



Faculty of Engineering & Technology
Department of Electrical & Computer Engineering
ENCS4130-Computer network laboratory
To DO #1 : Subnetting, Router Configuration and static Routing

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Question 1:

Question 1: Given the following topology, divide the given class C address 192.168.1.0/24 range on the networks A, B, C, D, E using minimum number of IPs.

Net A = 2

Net E = 5

B, C and D represent the last six digits of your university ID.

For example: if your university ID 1170302

1170302			
1	17	03	02
Not Use	B	C	D
	Net B Host	Net C Host	Net D Host

→ First I solve it in hand write to show all steps of the work:

Solve Q.2, To Do 1

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my ID is 121 07 37
B C D

So the number of host in each networks-

Net A = 2 → fixed

Net B = 21

Net C = 7

Net D = 37

Net E = 5 → fixed

we have the Ip 192.168.1.0/24

① Start with the largest number of host (Net D = 37)

$2^n - 2 \geq 37 \Rightarrow$ we need $n = 6 \Rightarrow$ The required subnet mask is /26

so we need 2 bit more \Rightarrow 192.168.1.0000 0000

1st subnet 192.168.1.0/26 \Rightarrow give it to Net D

② Next, Net B (21 hosts)

$2^n - 2 \geq 21 \Rightarrow n = 5$ we need 1 bit more (/27)

2nd subnet is 192.168.1.0100 0000 \Rightarrow 192.168.1.64/26

and we can divide it into 2 subnets-

192.168.1.0100 0000 \Rightarrow 192.168.1.64/27 \Rightarrow I
give it to Net B

192.168.1.0110 0000 \Rightarrow 192.168.1.96/27

③ Next, Net C (7 host)

$2^n - 2 \geq 7 \Rightarrow n = 4 \Rightarrow$ we need 1 bit more (/28)

we can divide the subnet 192.168.1.96/27 into 2 subnet

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$192.168.1.0110\ 0000 \Rightarrow 192.168.1.96/28 \Rightarrow$ we give
it to Net C

$192.168.1.0111\ 0000 \Rightarrow 192.168.1.112/28$

④ Next, Net E (5 hosts)

$2^n - 2 \stackrel{?}{=} 5 \Rightarrow n=3 \Rightarrow$ we need 1 bit more (/29)

we can divided $192.168.1.112/28$ into 2 subnets

$192.168.1.0111\ 0000 \Rightarrow 192.168.1.112/29 \Rightarrow$ give
it to Net E

$192.168.1.0111\ 1000 \Rightarrow 192.168.1.120/29$

⑤ Next, Net A (2 hosts):

$2^n - 2 \stackrel{?}{=} 2 \Rightarrow n=2 \Rightarrow$ we need 1 bit more (/30)

we can divided the subnet $192.168.1.120/29$ into
two subnets

$192.168.1.01111\ 000 \Rightarrow 192.168.1.120/30 \Rightarrow$ give it
to Net A

$192.168.1.01111\ 100 \Rightarrow 192.168.1.124/30$

* All Subnet &

Net D $\Rightarrow 192.168.1.0/26$

Net B $\Rightarrow 192.168.1.64/27$

Net C $\Rightarrow 192.168.1.96/28$

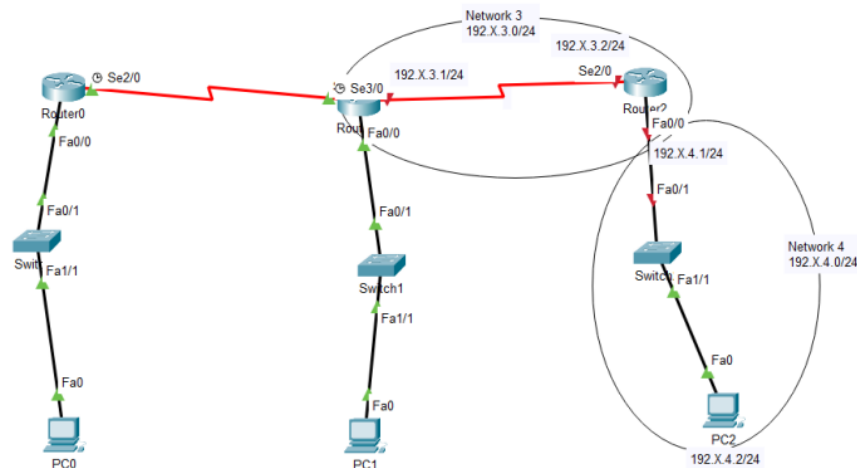
Net E $\Rightarrow 192.168.1.112/29$

Net A $\Rightarrow 192.168.1.120/30$

→ then complete the table:

Netwo rk symbol	Network IP	Broadcast IP	First allowed IP= Network IP +1	Last allowed IP= Broadcast IP -1	Numb er of Hosts
A	192.168.1.01111 000 →192.168.1.120 /30	192.168.1.01111 011 192.168.1.123	192.168.1.01111 001 192.168.1.121	192.168.1.01111 010 192.168.1.122	2^2-2 = 4-2 =2
B	192.168.1.01000 000 →192.168.1.64/ 27	192.168.1.01011 111 →192.168.1.95	192.168.1.01000 001 →192.168.1.65	192.168.1.01011 110 →192.168.1.94	2^5-2 = 32-2 =30
C	192.168.1.01100 000 →192.168.1.96/ 28	192.168.1.01101 111 →192.168.1.111	192.168.1.01100 001 →192.168.1.97	192.168.1.01101 110 →192.168.1.110	2^4-2 = 16-2 =14
D	192.168.1.00000 000 →192.168.1.0/ 26	192.168.1.00111 111 →192.168.1.63	192.168.1.00000 001 →192.168.1.1	192.168.1.00111 110 →192.168.1.62	2^6-2 =64-2 =62
E	192.168.1.01110 000 →192.168.1.112 /29	192.168.1.01110 111 →192.168.1.119	192.168.1.01110 001 →192.168.1.113	192.168.1.01110 110 →192.168.1.118	2^3-2 =8-2 =6

Question 2:



Do the following:

- 1- Add a new router, switch, and PC to the topology of **EXP#2** that you have done.
- 2- Complete the static routing, check the connectivity of this new network!
 - a. Add screenshots of the steps you took with the time and date shown.
 - b. Show the routing table on the new router with the time and date shown.

→I give the IPs for each network as shown in Figure 1

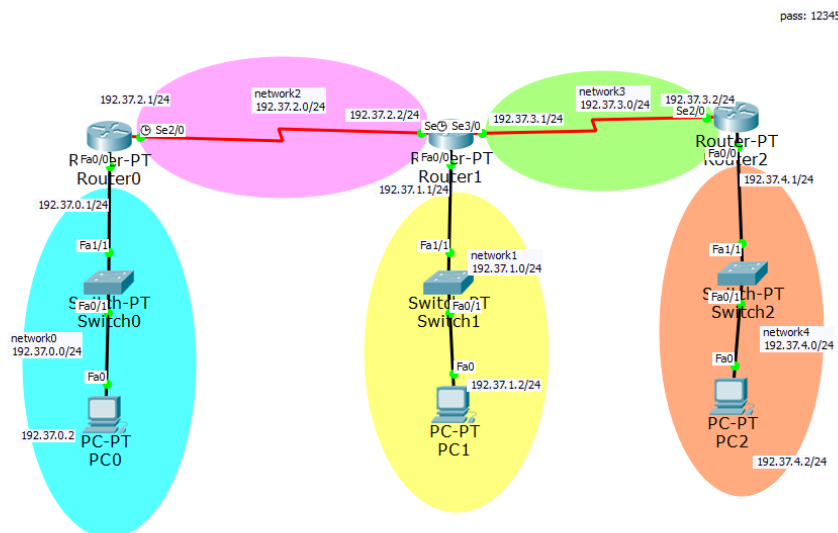


Figure 1: The topology

→ make the IP configuration for PC2:

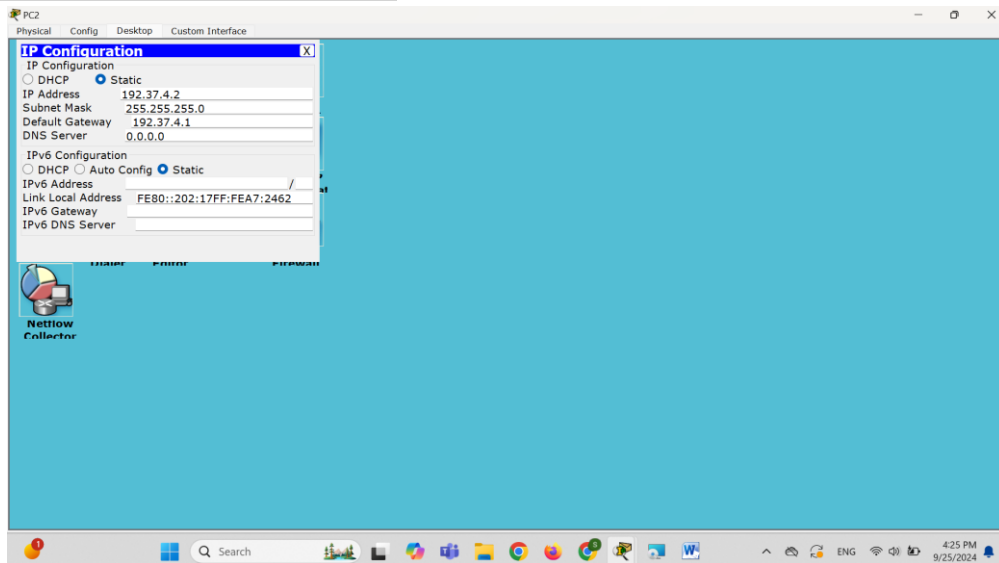


Figure 2: IP configuration for PC2

→ add serial3/0 for router1:

```
User Access Verification
Password:
Router>enable
Password:
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Serial3/0
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial3/0, changed state to down
Router(config-if)#ip address 192.37.3.1 255.255.255.0
Router(config-if)#
%LINK-5-CHANGED: Interface Serial3/0, changed state to up
```

→ then add new static route for all routers:

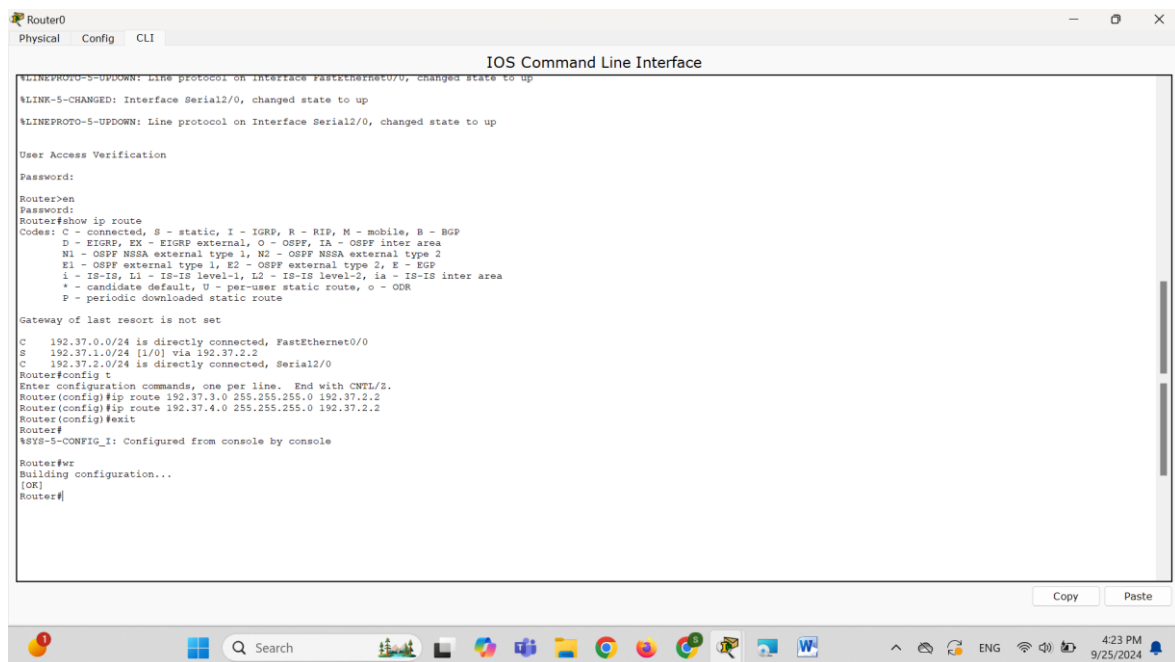
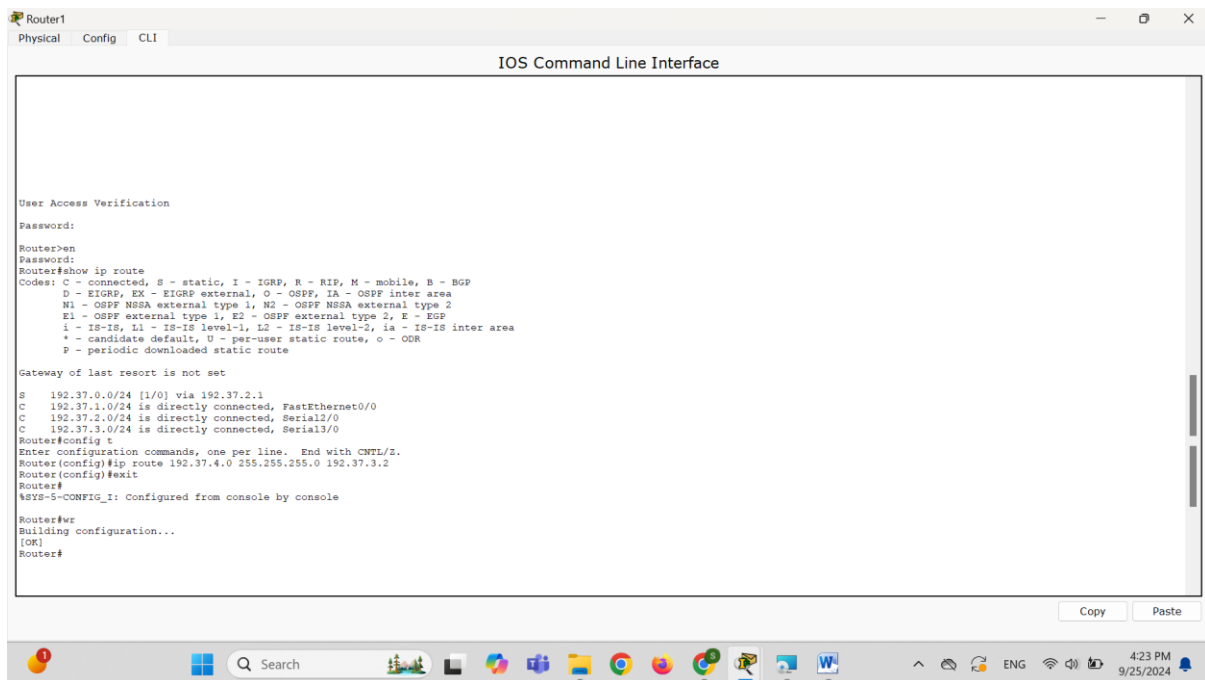


Figure 3: steps to complete static routing for router0

Note that in figure 3 , the routing table is before the update.



```
Router1
Physical Config CLI
IOS Command Line Interface

User Access Verification
Password:
Router>en
Password:
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       I - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

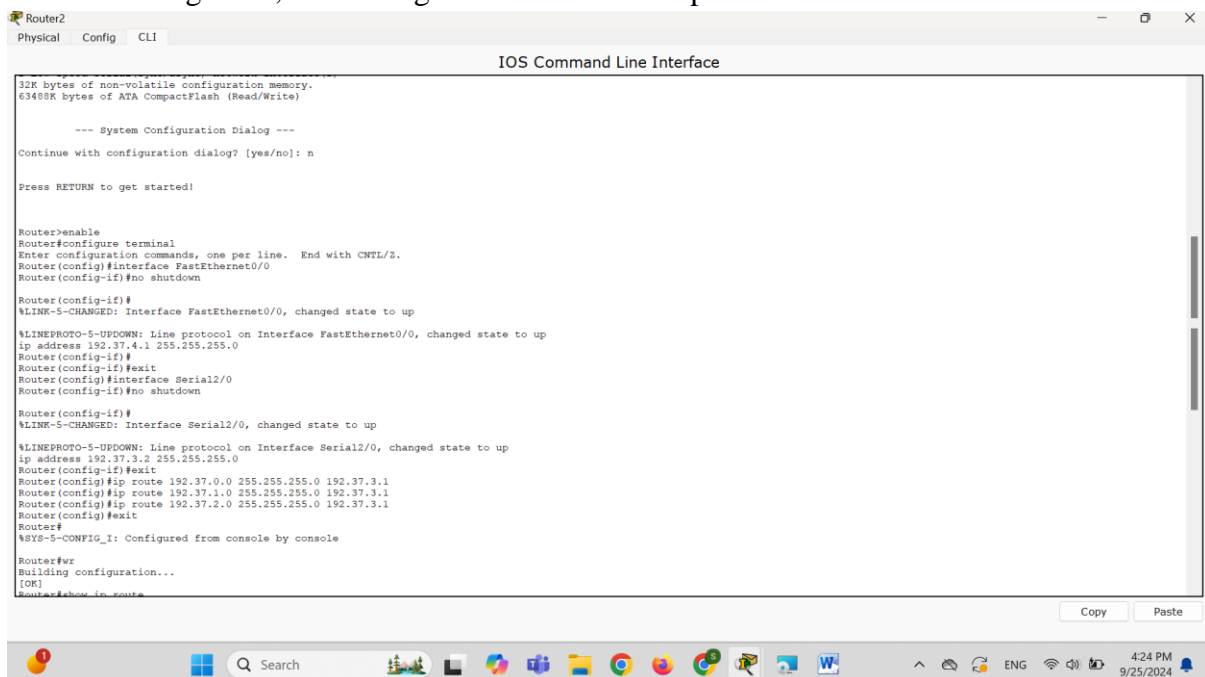
Gateway of last resort is not set

S    192.37.0.0/24 [1/0] via 192.37.2.1
C    192.37.1.0/24 is directly connected, FastEthernet0/0
C    192.37.2.0/24 is directly connected, Serial2/0
C    192.37.3.0/24 is directly connected, Serial3/0
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 192.37.4.0 255.255.255.0 192.37.3.2
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#wr
Building configuration...
[OK]
Router#
```

Figure 4:steps to complete static routing for router1

Note that in figure 4 , the routing table is before the update.



```
Router2
Physical Config CLI
IOS Command Line Interface

32K bytes of non-volatile configuration memory.
63488K bytes of ATA CompactFlash (Read/Write)

--- System Configuration Dialog ---
Continue with configuration dialog? [yes/no]: n

Press RETURN to get started!

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface FastEthernet0/0
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
ip address 192.37.4.1 255.255.255.0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial2/0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
ip address 192.37.3.2 255.255.255.0
Router(config-if)#exit
Router(config)#ip route 192.37.0.0 255.255.255.0 192.37.3.1
Router(config)#ip route 192.37.1.0 255.255.255.0 192.37.3.1
Router(config)#ip route 192.37.2.0 255.255.255.0 192.37.3.1
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#wr
Building configuration...
[OK]
Router#show ip route
```

Figure 5:steps to complete static routing for router2

→ check connection by ping command:

PC0:

Time: 00:04:29 Power Cycle Devices Fast Forward Time

Scenario 0

Fire Last Stat. Sourc Destination Type Colo Time(s) Period Num Edit Delete

Toggle PDU List Window

USD/GBP -0.55%

6:04 PM 9/26/2024

```
PC0
Physical Config Desktop Custom Interface
Command Prompt
PC>ping 192.37.1.2
Pinging 192.37.1.2 with 32 bytes of data:
Reply from 192.37.1.2: bytes=32 time=21ms TTL=126
Reply from 192.37.1.2: bytes=32 time=2ms TTL=126
Reply from 192.37.1.2: bytes=32 time=1ms TTL=126
Reply from 192.37.1.2: bytes=32 time=2ms TTL=126
Ping statistics for 192.37.1.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 21ms, Average = 6ms
PC>ping 192.37.4.2
Pinging 192.37.4.2 with 32 bytes of data:
Reply from 192.37.4.2: bytes=32 time=17ms TTL=125
Reply from 192.37.4.2: bytes=32 time=2ms TTL=125
Reply from 192.37.4.2: bytes=32 time=4ms TTL=125
Reply from 192.37.4.2: bytes=32 time=10ms TTL=125
Ping statistics for 192.37.4.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 10ms, Average = 10ms
PC>
```

PC1:

Time: 00:05:25 Power Cycle Devices Fast Forward Time

Scenario 0

Fire Last Stat. Sourc Destination Type Colo Time(s) Period Num Edit Delete

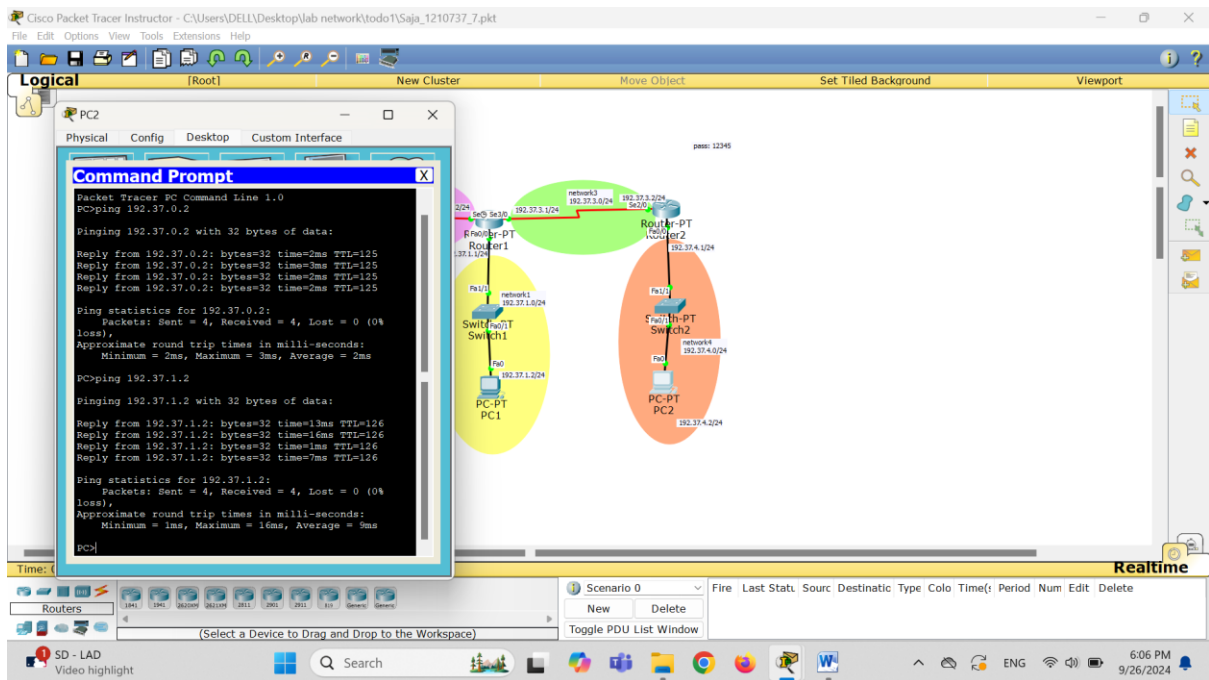
Toggle PDU List Window

Sunset 6:29 PM

6:05 PM 9/26/2024

```
PC1
Physical Config Desktop Custom Interface
Command Prompt
Packet Tracer PC Command Line 1.0
PC>ping 192.37.0.2
Pinging 192.37.0.2 with 32 bytes of data:
Reply from 192.37.0.2: bytes=32 time=1ms TTL=126
Reply from 192.37.0.2: bytes=32 time=9ms TTL=126
Reply from 192.37.0.2: bytes=32 time=7ms TTL=126
Reply from 192.37.0.2: bytes=32 time=1ms TTL=126
Ping statistics for 192.37.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 9ms, Average = 4ms
PC>ping 192.37.4.2
Pinging 192.37.4.2 with 32 bytes of data:
Reply from 192.37.4.2: bytes=32 time=1ms TTL=126
Reply from 192.37.4.2: bytes=32 time=1ms TTL=126
Reply from 192.37.4.2: bytes=32 time=4ms TTL=126
Reply from 192.37.4.2: bytes=32 time=1ms TTL=126
Ping statistics for 192.37.4.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 4ms, Average = 1ms
PC>
```

PC2:



→ show the routing table on all router:

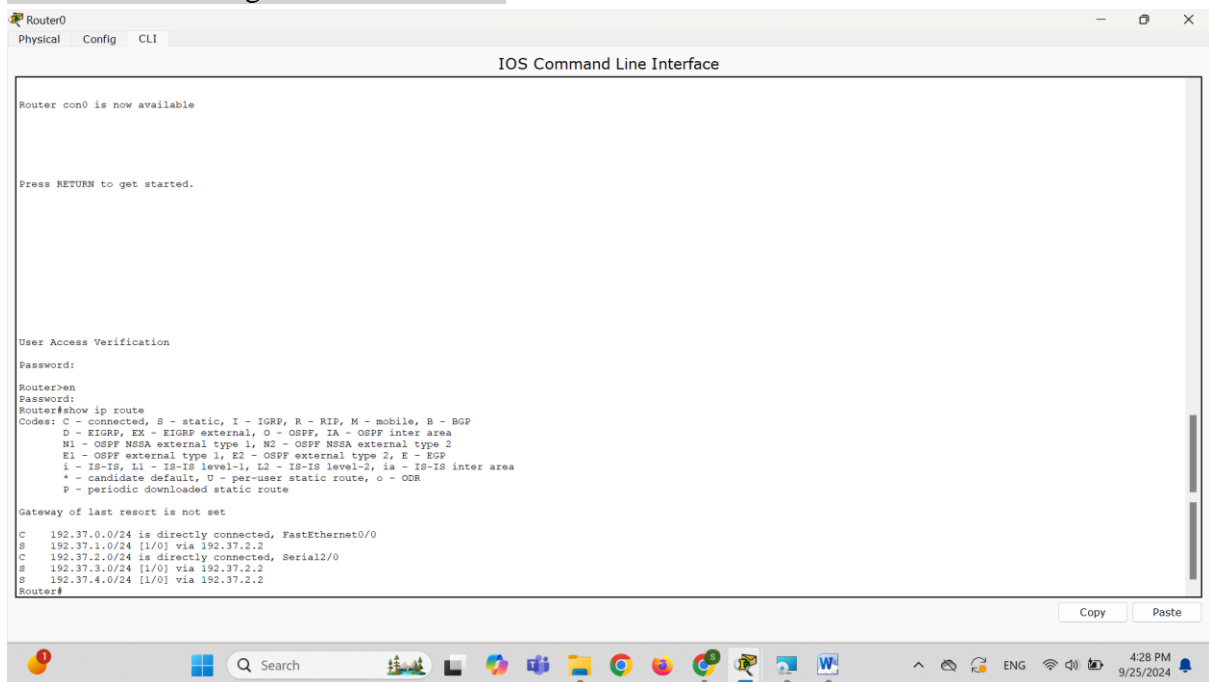


Figure 6: Routing table for router0

```
Router1
Physical Config CLI
IOS Command Line Interface

Router con0 is now available

Press RETURN to get started.

User Access Verification

Password:
Router>en
Password:
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route

Gateway of last resort is not set

S    192.37.0.0/24 [1/0] via 192.37.2.1
C    192.37.1.0/24 is directly connected, FastEthernet0/0
C    192.37.2.0/24 is directly connected, Serial2/0
C    192.37.3.0/24 is directly connected, Serial3/0
S    192.37.4.0/24 [1/0] via 192.37.3.2
Router#
```

Figure 7: Routing table for router1

```
Router2
Physical Config CLI
IOS Command Line Interface

Router#wr
Building configuration...
[OK]
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route

Gateway of last resort is not set

S    192.37.0.0/24 [1/0] via 192.37.3.1
S    192.37.1.0/24 [1/0] via 192.37.3.1
S    192.37.2.0/24 [1/0] via 192.37.3.1
C    192.37.3.0/24 is directly connected, Serial2/0
C    192.37.4.0/24 is directly connected, FastEthernet0/0
Router#

Router con0 is now available

Press RETURN to get started.
```

Figure 8: Routing table for router2