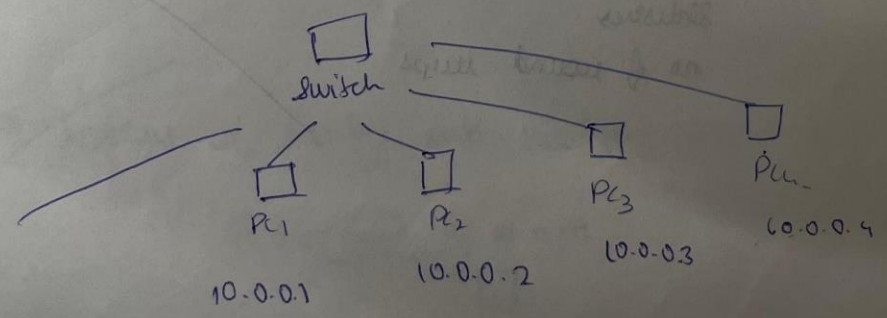
```
Packet Tracer PC Command Line 1.0
C:\>ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2: bytes=32 time=14ms TTL=128
Reply from 10.0.0.2: bytes=32 time<1ms TTL=128
Reply from 10.0.0.2: bytes=32 time=1ms TTL=128
Reply from 10.0.0.2: bytes=32 time=1ms TTL=128

Ping statistics for 10.0.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 14ms, Average = 4ms

C:\>
```

Switch Topology



Procedure

2) <u>using switch.</u>



<u>cmd</u>

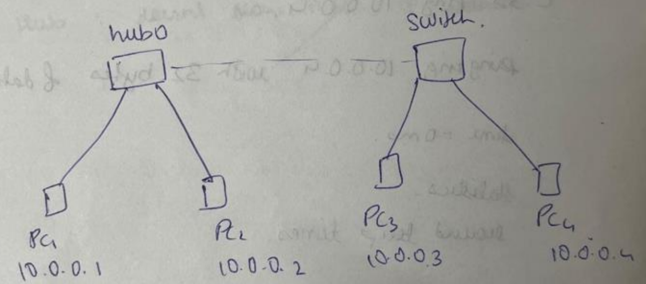
C:\> ping 10.0.0.8.

pinging 10.0.0.8 with 32 bytes of data.

Statistics
approx round trips.

→ configure PC1 PC2 PC3 and PC4.

3) <u>use both hub and switch</u>



→ configure PCs.

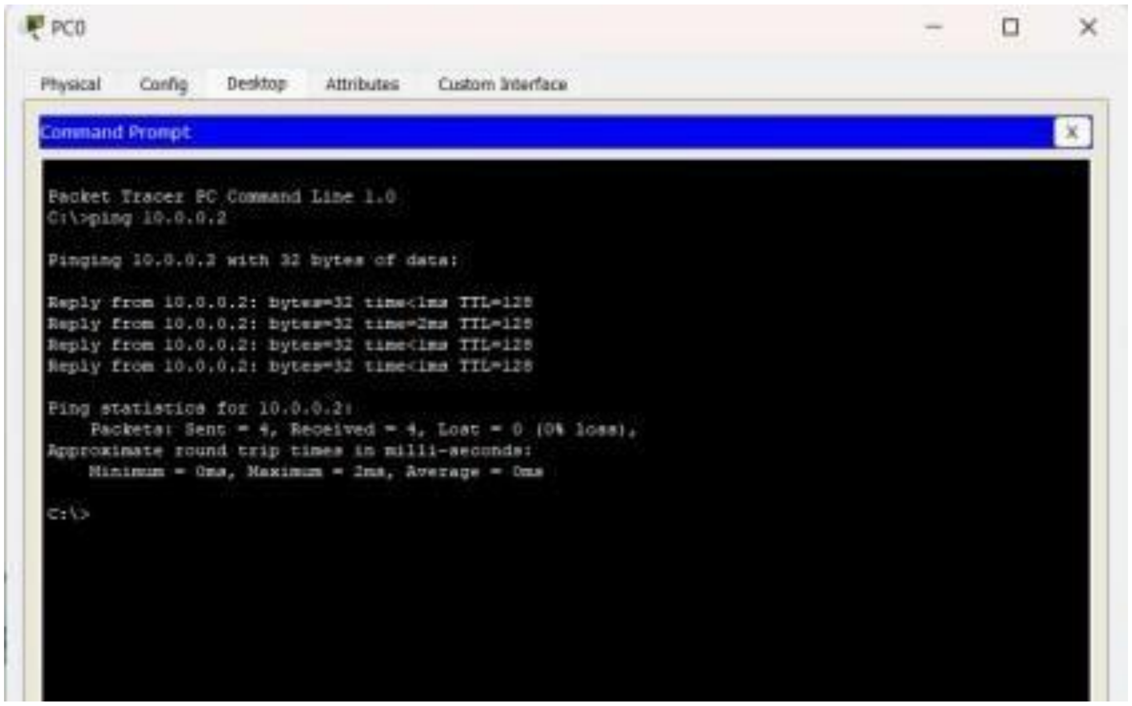
<u>Ping</u>

C:\> ping 10.0.0.8.

pinging with 32 bytes.

Statistics
no. of round trips.

Output



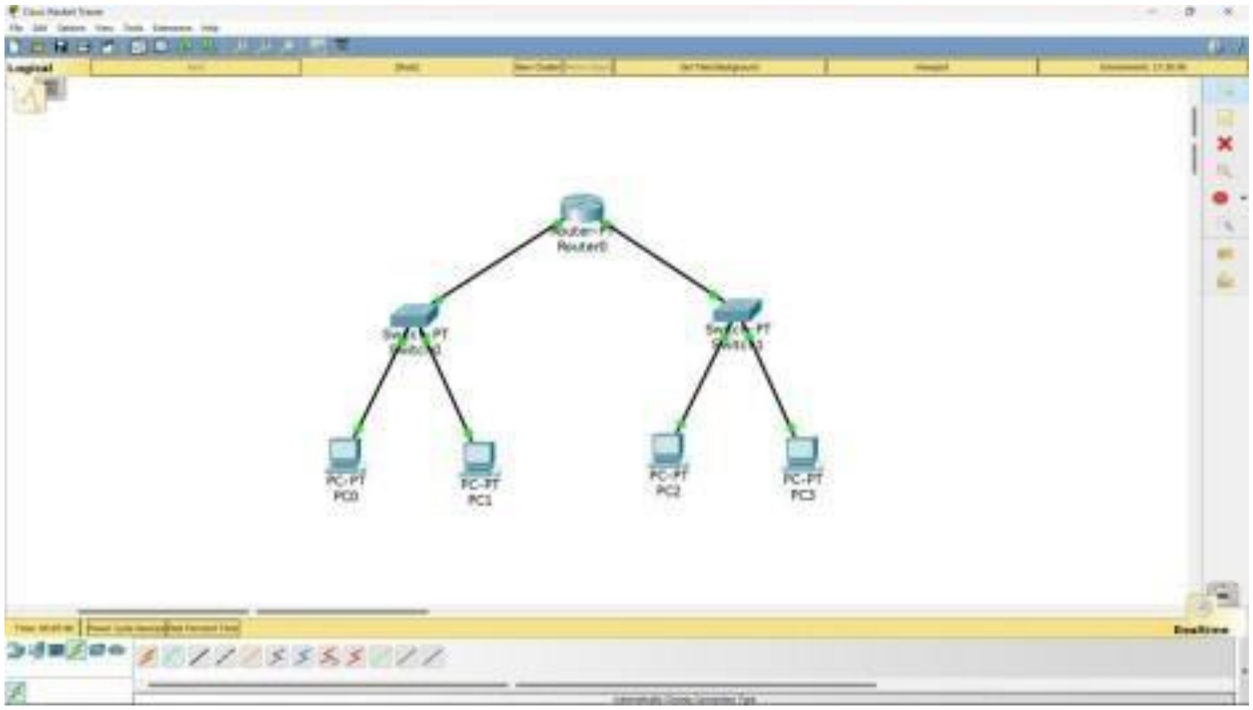
```
Packet Tracer PC Command Line 1.0
C:\>ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2: bytes=32 time<1ms TTL=128
Reply from 10.0.0.2: bytes=32 time=2ms TTL=128
Reply from 10.0.0.2: bytes=32 time<1ms TTL=128
Reply from 10.0.0.2: bytes=32 time<1ms TTL=128

Ping statistics for 10.0.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 2ms, Average = 0ms

C:\>
```

Experiment No 2

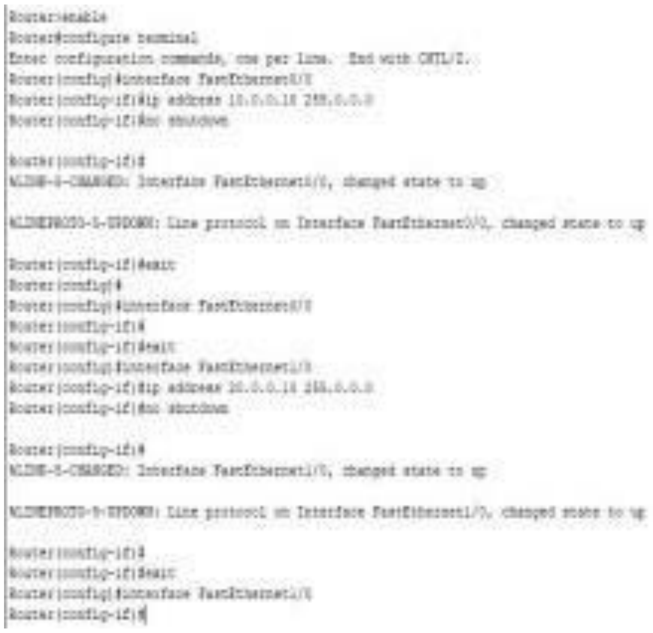
Aim of the program

Configuring IP address to Routers in Packet Tracer. Exploring the following messages: Ping Responses, Destination unreachable, Request timed out, Reply.

Topology

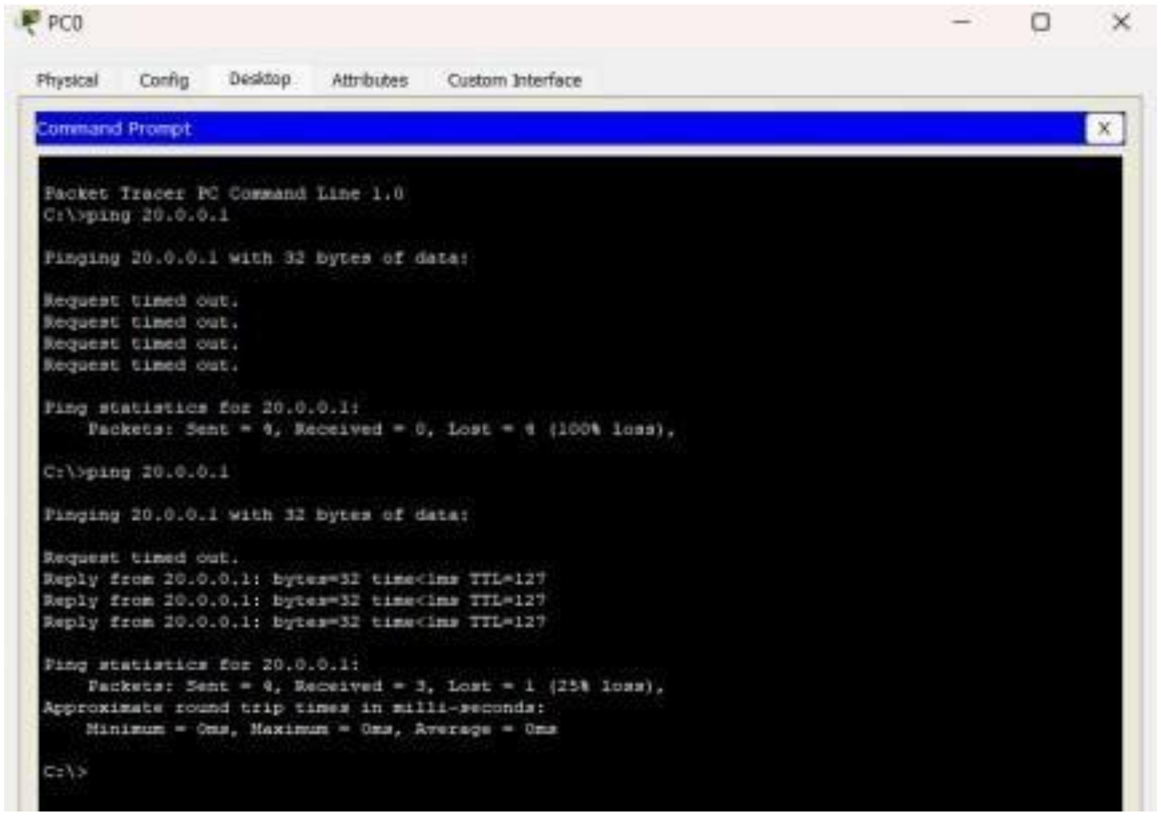


Procedure



```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#ip address 10.0.0.10 255.0.0.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet1/0
Router(config-if)#ip address 20.0.0.10 255.0.0.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed state to up

Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet1/0
Router(config-if)#
```

Output



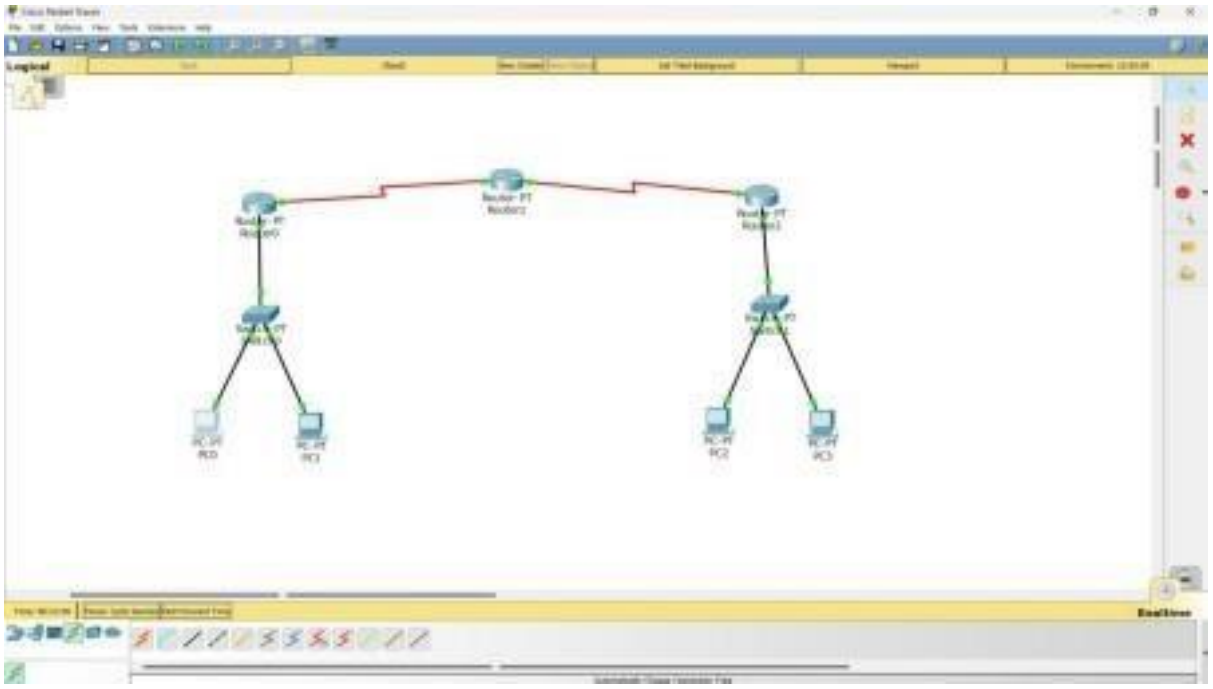
```
Packet Tracer PC Command Line 1.0
C:\>ping 20.0.0.1

Pinging 20.0.0.1 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 20.0.0.1:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 20.0.0.1

Pinging 20.0.0.1 with 32 bytes of data:

Request timed out.
Reply from 20.0.0.1: bytes=32 time<1ms TTL=127
Reply from 20.0.0.1: bytes=32 time<1ms TTL=127
Reply from 20.0.0.1: bytes=32 time<1ms TTL=127

Ping statistics for 20.0.0.1:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

Experiment No 3

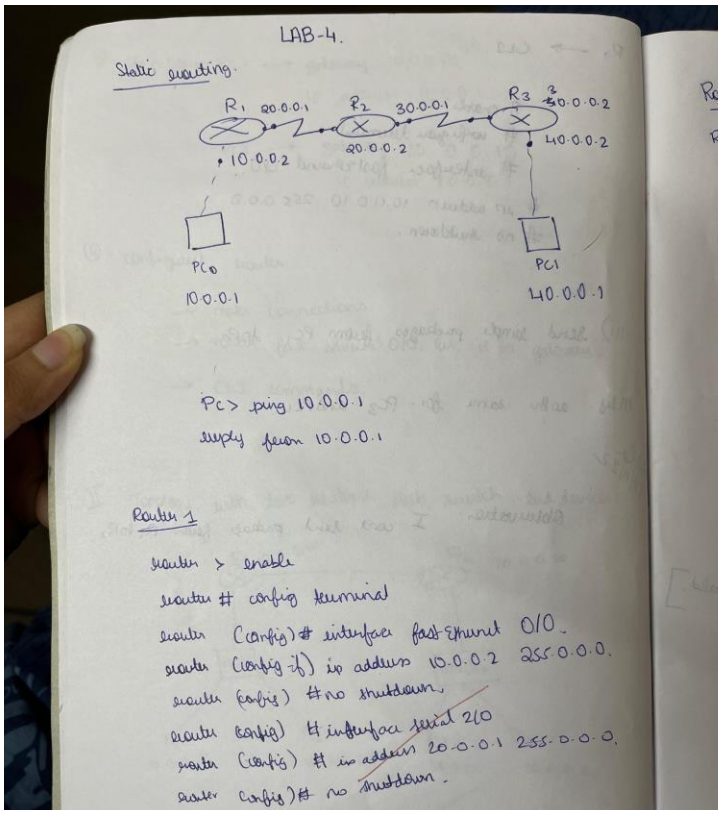
Aim of the program

Configuring static and default route to the Router

Topology for static routing

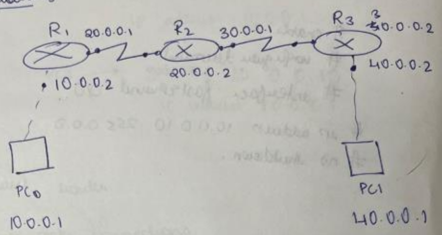

Logical
Router-PT
Router0
Router-PT
Router2
Router-PT
Router1
Switch-PT
Switch0
Switch-PT
Switch1
PC-PT
PC0
PC-PT
PC1
PC-PT
PC2
PC-PT
PC3
Realtime

Procedure



LAB-4.

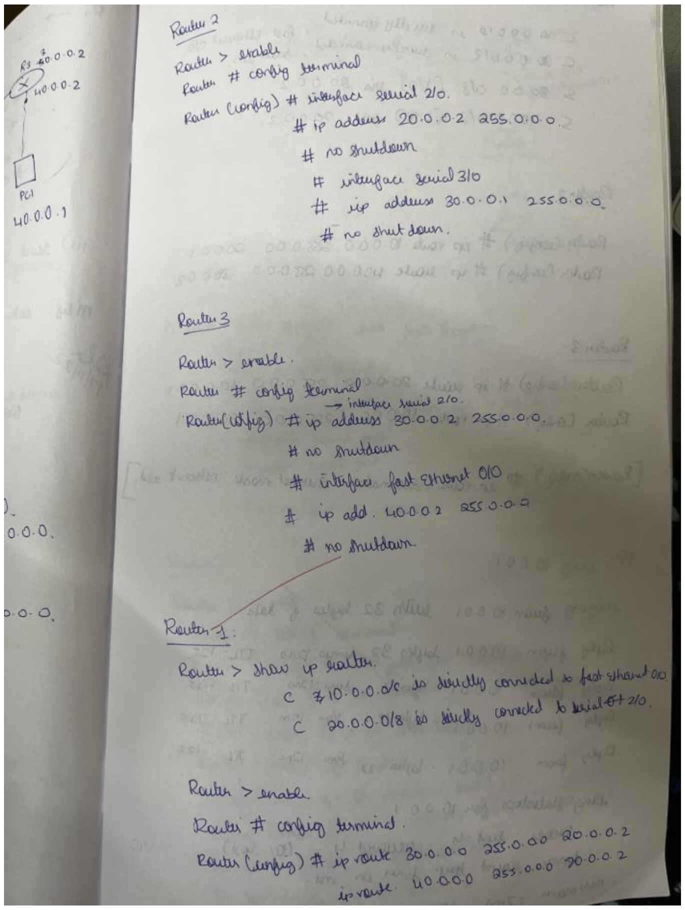
Static routing.



```
PC> ping 10.0.0.1
reply from 10.0.0.1
```

Router 1

```
router > enable
router # config terminal
router (config)# interface fast Ethernet 0/0.
router (config-if) ip address 10.0.0.2 255.0.0.0.
router (config) #no shutdown.
router config) # interface serial 2/0
router (config) # ip address 20.0.0.1 255.0.0.0.
router config)# no shutdown.
```



Router 2

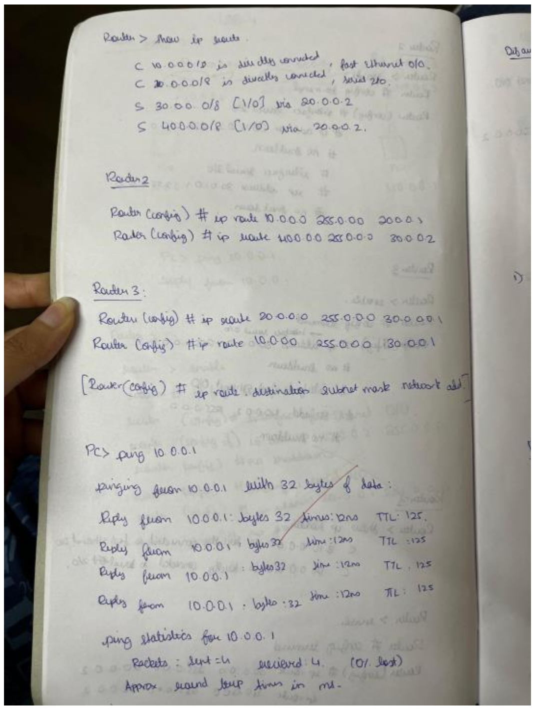
```
Router > enable
Router # config terminal
Router (config) # interface serial 2/0.
                 # ip address 20.0.0.2 255.0.0.0.
                 # no shutdown
                  # interface serial 3/0
                  # ip address 30.0.0.1 255.0.0.0.
                   # no shut down.
```

Router 3

```
Router > enable.
Router # config terminal
                 → interface serial 2/0.
Router(config) # ip address 30.0.0.2 255.0.0.0.
               # no shutdown
               # interface fast Ethernet 0/0
               # ip add. 40.0.0.2 255.0.0.0
                # no shutdown.
```

Router 1.

```
Router > show ip router.
           C ~~3~~10.0.0.0/8 is directly connected to fast ethernet 0/0
           C 20.0.0.0/8 is directly connected to serial ~~Et~~ 2/0.

Router > enable.
Router # config terminal.
Router (config) # ip route 30.0.0.0 255.0.0.0 20.0.0.2
                 ip route. 40.0.0.0 255.0.0.0 20.0.0.2
```



Router > show ip route.

C 10.0.0.0/8 is directly connected, fast ethernet 0/0.
C 20.0.0.0/8 is directly connected, serial 2/0.
S 30.0.0.0/8 [1/0] via 20.0.0.2
S 40.0.0.0/8 [1/0] via 20.0.0.2.

Router2

Router (config) # ip route 10.0.0.0 255.0.0.0 20.0.0.1
Router (config) # ip route 40.0.0.0 255.0.0.0 30.0.0.2

Router 3:

Router (config) # ip route 20.0.0.0 255.0.0.0 30.0.0.1
Router (config) # ip route 10.0.0.0 255.0.0.0 30.0.0.1

[Router(config) # ip route . destination subnet mask network add]

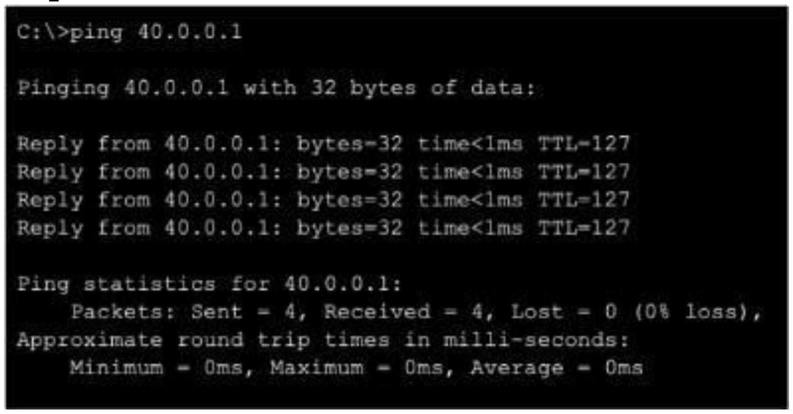
PC> ping 10.0.0.1

pinging from 10.0.0.1 with 32 bytes of data:

Reply from 10.0.0.1: bytes 32 times: 12ms TTL: 125.
Reply from 10.0.0.1 : bytes 32 time : 12ms TTL : 125
Reply from 10.0.0.1 : bytes 32 time : 12ms TTL : 125
Reply from 10.0.0.1 : bytes : 32 time : 12ms TTL : 125

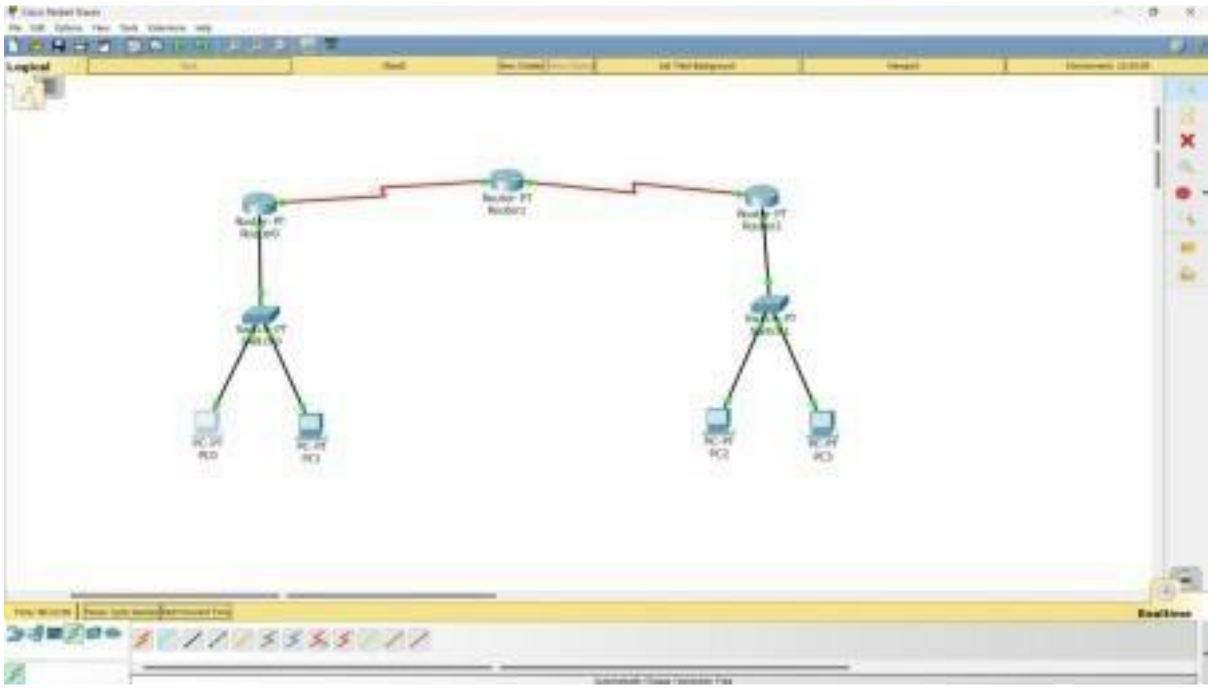
ping statistics for 10.0.0.1
Packets : sent = 4 recieved 4. (0% lost)
Approx round trip times in ms.

Output

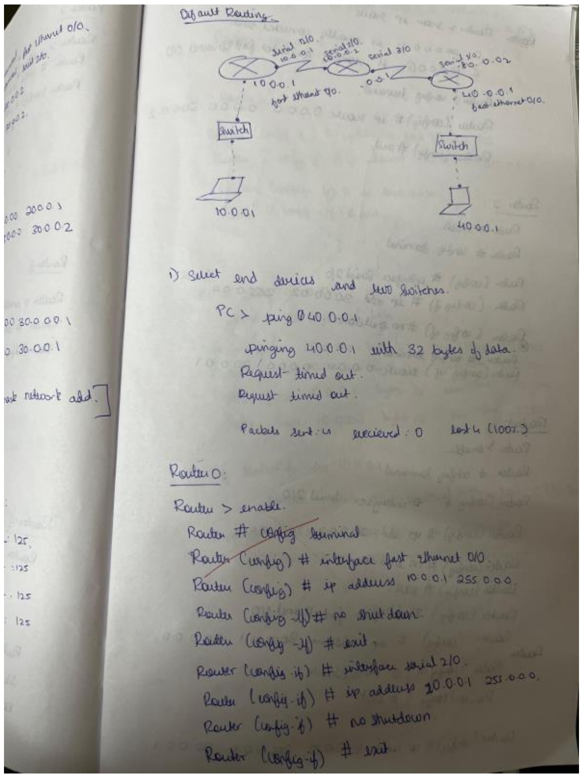


```
C:\>ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data:

Reply from 40.0.0.1: bytes=32 time<1ms TTL=127
Reply from 40.0.0.1: bytes=32 time<1ms TTL=127
Reply from 40.0.0.1: bytes=32 time<1ms TTL=127
Reply from 40.0.0.1: bytes=32 time<1ms TTL=127

Ping statistics for 40.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Topology for default routing



Procedure



Default Routing.

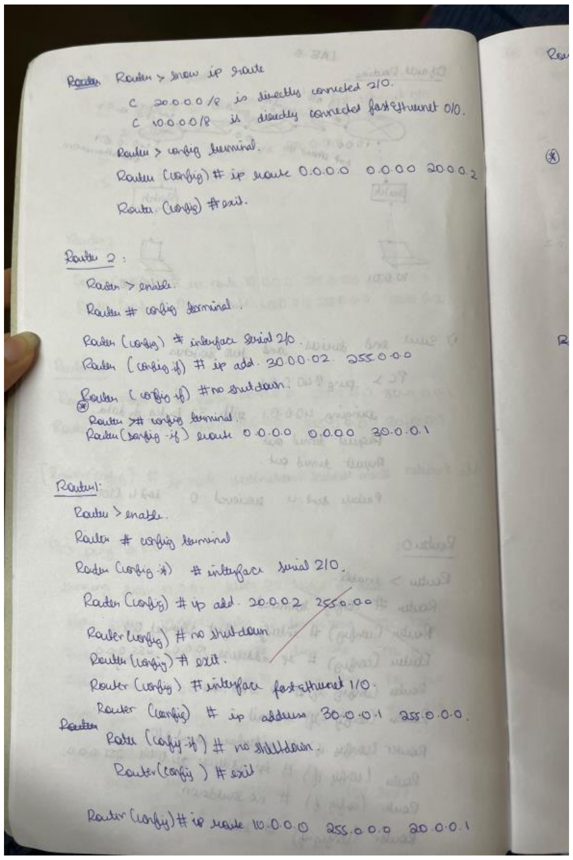
serial 2/0
10.0.0.1
serial 2/0
20.0.0.2
serial 3/0
30.0.0.1
serial 2/0
30.0.0.2
10.0.0.1
fast ethernet 0/0.
40.0.0.1
fast ethernet 0/0.
Switch
Switch
10.0.0.1
40.0.0.1

1) Select end devices and two switches.

```
PC > ping 40.0.0.1

pinging 40.0.0.1 with 32 bytes of data
Request timed out.
Request timed out.

Packets sent: 4   recieved: 0   lost 4 (100%)
```

Router 0:

```
Router > enable.
Router # config terminal
Router (config) # interface fast ethernet 0/0
Router (config) # ip address 10.0.0.1 255.0.0.0
Router (config-if) # no shut down
Router (config-if) # exit.
Router (config-if) # interface serial 2/0.
Router (config-if) # ip address 20.0.0.1 255.0.0.0.
Router (config-if) # no shutdown
Router (config-if) # exit.
```



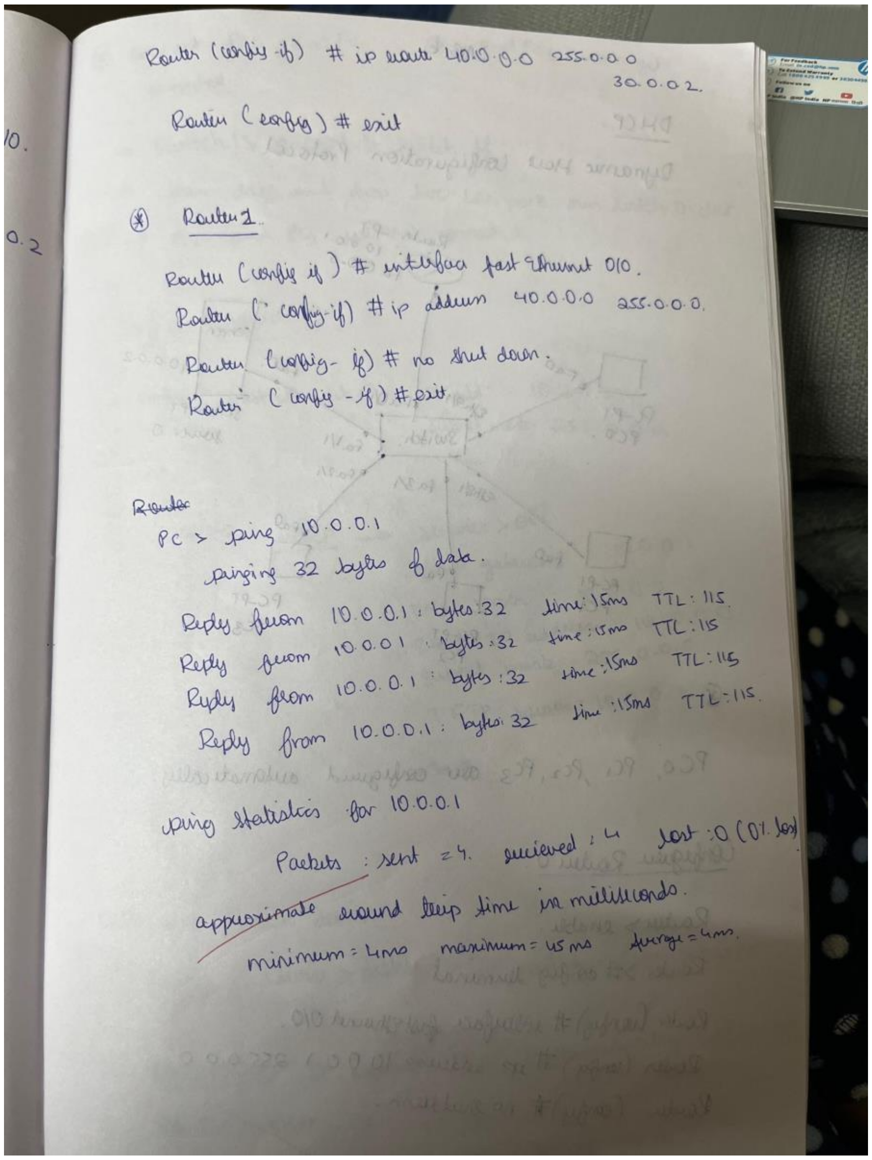
```
Router  Router > show ip route
           C  20.0.0.0/8 is directly connected 2/0.
           C  10.0.0.0/8 is directly connected fastEthernet 0/0.

        Router > config terminal.
        Router (config) # ip route 0.0.0.0  0.0.0.0  20.0.0.2
        Router (config) # exit.
```

Router 2 :

```
Router > enable.
Router # config terminal.
Router (config) # interface Serial 2/0.
Router (config-if) # ip add. 30.0.0.02  255.0.0.0
Router (config-if) # no shutdown.
(*)
Router ># config terminal.
Router (config-if) route 0.0.0.0  0.0.0.0  30.0.0.1
```

Router1:

```
Router > enable.
Router # config terminal
Router (config-if) # interface Serial 2/0.
Router (config) # ip add. 20.0.0.2  255.0.0.0
Router (config) # no shutdown
Router (config) # exit.
Router (config) # interface fast ethernet 1/0.
Router (config) # ip address 30.0.0.1  255.0.0.0.
Router (config-if) # no shutdown.
Router (config) # exit

Router (config) # ip route 10.0.0.0  255.0.0.0  20.0.0.1
```



Router (config-if) # ip route 40.0.0.0 255.0.0.0
30.0.0.2.

Router (config) # exit

(*) Router 1

Router (config if) # interface fast Ethernet 0/0.

Router (config-if) # ip address 40.0.0.0 255.0.0.0.

Router (config-if) # no shut down.

Router (config-if) # exit

~~Router~~

PC > ping 10.0.0.1

pinging 32 bytes of data.

Reply from 10.0.0.1 : bytes:32 time:15ms TTL:115.
Reply from 10.0.0.1 : bytes:32 time:15ms TTL:115
Reply from 10.0.0.1 : bytes:32 time:15ms TTL:115
Reply from 10.0.0.1 : bytes:32 time:15ms TTL:115.

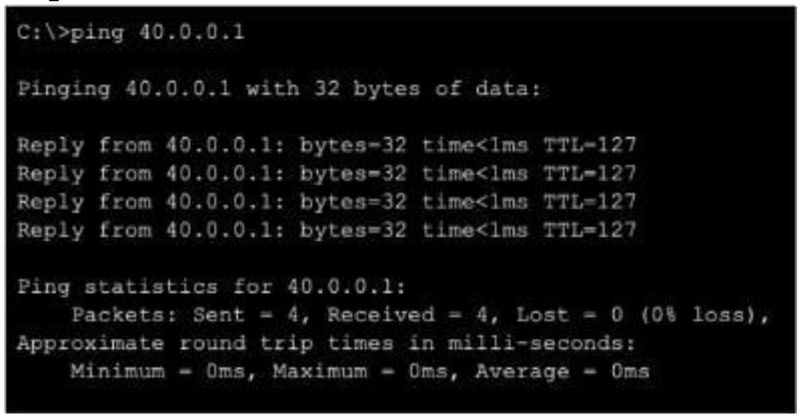
ping statistics for 10.0.0.1

Packets : sent = 4. recieved : 4 lost : 0 (0% loss)

approximate round trip time in milliseconds.

minimum = 4ms maximum = 45 ms Average = 4ms.

Output



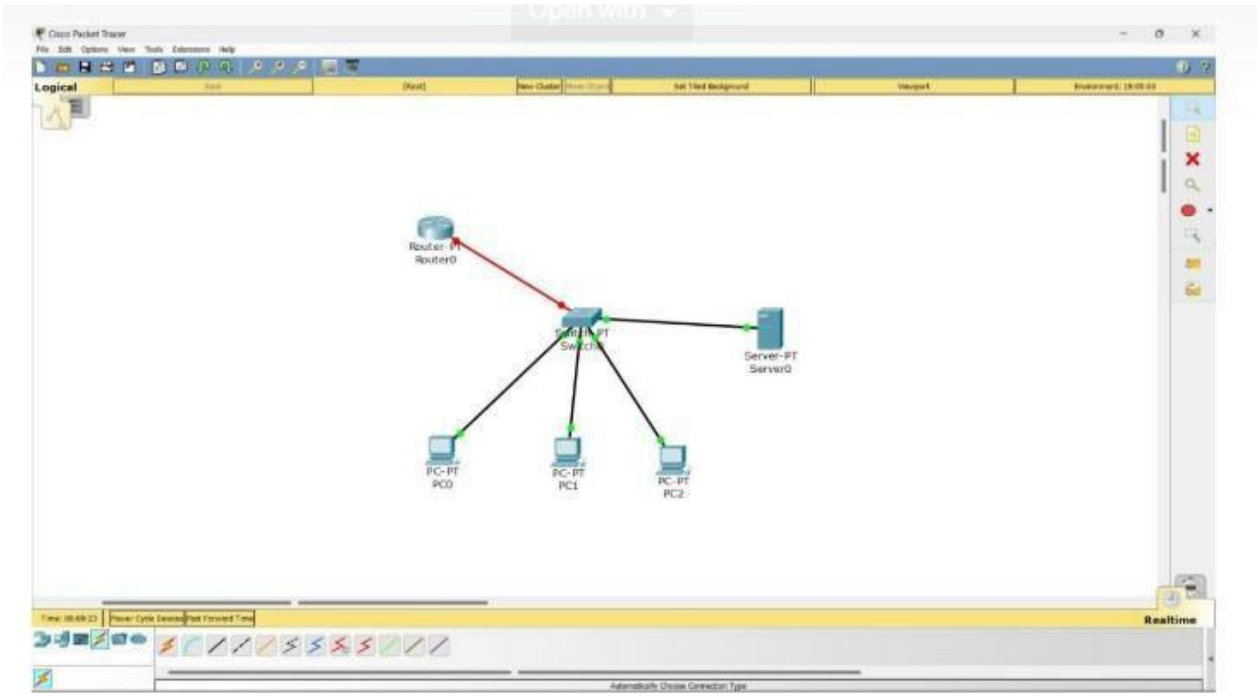
```
C:\>ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data:

Reply from 40.0.0.1: bytes=32 time<1ms TTL=127
Reply from 40.0.0.1: bytes=32 time<1ms TTL=127
Reply from 40.0.0.1: bytes=32 time<1ms TTL=127
Reply from 40.0.0.1: bytes=32 time<1ms TTL=127

Ping statistics for 40.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Experiment No 4

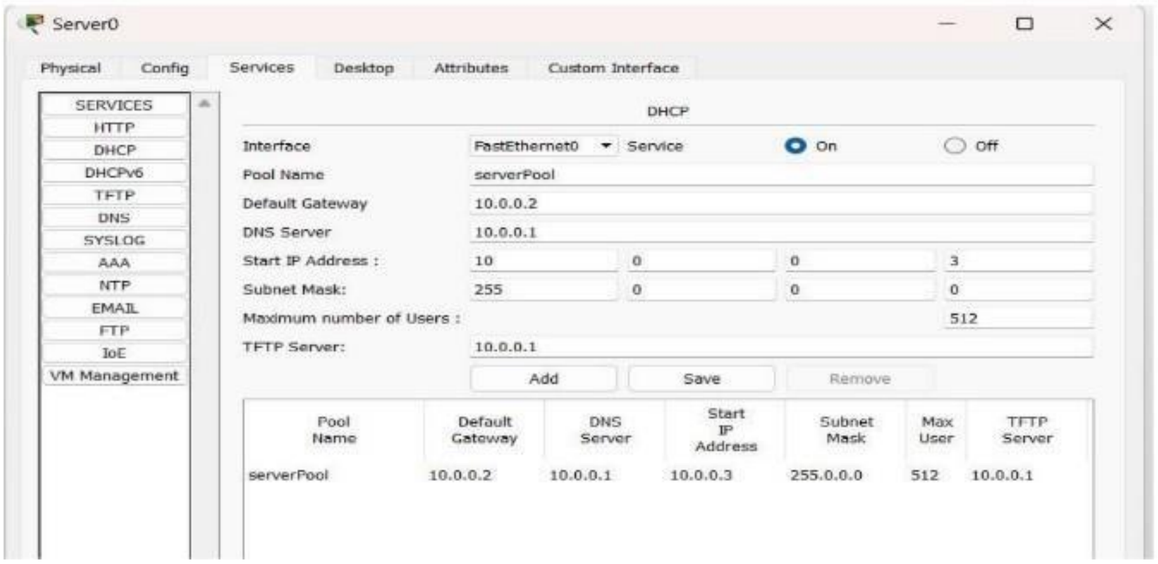
Aim of the program

Configuring DHCP within a LAN in a packet Tracer

Topology



Procedure



DHCP

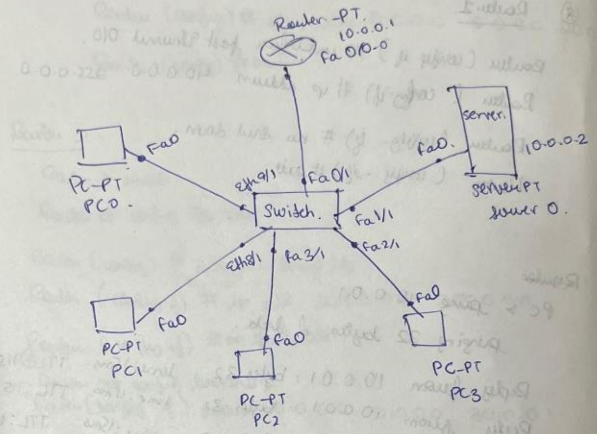
Interface	FastEthernet0	Service	[✓ On]	Off
Pool Name	serverPool			
Default Gateway	10.0.0.2			
DNS Server	10.0.0.1			
Start IP Address :	10	0	0	3
Subnet Mask:	255	0	0	0
Maximum number of Users :				512
TFTP Server:	10.0.0.1			

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server
serverPool	10.0.0.2	10.0.0.1	10.0.0.3	255.0.0.0	512	10.0.0.1

LAB-6

DHCP.

Dynamic Host Configuration Protocol.



(*)

PC0, PC1, PC2, PC3 are configured automatically.

Configure Router 0.

```
Router > enable.
Router ># config terminal
Router (config)# interface fastEthernet 0/0.
Router (config)# ip address 10.0.0.1 255.0.0.0
Router (config)# no shutdown.
```

(*) connec
conn

→ Sw
→ t
→

Confi

Con

cli

⑧ connect PC0 and PC1. , PC2 and PC3 wont get connected.

→ Switch1 > physical. > switch off.
→ then drag and drop two. LAN ports, then switch on. click.
→ PC2 and PC3 will get connected.

<u>Configure. server. 0</u>

config: fastEthernet 0 IP add: 10.0.0.2
Subnet mask: 255.0.0.0.

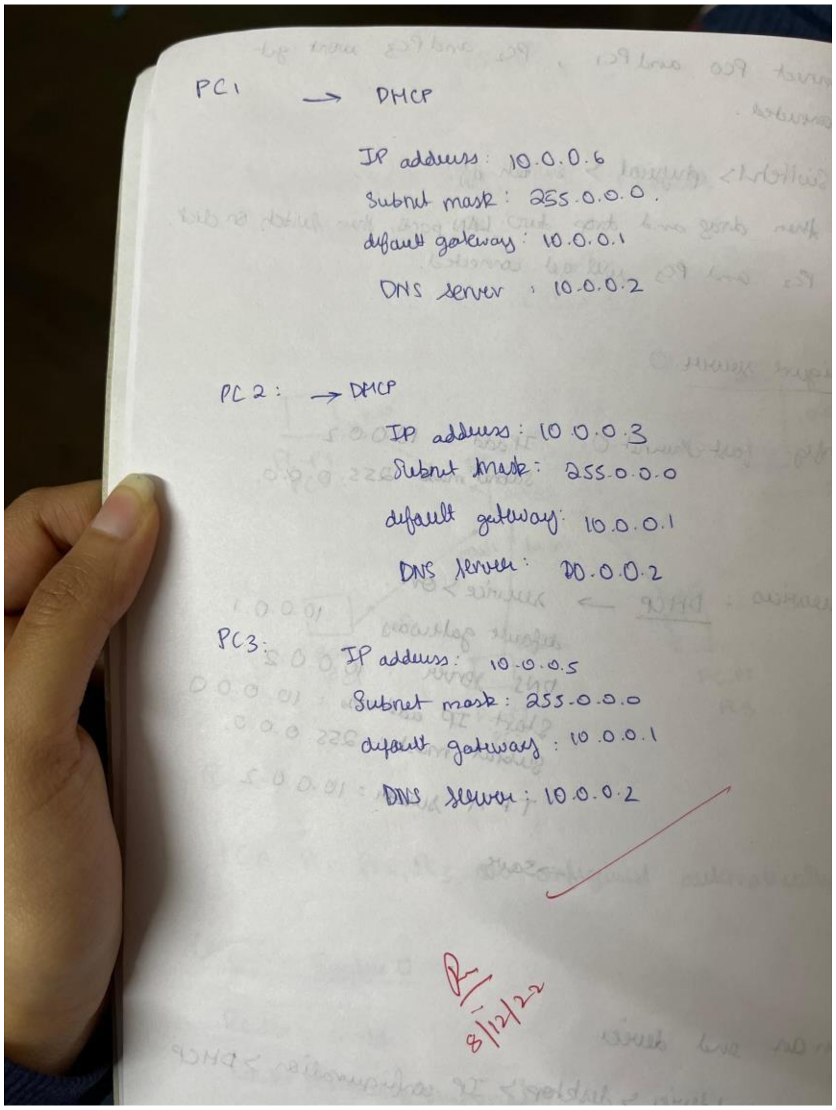
Services : <u>DHCP</u> → service > on.
default gateway : 10.0.0.1
DNS server : 10.0.0.2
Start IP address : 10.0.0.0
subnet mask : 255.0.0.0.
TFTP server : 10.0.0.2
→ save.

click on an end device

enddevice > desktop > IP configuration > DHCP.

<u>Observation</u>: IP address gets automatically configured.

~~Fo~~ PC0 : DHCP : IP add : 10.0.0.4
Subnet mask : 255.0.0.0.
default gateway : 10.0.0.1
DNS server : 10.0.0.2



PC1 → DHCP

IP address: 10.0.0.6

Subnet mask: 255.0.0.0.

default gateway: 10.0.0.1

DNS server : 10.0.0.2

PC2: → DHCP

IP address: 10.0.0.3

Subnet mask: 255.0.0.0

default gateway: 10.0.0.1

DNS server: 10.0.0.2

PC3: IP address: 10.0.0.5

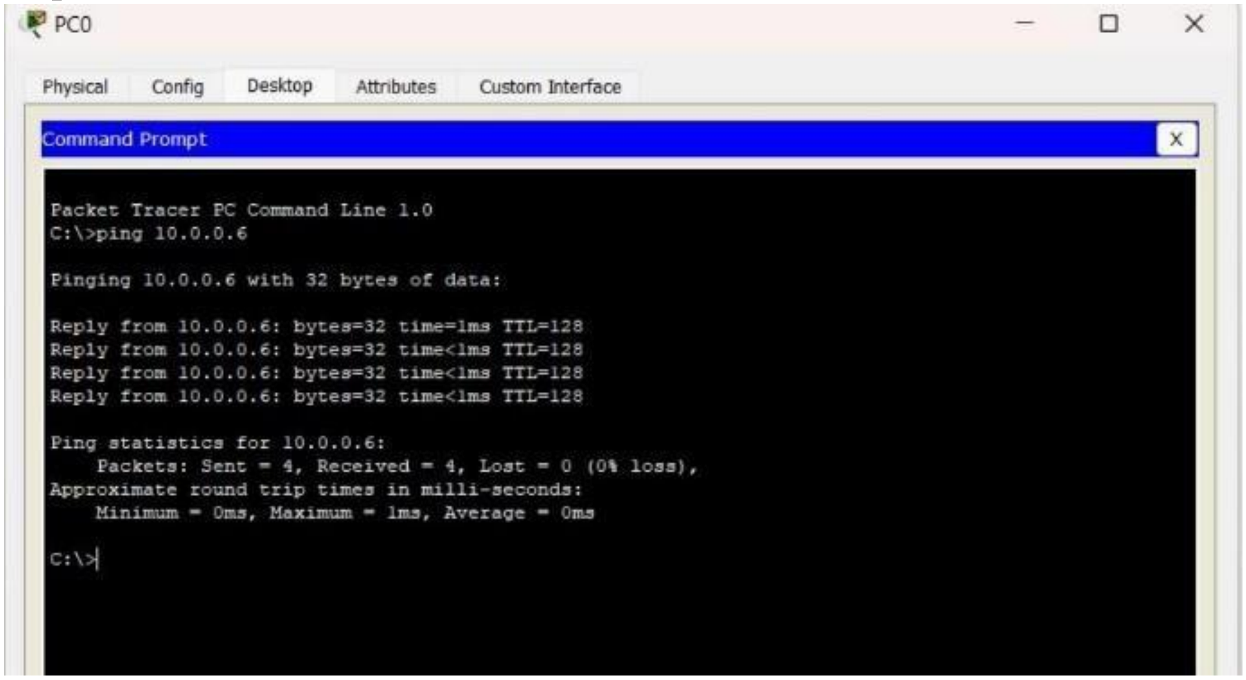
Subnet mask: 255.0.0.0

default gateway: 10.0.0.1

DNS server: 10.0.0.2

[illegible] 8/12/22

Output



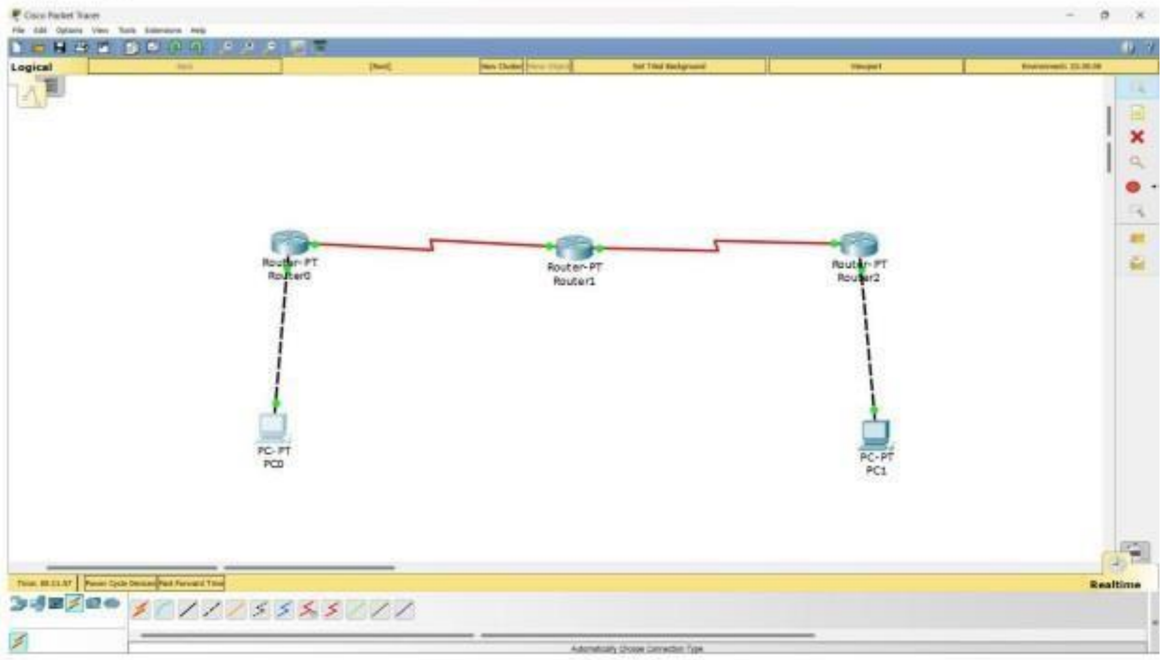
```
Packet Tracer PC Command Line 1.0
C:\>ping 10.0.0.6

Pinging 10.0.0.6 with 32 bytes of data:

Reply from 10.0.0.6: bytes=32 time=1ms TTL=128
Reply from 10.0.0.6: bytes=32 time<1ms TTL=128
Reply from 10.0.0.6: bytes=32 time<1ms TTL=128
Reply from 10.0.0.6: bytes=32 time<1ms TTL=128

Ping statistics for 10.0.0.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

Experiment No 5

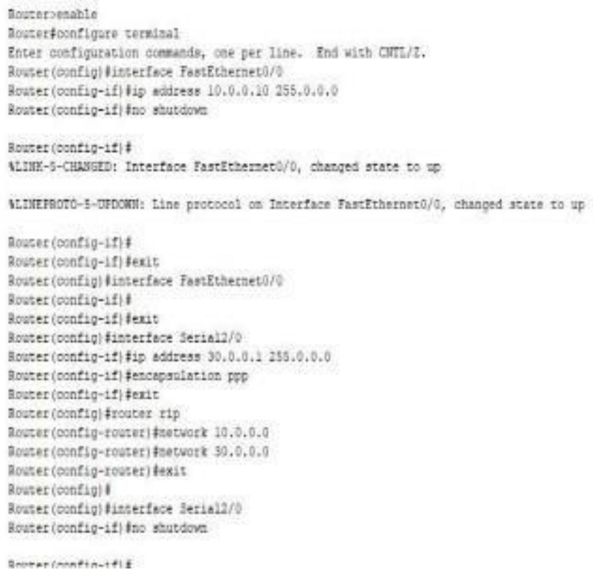
Aim of the program

Configuring RIP Routing Protocol in Routers

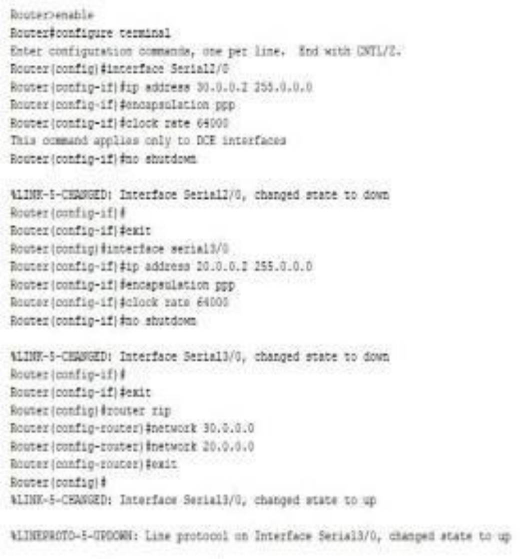
Topology



Procedure



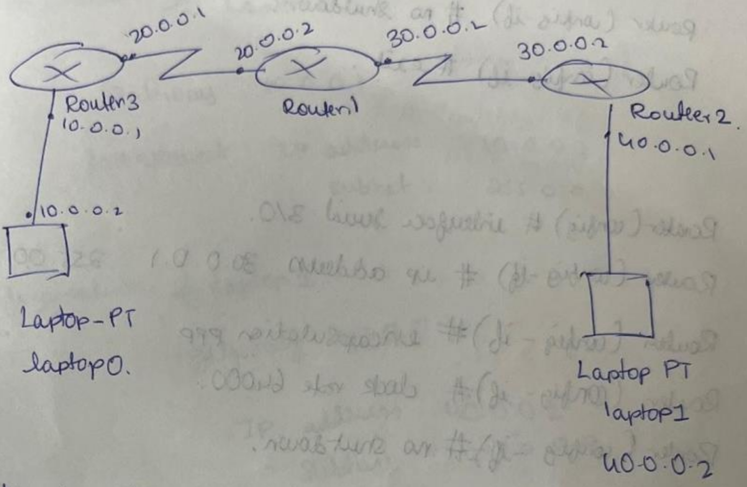
```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#ip address 10.0.0.10 255.0.0.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial2/0
Router(config-if)#ip address 30.0.0.1 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#exit
Router(config)#router rip
Router(config-router)#network 10.0.0.0
Router(config-router)#network 30.0.0.0
Router(config-router)#exit
Router(config)#
Router(config)#interface Serial2/0
Router(config-if)#no shutdown

Router(config-if)#
```



```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface Serial2/0
Router(config-if)#ip address 30.0.0.2 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#clock rate 64000
This command applies only to DCE interfaces
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial2/0, changed state to down
Router(config-if)#
Router(config-if)#exit
Router(config)#interface serial3/0
Router(config-if)#ip address 20.0.0.2 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#clock rate 64000
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial3/0, changed state to down
Router(config-if)#
Router(config-if)#exit
Router(config)#router rip
Router(config-router)#network 30.0.0.0
Router(config-router)#network 20.0.0.0
Router(config-router)#exit
Router(config)#
%LINK-5-CHANGED: Interface Serial3/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up
```

LAB-7. 15/12/22

Dynamic Routing RIP-
↳ Router information protocal.



Router 1 config.

```
(config)# interface fastEthernet 0/0.
(config-if)# ip address 10.0.0.1 255.0.0.0.
(config-if) # no shutdown.

(config-if) # exit

(config) # ~~interface~~ serial 2/0.
         # ip address 20.0.0.1 255.0.0.0.
         # encapsulation ppp
         # clock rate 64000.
         # no shutdown.

(config) # router rip
Router(config-router) #network 10.0.0.0.
Router (config-router) # network 20.0.0.0.
```

Router 1 configuration

```
Router (config)#. interface serial 2/0.
Router (config-if) # ip address 20.0.0.2  255.0.0.0.
Router (config-if) # encapsulation PPP.
Router (config-if). # no shutdown.
Router (config-if) # exit.


Router (config) # interface serial 3/0.
Router (config-if) # ip address 30.0.0.1  255.0.0.0.
Router (config - if) # encapsulation PPP
Router (config- if) # clock rate 64000.
Router (config -if) # no shutdown.

Router (config) # router rip
  Router (config -router) # network 20.0.0.0.
  Router (config- router) # network 30.0.0.0
```

Router2config

```
Router (config)# interface fast ethernet 0/0
 Router (config- if) # ip address 40.0.0.1 255.0.0.0.
                   # no shutdown.

 Router (config)# interface serial 2/0.
 Router (config- if)# ip add. 30.0.0.2    255.0.0.0.
              # encapsulation PPP
              # no shutdown
```

Router (config)

Router

Configuration

Ga

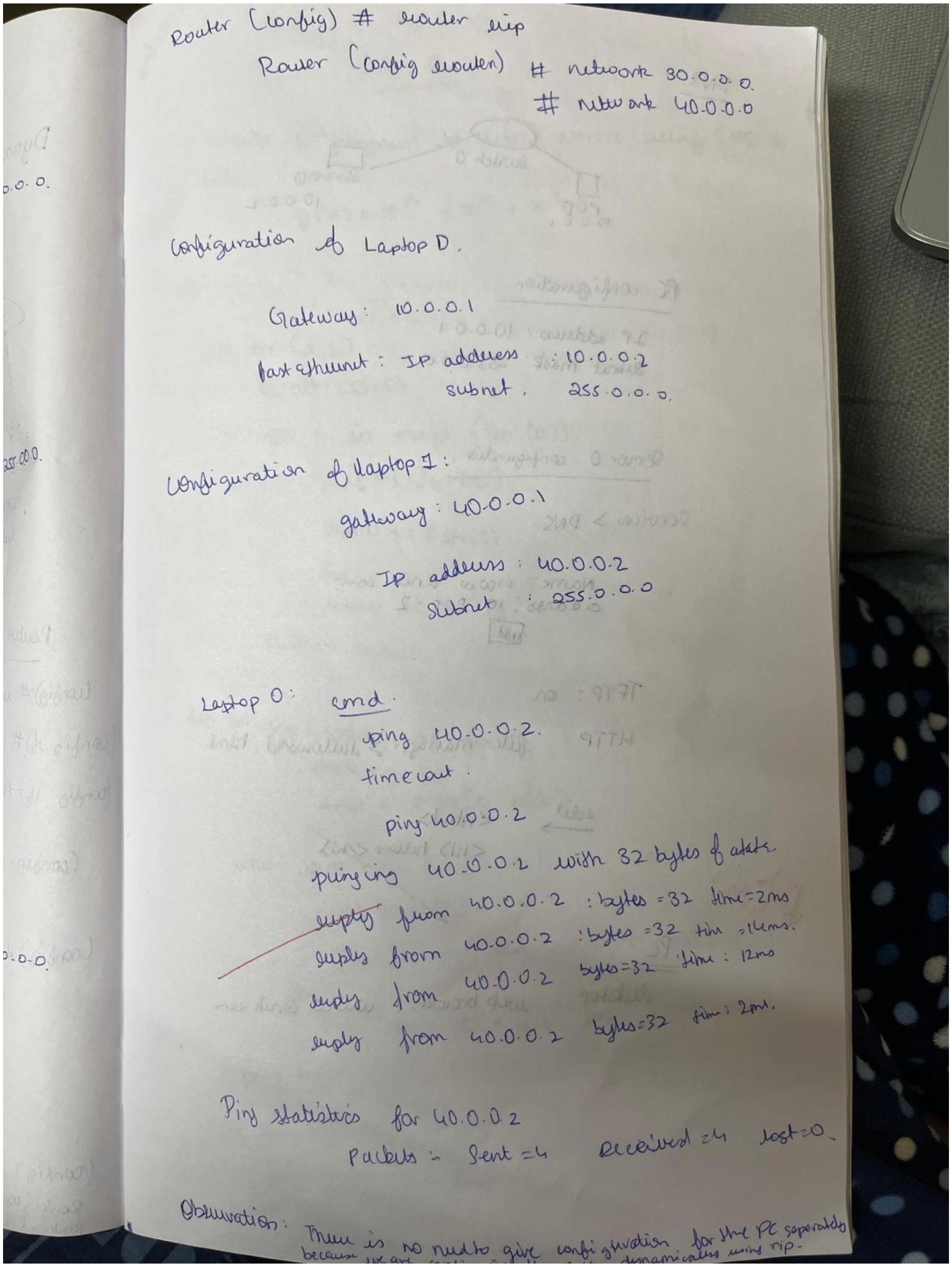
fast

Configuration

Laptop 0:

Ping

Observation



Router (config) # router rip

Router (config router) # network 30.0.0.0.
# network 40.0.0.0

Configuration of Laptop 0.

Gateway: 10.0.0.1

fast ethernet: IP address : 10.0.0.2
subnet. 255.0.0.0.

Configuration of laptop 1:

gateway: 40.0.0.1

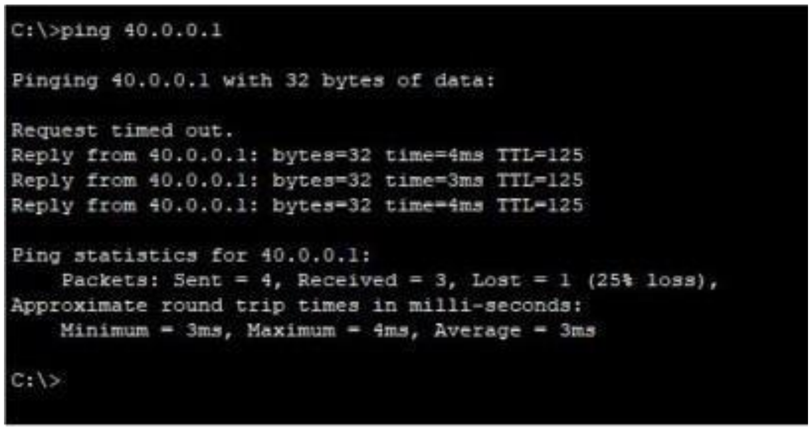
IP address: 40.0.0.2
Subnet: 255.0.0.0

Laptop 0: cmd.

```
ping 40.0.0.2.
timeout.

ping 40.0.0.2
pinging 40.0.0.2 with 32 bytes of data
~~reply~~ from 40.0.0.2 : bytes =32 time=2ms
reply from 40.0.0.2 : bytes =32 time =14ms.
reply from 40.0.0.2 bytes=32 time : 12ms
reply from 40.0.0.2 bytes=32 time : 2ms.

Ping statistics for 40.0.0.2
Packets :- Sent =4 Received =4 lost=0.
```

Observation: There is no need to give configuration for the PC seperately because we are [illegible] dynamically using rip.

Output:



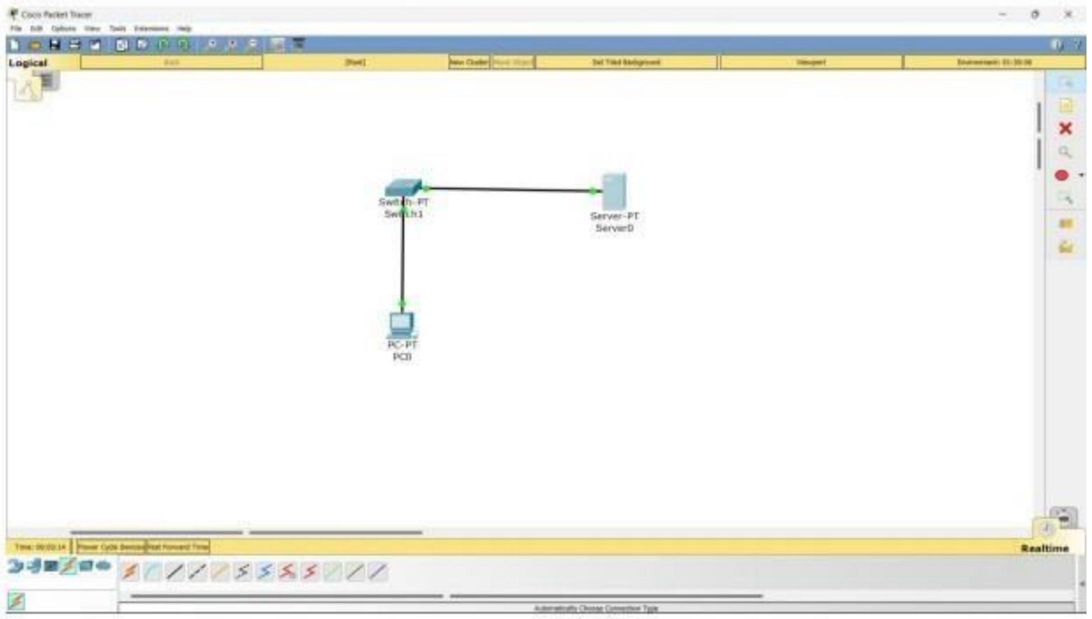
```
C:\>ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data:

Request timed out.
Reply from 40.0.0.1: bytes=32 time=4ms TTL=125
Reply from 40.0.0.1: bytes=32 time=3ms TTL=125
Reply from 40.0.0.1: bytes=32 time=4ms TTL=125

Ping statistics for 40.0.0.1:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 4ms, Average = 3ms

C:\>
```

Experiment No 6

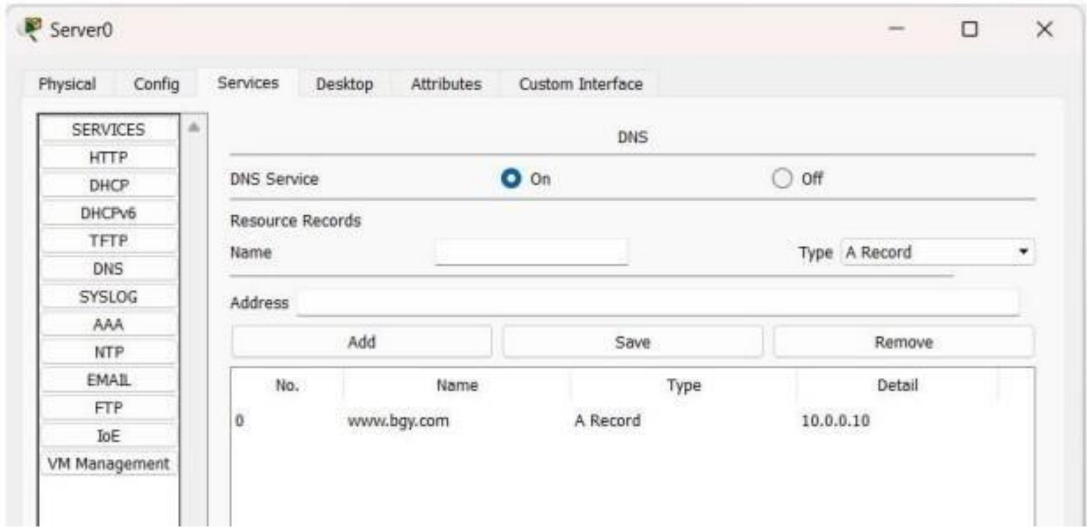
Aim of the program

Demonstration of WEB server and DNS using Packet Tracer

Topology



Procedure



DNS

DNS Service [✓ On] Off

Resource Records

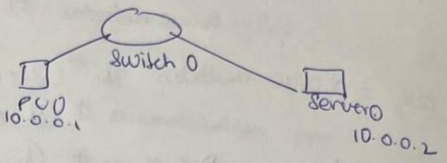
Name

Type A Record

Address

No.	Name	Type	Detail
0	www.bgy.com	A Record	10.0.0.10

DNS.



PC configuration.

IP address : 10.0.0.1
Subnet mask : 255.0.0.0.

Server 0 configuration.

Services > DNS

Name : www. anik. com.
address : 10.0.0.2
$\boxed{\text{add.}}$

TFTP : on.

HTTP : file manager > helloworld. html.

$\xrightarrow{\text{edit}}$ <html>
<h1> helloooo </h1>

[illegible]
15/12/22

PC

desktop : web browser. : www. anik.com

29/12/22.

We

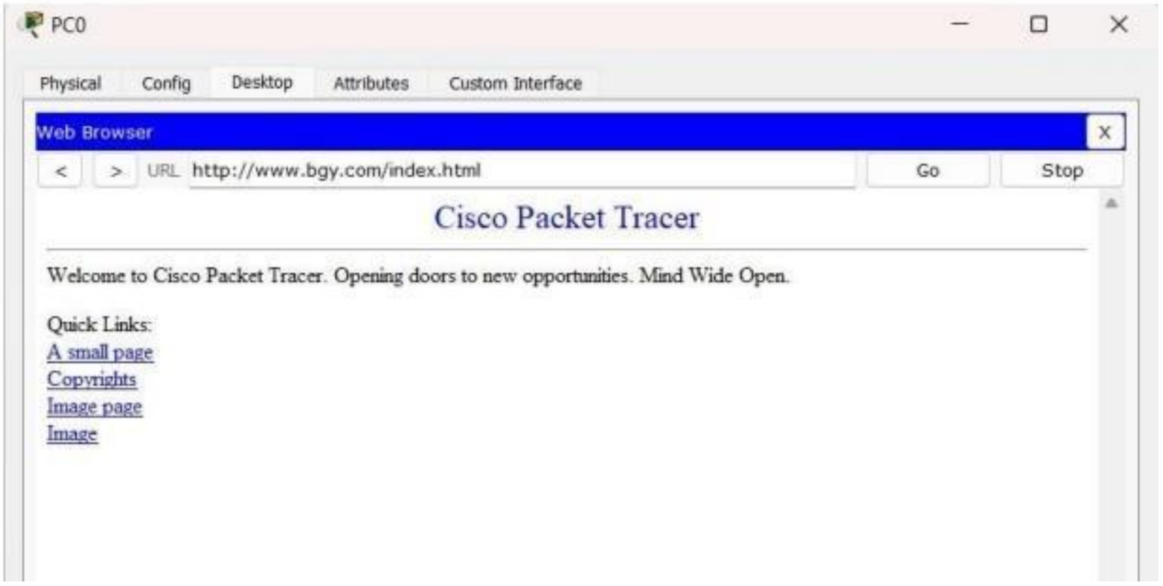
bits

def

def bi

if

Output



http://www.bgy.com/index.html

Cisco Packet Tracer

Welcome to Cisco Packet Tracer. Opening doors to new opportunities. Mind Wide Open.

Quick Links:
A small page
Copyrights
Image page
Image

Cycle-2 Experiment No 1

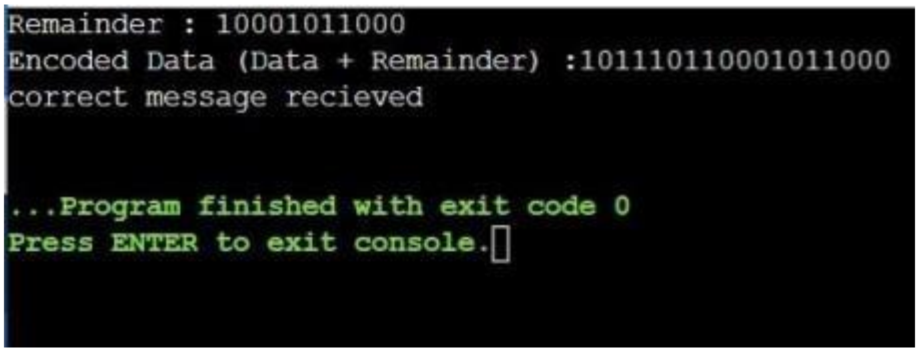
Aim of the Experiment

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

Code

```
          import
          java.util.*;
 public class Main{
                    public static int n;   public static
void main(String[] args){
                    Scanner in=new Scanner(System.in);
                    Main ob=new Main();
                        String data,data_copy,zero="0000000000000000",ans,data_r;
                      System.out.print("Enter the data to be
                    transferred:"); data=in.nextLine(); data_copy=data;
                    data+=zero; n=data_copy.length();

                    System.out.println("Divisor:10001000000100001");

                    System.out.println("Modified poly: "+data);
                    data=ob.divide(data);

                    System.out.println("CheckSum: "+data.substring(n));
                    data_copy=data_copy.substring(0,n)+data.substring(n);
                    System.out.println("Final Codeword: "+data_copy);


                    System.out.print("Enter the data received at the destination:"); data_r=in.nextLine();
                    data_r=ob.divide(data_r);
                    System.out.println("Remainder:"+data_r);
zero="0000000000000000000000"; if(data_r.equals(zero)==true){
                    System.out.println("No error");
                    }
                    else{
                    System.out.println("Error detected");

                    }
                    }
 public String divide(String s){ int i,j; char x;
                    String div="10001000000100001";
for(i=0;i<n;i++){ x=s.charAt(i);
for(j=0;j<17;j++){ if(x=='1'){
if(s.charAt(i+j)!=div.charAt(j)
)
                        s=s.substring(0,i+j)+"1"+s.substring(i+j+1);
else
                        s=s.substring(0,i+j)+"0"+s.substring(i+j+1);
}
}
}


return s;
}
}
```

Output



```
Remainder : 10001011000
Encoded Data (Data + Remainder) :101110110001011000
correct message recieved


...Program finished with exit code 0
Press ENTER to exit console.
```

Experiment No 2

Aim of the Experiment

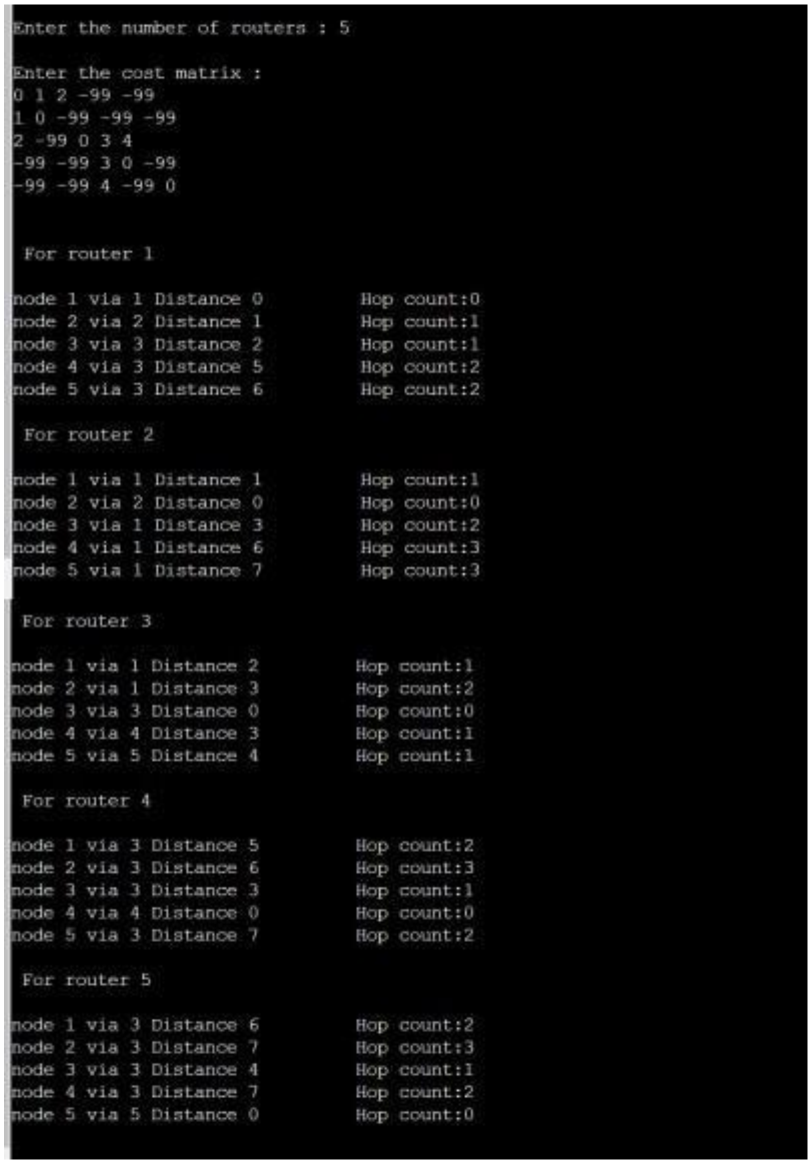
Write a program for distance vector algorithm to find suitable path for transmission.

Code

```
#include<stdio.h>

          struct node
          {   unsigned   dist[20];
           unsigned     from[20];
           unsigned hopcount[20];
          }rt[10]; int
          main()
          { int costmat[20][20]; int
           nodes,i,j,k,count=0; printf("\nEnter the
           number of routers : "); scanf("%d",&nodes);
           printf("\nEnter the cost matrix :\n");
           for(i=0;i<nodes;i++)
```

```
 {
 for(j=0;j<nodes;j++)
 { scanf("%d",&costmat[i][j]);
 if(costmat[i][j]>0){
 rt[i].hopcount[j]=1;
 } else rt[i].hopcount[j]=0; costmat[i][i]=0;
 rt[i].dist[j]=costmat[i][j];//initialise the distance equal to cost
matrix
 rt[i].from[j]=j;
 } } do {
 count=0;
             for(i=0;i<nodes;i++)//We choose arbitary vertex k and we
calculate the direct distance from the node i to k using the cost
matrix //and add the distance from k to node j for(j=0;j<nodes;j++)
for(k=0;k<nodes;k++)
```

```
 if(rt[i].dist[j]>costmat[i][k]+rt[k].dist[j]) {//We
calculate the minimum distance
rt[i].dist[j]=rt[i].dist[k]+rt[k].dist[j];
rt[i].hopcount[j]=rt[i].hopcount[k]+rt[k].hopcount[j]
; rt[i].from[j]=k;
 count++;
 }
 }while(count!=0); for(i=0;i<nodes;i++)
 { printf("\n\n For router
 %d\n",i+1);
 for(j=0;j<nodes;j++)
 {
 printf("\t\nnode %d via %d Distance %d
",j+1,rt[i].from[j]+1,rt[i].dist[j]); printf("\tHop
 count:%d",rt[i].hopcount[j]); }
 }
 printf("\n\n");
 getch();
}
```



```
Enter the number of routers : 5

Enter the cost matrix :
0 1 2 -99 -99
1 0 -99 -99 -99
2 -99 0 3 4
-99 -99 3 0 -99
-99 -99 4 -99 0


 For router 1

node 1 via 1 Distance 0         Hop count:0
node 2 via 2 Distance 1         Hop count:1
node 3 via 3 Distance 2         Hop count:1
node 4 via 3 Distance 5         Hop count:2
node 5 via 3 Distance 6         Hop count:2

 For router 2

node 1 via 1 Distance 1         Hop count:1
node 2 via 2 Distance 0         Hop count:0
node 3 via 1 Distance 3         Hop count:2
node 4 via 1 Distance 6         Hop count:3
node 5 via 1 Distance 7         Hop count:3

 For router 3

node 1 via 1 Distance 2         Hop count:1
node 2 via 1 Distance 3         Hop count:2
node 3 via 3 Distance 0         Hop count:0
node 4 via 4 Distance 3         Hop count:1
node 5 via 5 Distance 4         Hop count:1

 For router 4

node 1 via 3 Distance 5         Hop count:2
node 2 via 3 Distance 6         Hop count:3
node 3 via 3 Distance 3         Hop count:1
node 4 via 4 Distance 0         Hop count:0
node 5 via 3 Distance 7         Hop count:2

 For router 5

node 1 via 3 Distance 6         Hop count:2
node 2 via 3 Distance 7         Hop count:3
node 3 via 3 Distance 4         Hop count:1
node 4 via 3 Distance 7         Hop count:2
node 5 via 5 Distance 0         Hop count:0
```

Experiment No 3 Aim of the Experiment

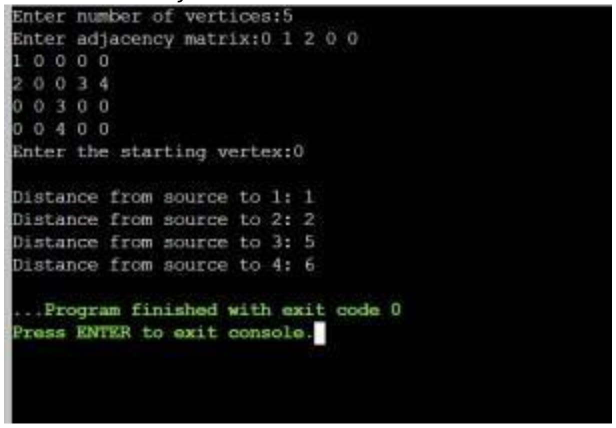
Implement Dijkstra’s algorithm to compute the shortest path for a given topology.

Code

```
  #include
  <stdio.h>
                    #define INFINITY 9999
                    #define MAX 10   void Dijkstra(int Graph[MAX][MAX],
int n, int start);   void Dijkstra(int Graph[MAX][MAX], int n, int start) { int
cost[MAX][MAX], distance[MAX], pred[MAX]; int visited[MAX], count, mindistance,
nextnode, i, j;
                     // Creating cost matrix
                     for (i = 0; i < n; i++)
                     for (j = 0; j < n; j++)
                     if (Graph[i][j] == 0)
                     cost[i][j] = INFINITY;
                     else cost[i][j] =
                     Graph[i][j];
  for (i = 0; i < n; i++) { distance[i] = cost[start][i];
pred[i] = start; visited[i] = 0;
                     }
  distance[start] = 0; visited[start] = 1; count
= 1;
  while (count < n - 1) { mindistance = INFINITY;

                     for (i = 0; i < n; i++) if (distance[i] <
                     mindistance && !visited[i]) { mindistance =
                     distance[i]; nextnode = i;
                     }
```

```
                    visited[nextnode] = 1;
                     for (i = 0; i < n; i++)
                     if (!visited[i])
                     if (mindistance + cost[nextnode][i] < distance[i]) {
                     distance[i] = mindistance + cost[nextnode][i]; pred[i]
                     = nextnode;
                     }
                     count++;
```

```
                            }
 for (i = 0; i < n; i++) if (i != start) { printf("\nDistance from source to %d: %d", i,
distance[i]); }
                            } int
                            main() {
                             int Graph[MAX][MAX], i, j, n, u;
                             printf("Enter number of
                             vertices:"); scanf("%d",&n);
                             printf("Enter adjacency matrix:");
                             for(i=0;i<n;i++){ for(j=0;j<n;j++){
                             scanf("%d",&Graph[i][j]);
                             } } printf("Enter the starting
                             vertex:"); scanf("%d",&u);
                             Dijkstra(Graph, n,
u);   return 0;
                            }
```



```
Enter number of vertices:5
Enter adjacency matrix:0 1 2 0 0
1 0 0 0 0
2 0 0 3 4
0 0 3 0 0
0 0 4 0 0
Enter the starting vertex:0

Distance from source to 1: 1
Distance from source to 2: 2
Distance from source to 3: 5
Distance from source to 4: 6

...Program finished with exit code 0
Press ENTER to exit console.
```

Experiment No 4

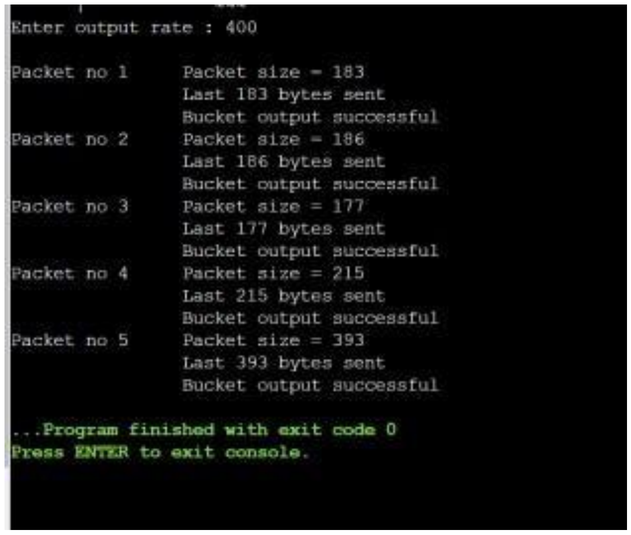
Aim of the Experiment

Write a program for congestion control using leaky bucket algorithm.

CODE

```
  #include<stdio.h>
                         #define bucketSize 500   void
bucketInput(int a,int b)
                         { if(a > bucketSize) printf("\n\t\tBucket
                                overflow");
                                else{   while(a   >   b){   printf("\n\t\t%d   bytes
                                       outputted.",b);
                                              a-=b;
                                       } if(a > 0) printf("\n\t\tLast %d bytes
                                       sent\t",a);
                                       printf("\n\t\tBucket output successful"); }
} int
main()
{ int op,pktSize; printf("Enter output
       rate : "); scanf("%d",&op);
       for(int i=1;i<=5;i++)
       { pktSize=rand()%700;
              printf("\nPacket no %d \tPacket size = %d",i,pktSize);
              bucketInput(pktSize,op);
       } return
       0;
}
```

OUTPUT:



```
Enter output rate : 400

Packet no 1     Packet size = 183
                Last 183 bytes sent
                Bucket output successful
Packet no 2     Packet size = 186
                Last 186 bytes sent
                Bucket output successful
Packet no 3     Packet size = 177
                Last 177 bytes sent
                Bucket output successful
Packet no 4     Packet size = 215
                Last 215 bytes sent
                Bucket output successful
Packet no 5     Packet size = 393
                Last 393 bytes sent
                Bucket output successful

...Program finished with exit code 0
Press ENTER to exit console.
```

Experiment No 5 Aim of the Experiment

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.

Code

Server:

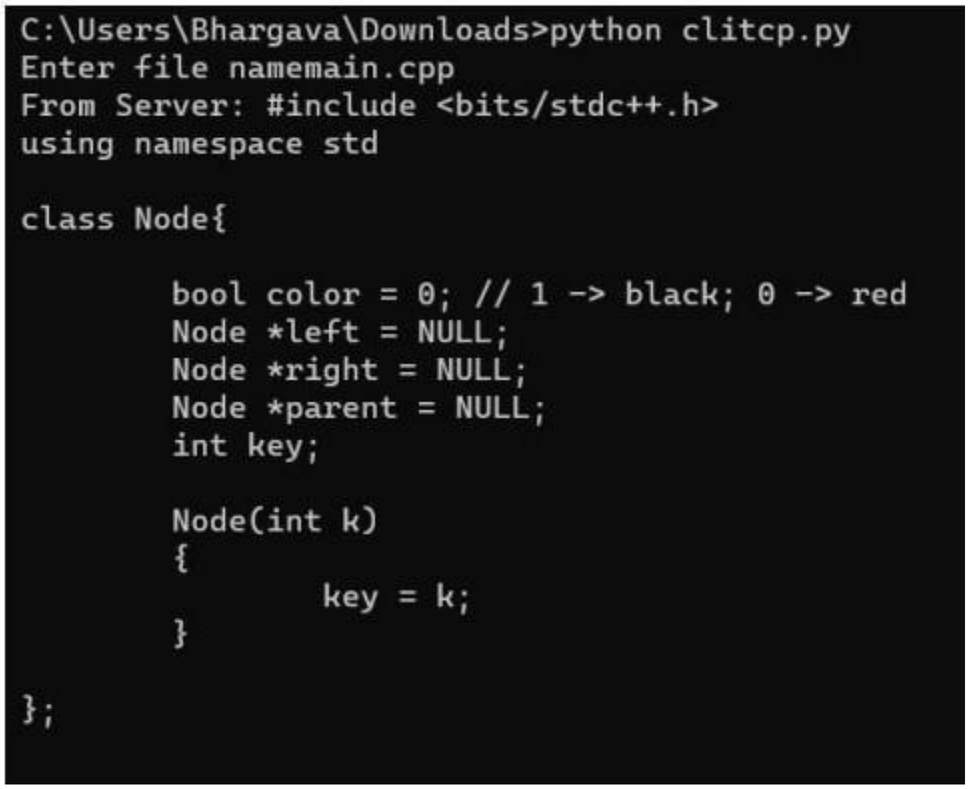
```
from socket import * serverName = '' serverPort =
12530 serverSocket = socket(AF_INET,SOCK_STREAM)
serverSocket.bind((serverName,serverPort))
serverSocket.listen(1) print("The server is ready to receive")
while 1:
connectionSocket, addr = serverSocket.accept()
sentence = connectionSocket.recv(1024).decode() try:
file = open(sentence,"r") l = file.read(1024)
connectionSocket.send(l.encode()) file.close() except Exception as e:
message = "No such file exist"
connectionSocket.send(message.encode()) connectionSocket.close()
```

Client:

```
from socket import * serverName =
'192.168.1.104' serverPort = 12530 clientSocket =
socket(AF_INET, SOCK_STREAM)
clientSocket.connect((serverName,serverPort))
sentence = input("Enter file name")
```

```
clientSocket.send(sentence.encode()) filecontents = clientSocket.recv(1024).decode() print
('From Server:', filecontents) clientSocket.close()
```

Output



```
C:\Users\Bhargava\Downloads>python clitcp.py
Enter file namemain.cpp
From Server: #include <bits/stdc++.h>
using namespace std

class Node{

        bool color = 0; // 1 -> black; 0 -> red
        Node *left = NULL;
        Node *right = NULL;
        Node *parent = NULL;
        int key;

        Node(int k)
        {
                key = k;
        }

};
```

Experiment No 6

Aim of the Experiment

Using UDP 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.

Code

Server: from socket import *

serverPort

= 12000

serverSocket = socket(AF_INET, SOCK_DGRAM)

serverSocket.bind(("127.0.0.1",   serverPort))

print("The server is ready to receive") while 1:

sentence,clientAddress = serverSocket.recvfrom(2048)
 file=open(sentence,"r")
l=file.read(2048)

serverSocket.sendto(bytes(l,"utf-8"),clientAddress)

print("sent back to client",l) file.close() Client: from

socket import * serverName = "127.0.0.1"

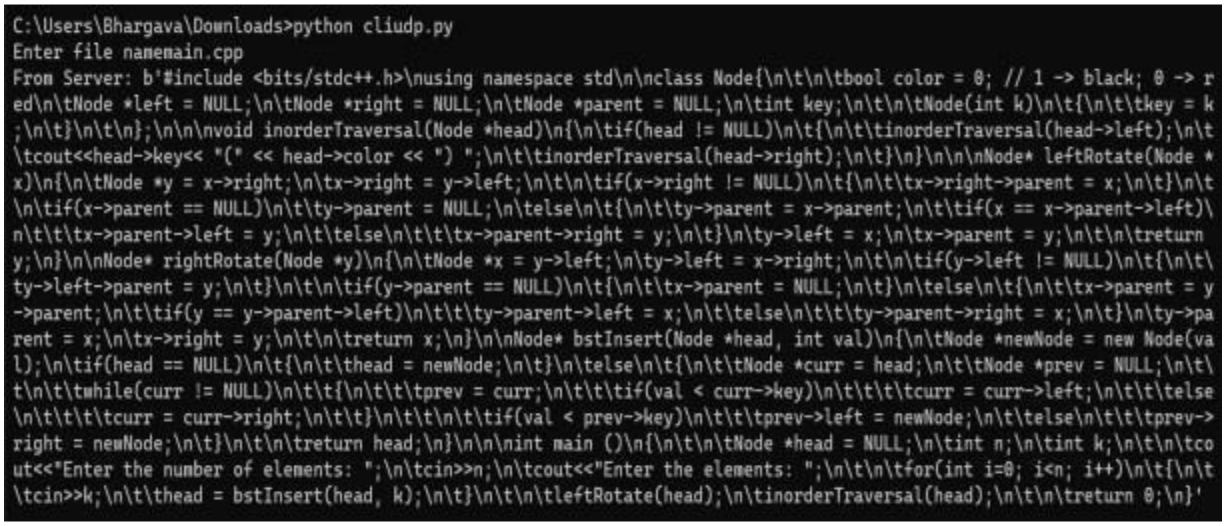
serverPort = 12000 clientSocket =

socket(AF_INET, SOCK_DGRAM)

sentence = input("Enter file name") clientSocket.sendto(bytes(sentence,"utf-8"),(serverName, serverPort)) filecontents,serverAddress = clientSocket.recvfrom(2048) print ('From Server:', filecontents)

clientSocket.close()

Output



```
C:\Users\Bhargava\Downloads>python cliudp.py
Enter file namemain.cpp
From Server: b'#include <bits/stdc++.h>\nusing namespace std\n\nclass Node{\n\t\n\tbool color = 0; // 1 -> black; 0 -> r
ed\n\tNode *left = NULL;\n\tNode *right = NULL;\n\tNode *parent = NULL;\n\tint key;\n\t\n\tNode(int k)\n\t{\n\t\tkey = k
;\n\t}\n\t\n};\n\n\nvoid inorderTraversal(Node *head)\n{\n\tif(head != NULL)\n\t{\n\t\tinorderTraversal(head->left);\n\t
\tcout<<head->key<< "(" << head->color << ") ";\n\t\tinorderTraversal(head->right);\n\t}\n}\n\n\nNode* leftRotate(Node *
x)\n{\n\tNode *y = x->right;\n\tx->right = y->left;\n\t\n\tif(x->right != NULL)\n\t{\n\t\tx->right->parent = x;\n\t}\n\t
\n\tif(x->parent == NULL)\n\t\ty->parent = NULL;\n\telse\n\t{\n\t\ty->parent = x->parent;\n\t\tif(x == x->parent->left)\
n\t\t\tx->parent->left = y;\n\t\telse\n\t\t\tx->parent->right = y;\n\t}\n\ty->left = x;\n\tx->parent = y;\n\t\n\treturn
y;\n}\n\nNode* rightRotate(Node *y)\n{\n\tNode *x = y->left;\n\ty->left = x->right;\n\t\n\tif(y->left != NULL)\n\t{\n\t\
ty->left->parent = y;\n\t}\n\t\n\tif(y->parent == NULL)\n\t{\n\t\tx->parent = NULL;\n\t}\n\telse\n\t{\n\t\tx->parent = y
->parent;\n\t\tif(y == y->parent->left)\n\t\t\ty->parent->left = x;\n\t\telse\n\t\t\ty->parent->right = x;\n\t}\n\ty->pa
rent = x;\n\tx->right = y;\n\t\n\treturn x;\n}\n\nNode* bstInsert(Node *head, int val)\n{\n\tNode *newNode = new Node(va
l);\n\tif(head == NULL)\n\t{\n\t\thead = newNode;\n\t}\n\telse\n\t{\n\t\tNode *curr = head;\n\t\tNode *prev = NULL;\n\t\
t\n\t\twhile(curr != NULL)\n\t\t{\n\t\t\tprev = curr;\n\t\t\tif(val < curr->key)\n\t\t\t\tcurr = curr->left;\n\t\t\telse
\n\t\t\t\tcurr = curr->right;\n\t\t}\n\t\t\n\t\tif(val < prev->key)\n\t\t\tprev->left = newNode;\n\t\telse\n\t\t\tprev->
right = newNode;\n\t}\n\t\n\treturn head;\n}\n\n\nint main ()\n{\n\t\n\tNode *head = NULL;\n\tint n;\n\tint k;\n\t\n\tco
ut<<"Enter the number of elements: ";\n\tcin>>n;\n\tcout<<"Enter the elements: ";\n\t\n\tfor(int i=0; i<n; i++)\n\t{\n\t
\tcin>>k;\n\t\thead = bstInsert(head, k);\n\t}\n\t\n\tleftRotate(head);\n\tinorderTraversal(head);\n\t\n\treturn 0;\n}'
```