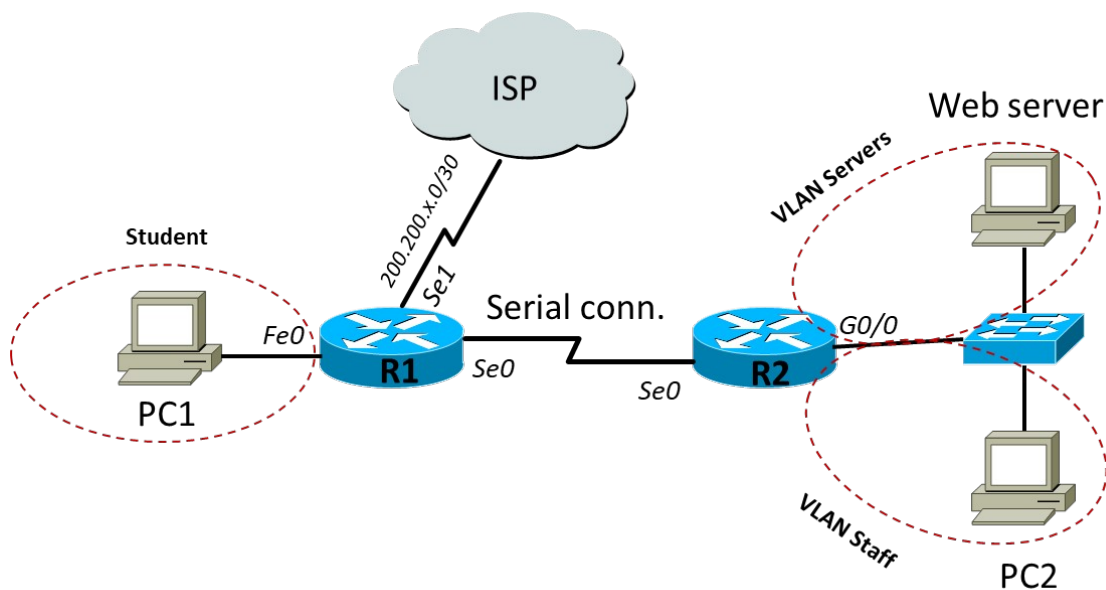# Lab Exam – IT (Mon)

Time: 03 hours

Student name: Phan Phương Duy Student ID: ITITIU16010

Topology

Task 1 (30 points): IP addressing

Step 1. (15 points) Given the IP range 172.x.0.0/16 and the following requirements:

- Each Subnet Server or Staff needs 500 IP addresses.
- Subnet Student needs 8000 IP addresses.
- The subnet-mask /30 must be used for the serial connection between the routers.
- The connection between R1 and Internet uses the subnet 200.200.x.0/30.
- 'x' in the IP addresses matches with the student ID.

Assign the IP subnets used in the network:

Servers: 172.10.32.0/23...

Staff: 172.10.34.0/23..

Student: 172.10.0.0/19..

Serial connection: 172.10.36.0/30...

Management switch interface: 172.10.38.0/30

Explain above subnet assignment.

Because subnet Student needs 8000 IP addresses so the subnet mask of it is /19

The IP range of Student subnet: 172.10.0.1/19 to 172.10.31.254/19

The Server and Staff subnet needs 500 IP addresses so the subnet mask of it is /23

The IP range of Server subnet: 172.10.32.1/23 to 172.10.33.254/23

The IP range of Staff subnet: 172.10.34.1/23 to 172.10.35.254/23

The Serial connection only needs 2 IP addresses so the subnet mask of it is /30

The IP range of Serial connection: 172.10.36.1/30 to 172.10.36.2/30

The Management Switch interface IP: 172.10.38.1/30

(Note: If you omit Step 1, you can use the following subnets for the next steps:

Servers: 172.x.1.0/24

Staff: 172.x.2.0/24

Student: 172.x.3.0/24

Serial connection: 172.x.4.0/24.)

Step 2. (15 points) Filling the following table:

Device	Interface	IP Address	Subnet Mask	Descriptions / Default Gateway
R1	Fe0/0	172.10.0.1	255.255.224.0	
	Serial0	172.10.36.1	255.255.255.252	
R2	G0/0.1	172.10.32.1	255.255.254.0	
	G0/0.2	172.10.34.1	255.255.254.0	
	Serial0	172.10.36.2	255.255.255.252	
Web Server	NIC	172.10.32.2	255.255.254.0	172.10.32.1
PC1	NIC	172.10.0.2	255.255.224.0	172.10.0.1
PC2	NIC	172.10.34.2	255.255.254.0	172.10.34.1

Task 2: (15 points) Perform Basic Router Configurations.

Step 1. Perform basic configuration of the R1 and R2 routers according to the following guidelines:

1. Configure the router hostname.
2. Disable DNS lookup.
3. Configure an EXEC mode password.
4. Configure a password for console connections.

Step 2. Configure and activate the interfaces of routers. (The configuration of interface G0/0 on R2 is reserved for next tasks.) Verify the configuration using appropriate 'show' command.
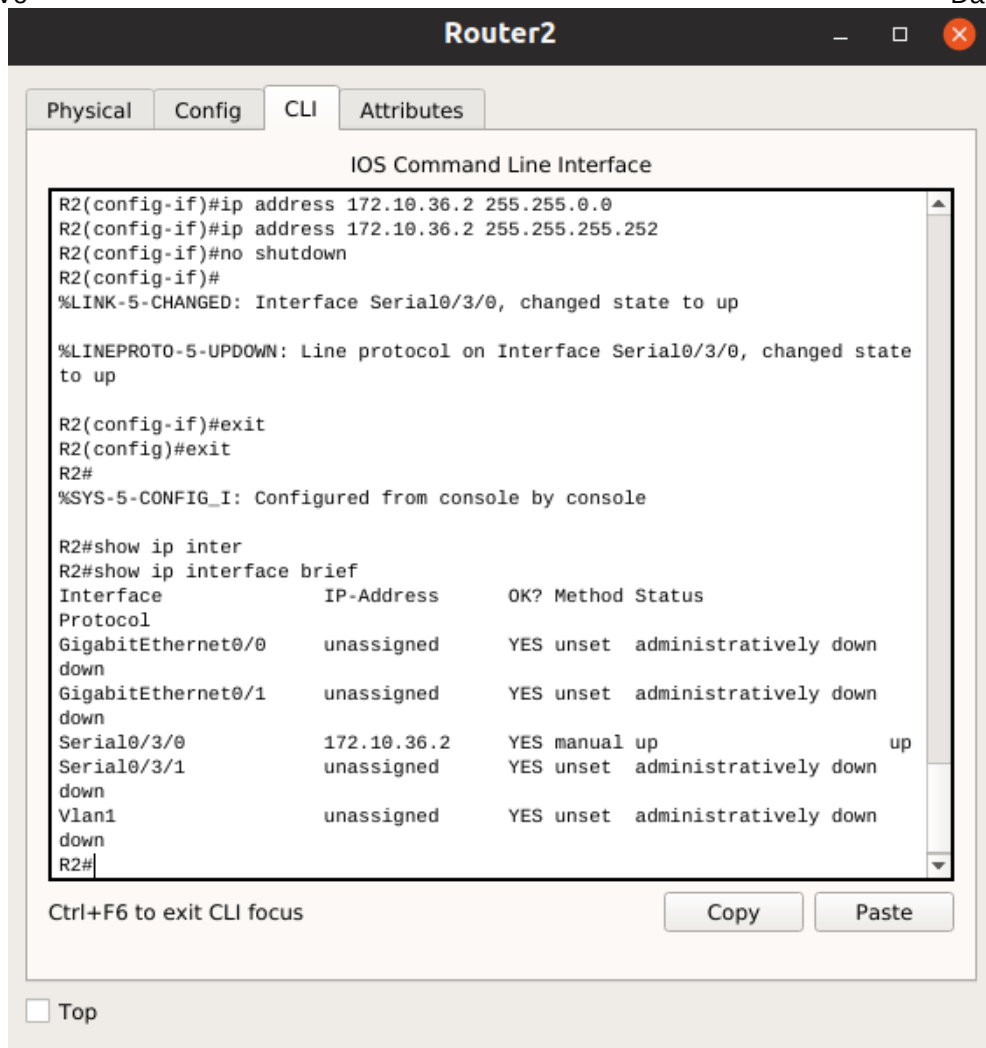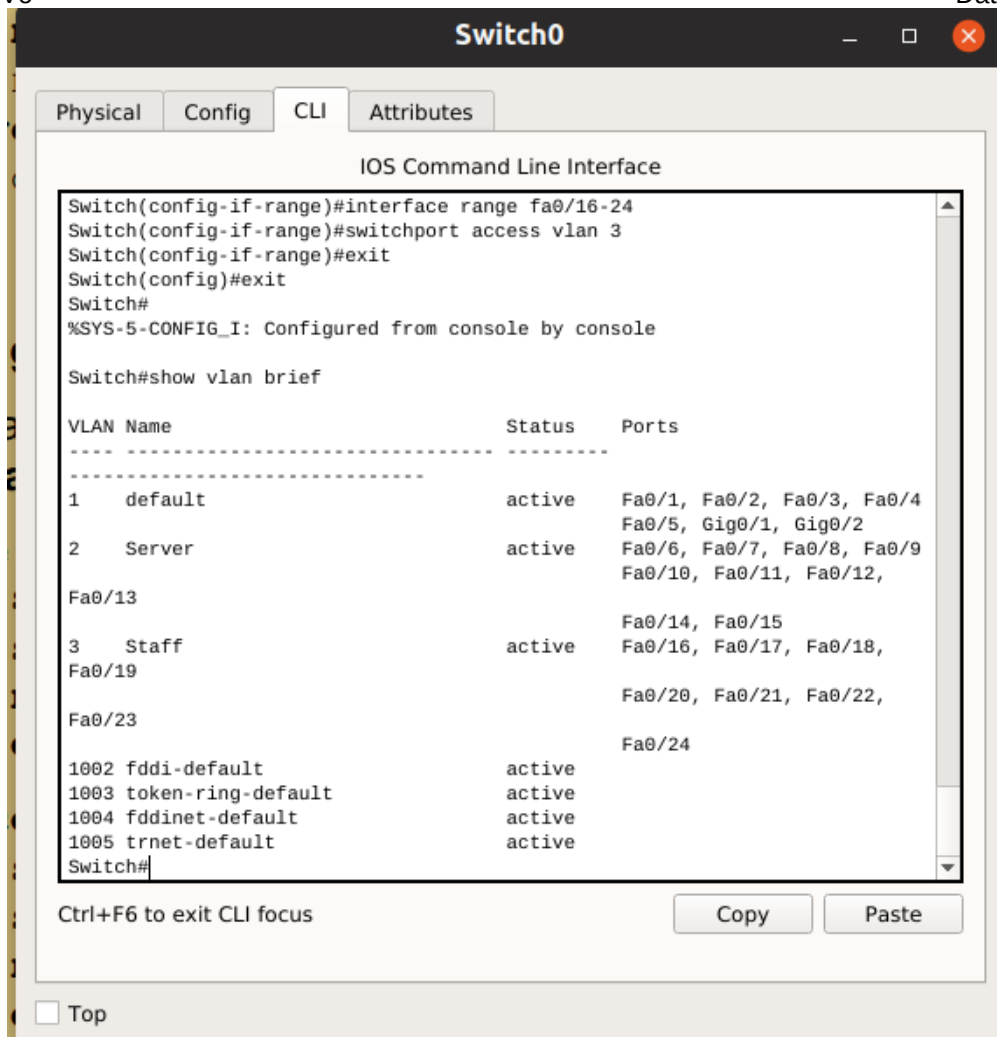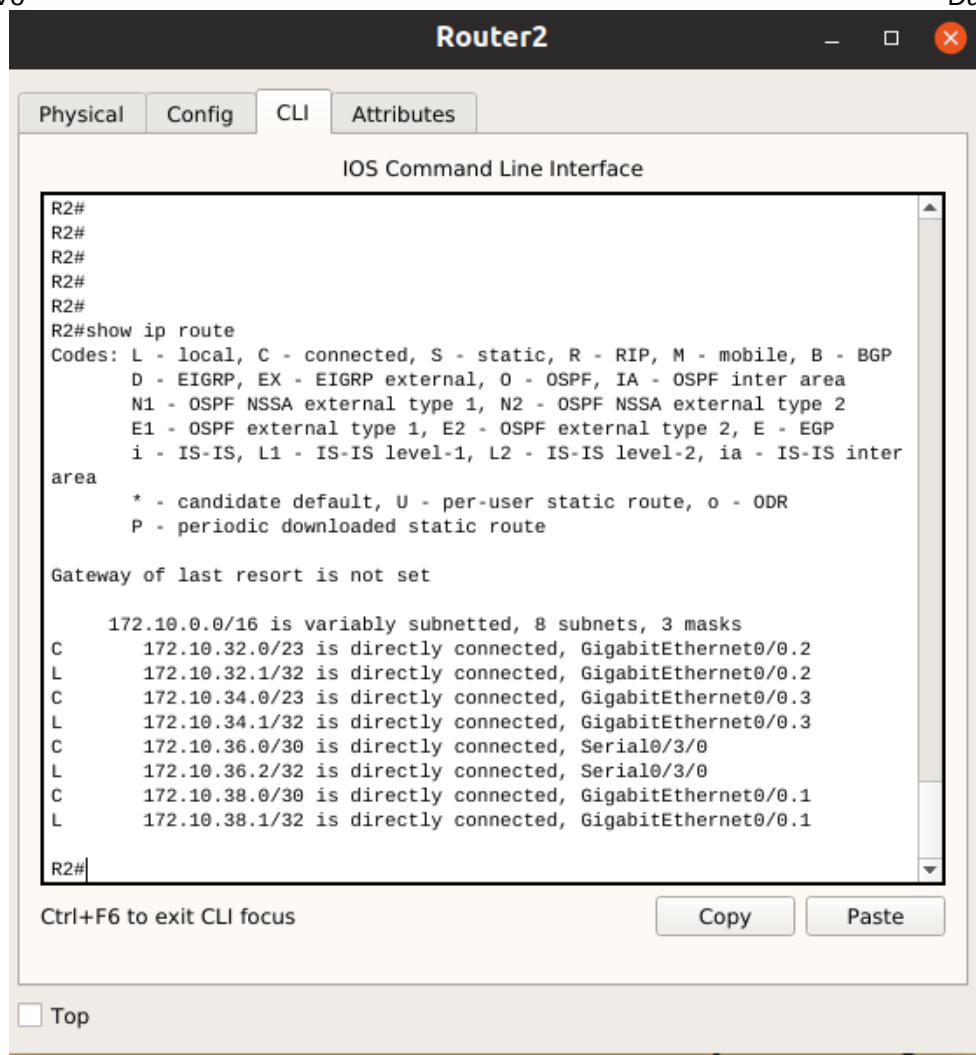
show running-config

Output of `show ip interface brief` command:

R1:
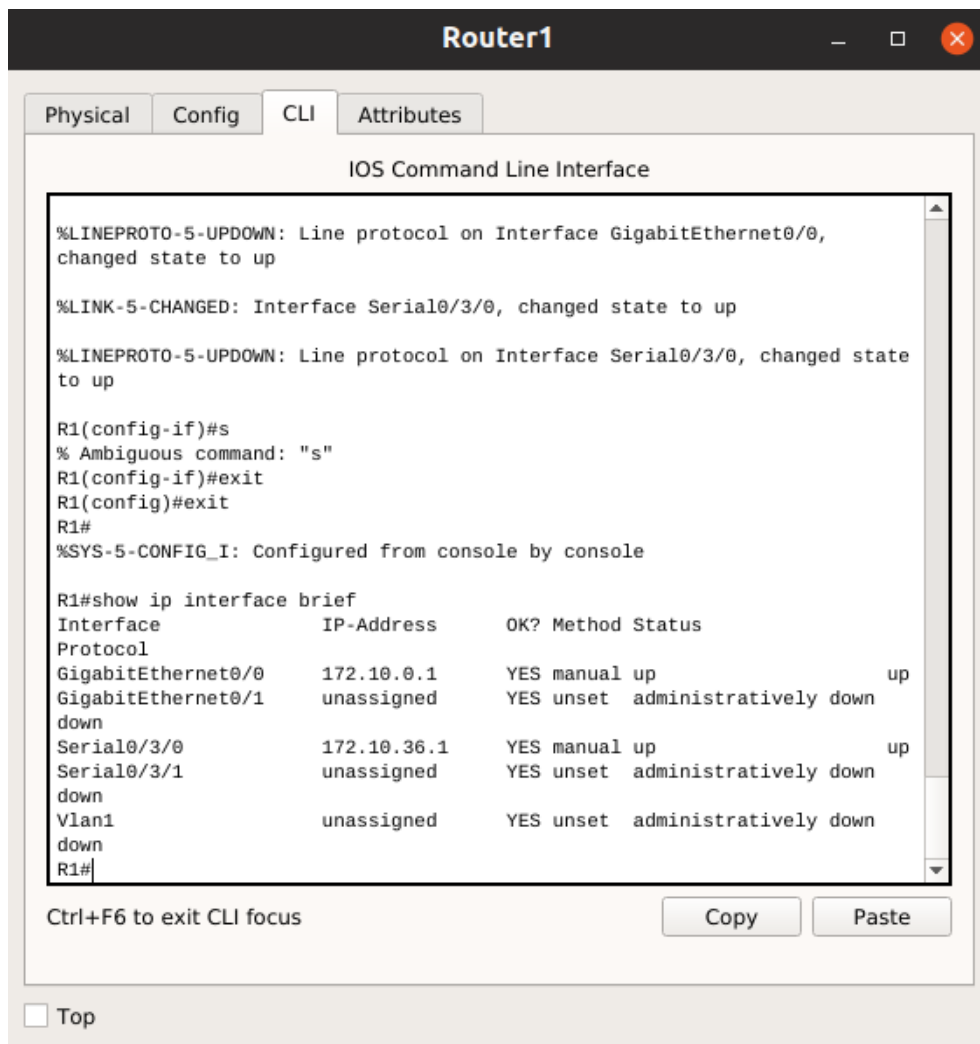
R2:

Task 3: (20 points) Configure VLANs

Step 1. Configure Switch and VLANs. Verify the configuration using appropriate show command.

Step 2. Configure trunking between the switch and R2 and assign IP addresses for the sub-interfaces corresponding to VLANs.

Step 3. Configure Ethernet interfaces of PC1, PC2, and Web server with the IP addresses and default gateways and test the Ethernet connections by pinging the default gateway. Also verify other connections between adjacent nodes using ping command

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC2	Server0	ICMP		0.000	N	0	(e...	(delete)
	Successful	Server0	PC2	ICMP		0.000	N	1	(e...	(delete)
	Successful	PC2	Router2	ICMP		0.000	N	2	(e...	(delete)
	Successful	Server0	Router2	ICMP		0.000	N	3	(e...	(delete)

```
                               Server0                          _  □  ⊗

  Physical   Config   Services   Desktop   Programming   Attributes

  Command Prompt                                                          X

    Packet Tracer SERVER Command Line 1.0
    C:\>ping 172.10.32.1

    Pinging 172.10.32.1 with 32 bytes of data:

    Reply from 172.10.32.1: bytes=32 time=2ms TTL=255
    Reply from 172.10.32.1: bytes=32 time<1ms TTL=255
    Reply from 172.10.32.1: bytes=32 time<1ms TTL=255
    Reply from 172.10.32.1: bytes=32 time<1ms TTL=255

    Ping statistics for 172.10.32.1:
        Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 2ms, Average = 0ms

    C:\>
```

```
                                PC2                            _  □  ⊗

  Physical   Config   Desktop   Programming   Attributes

  Command Prompt                                                          X

    Packet Tracer PC Command Line 1.0
    C:\>ping 172.10.34.1

    Pinging 172.10.34.1 with 32 bytes of data:

    Reply from 172.10.34.1: bytes=32 time=2ms TTL=255
    Reply from 172.10.34.1: bytes=32 time<1ms TTL=255
    Reply from 172.10.34.1: bytes=32 time<1ms TTL=255
    Reply from 172.10.34.1: bytes=32 time<1ms TTL=255

    Ping statistics for 172.10.34.1:
        Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 2ms, Average = 0ms

    C:\>
```

Task 4: (20 points) Configure OSPF.

Step 1. Enable OSPF routing on the routers. Show the OSPF configuration.
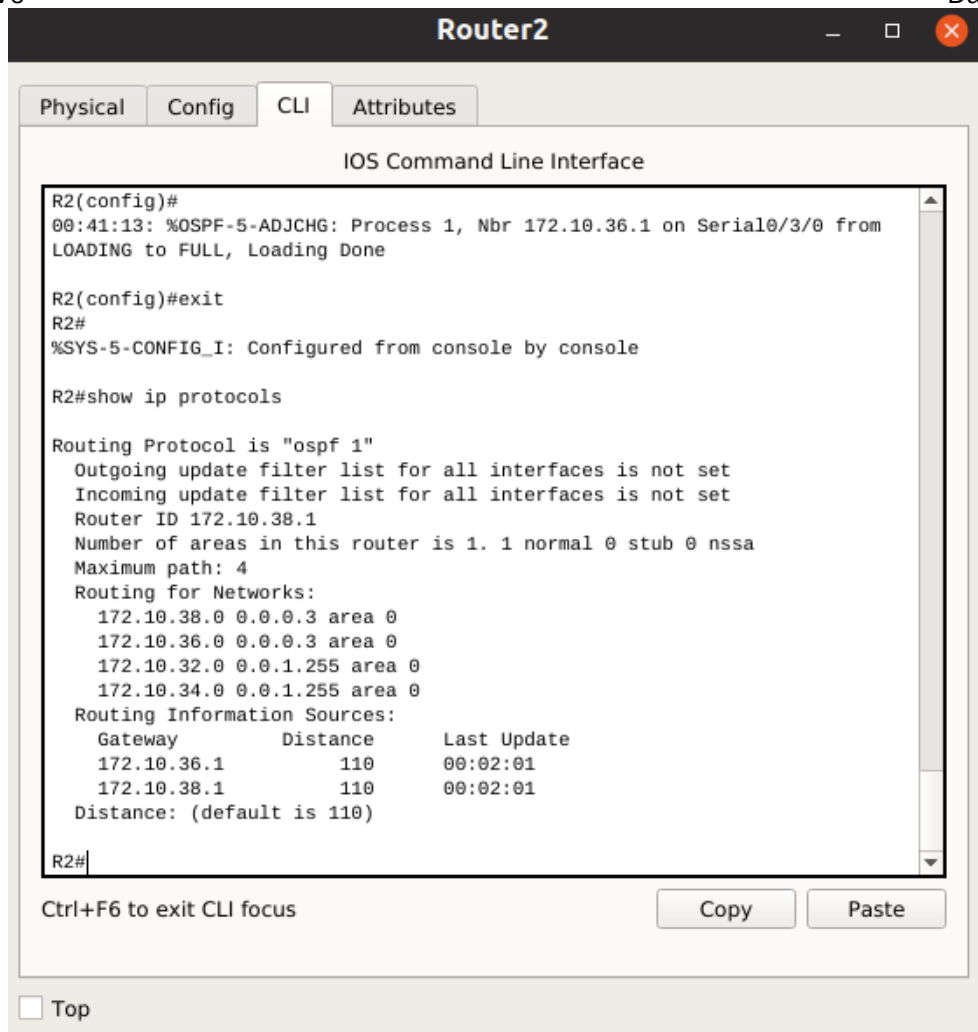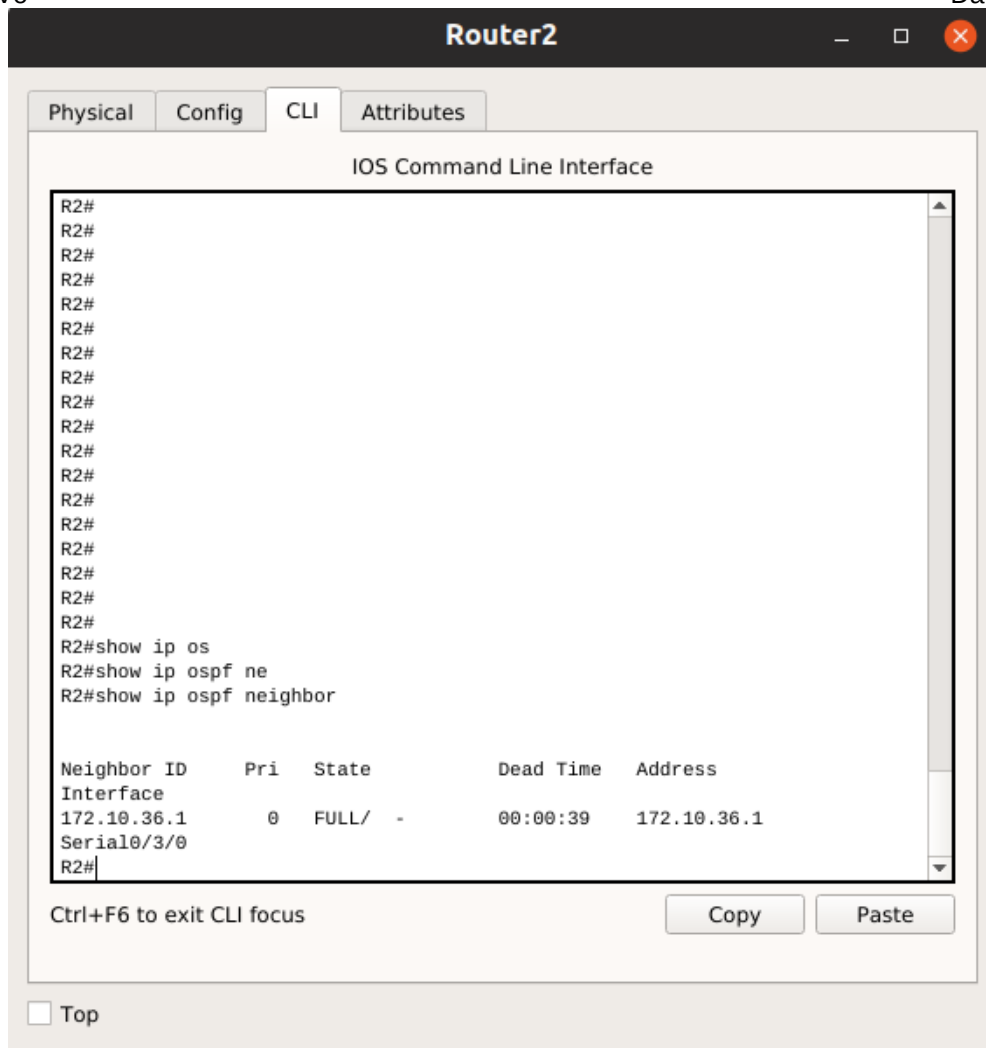
R1 show ip protocols
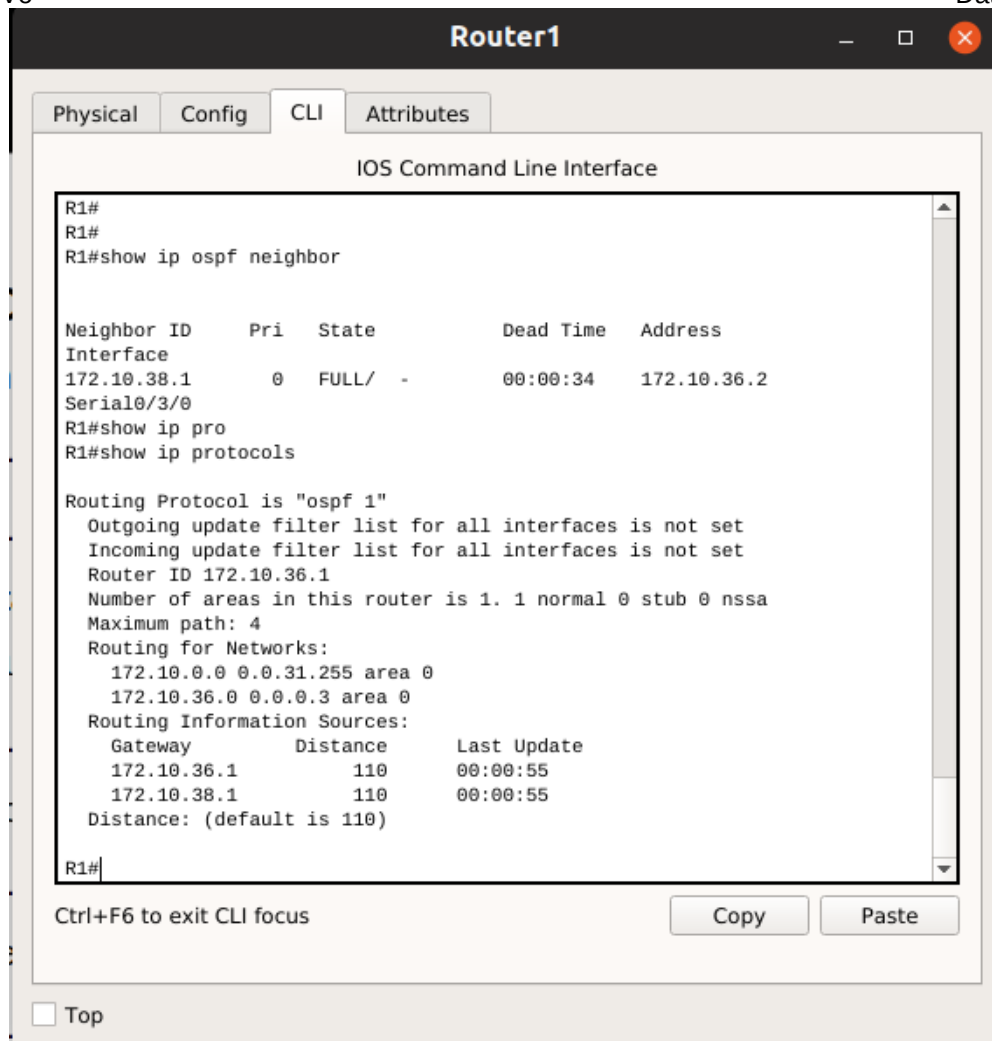
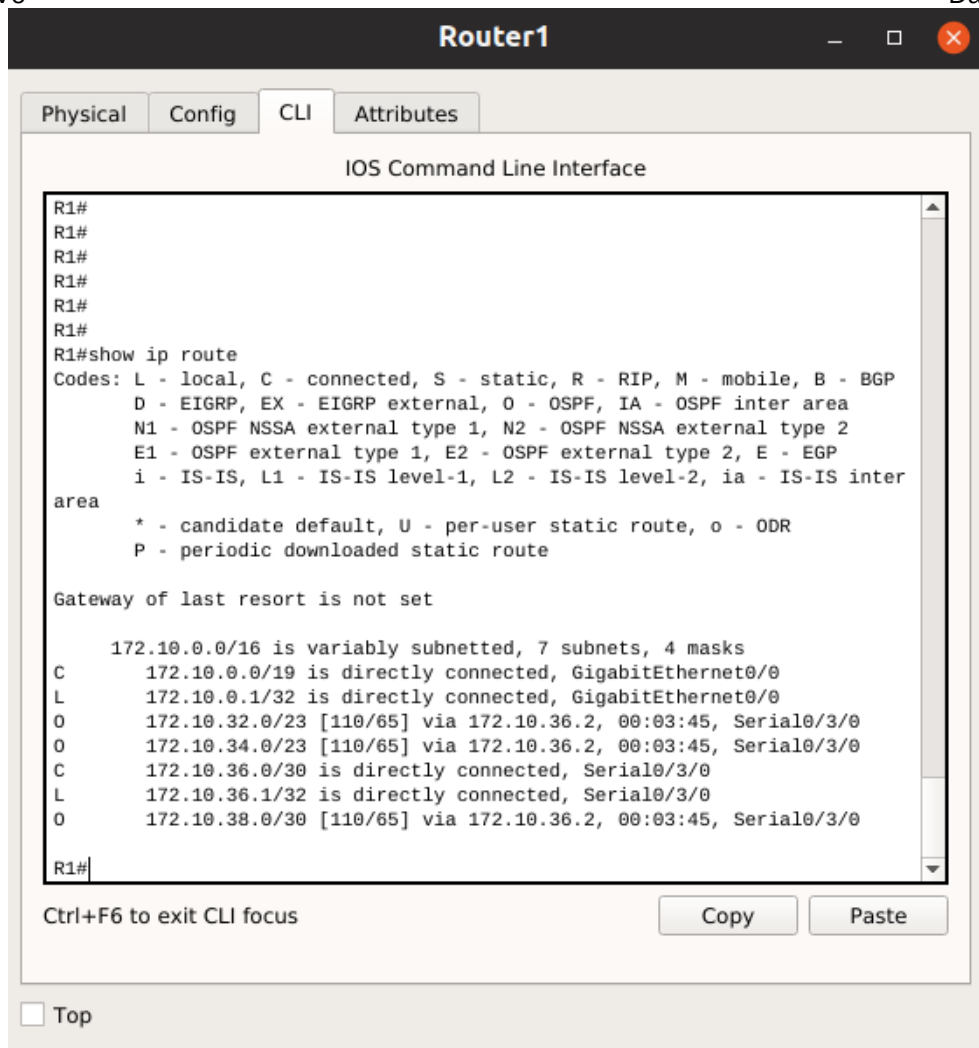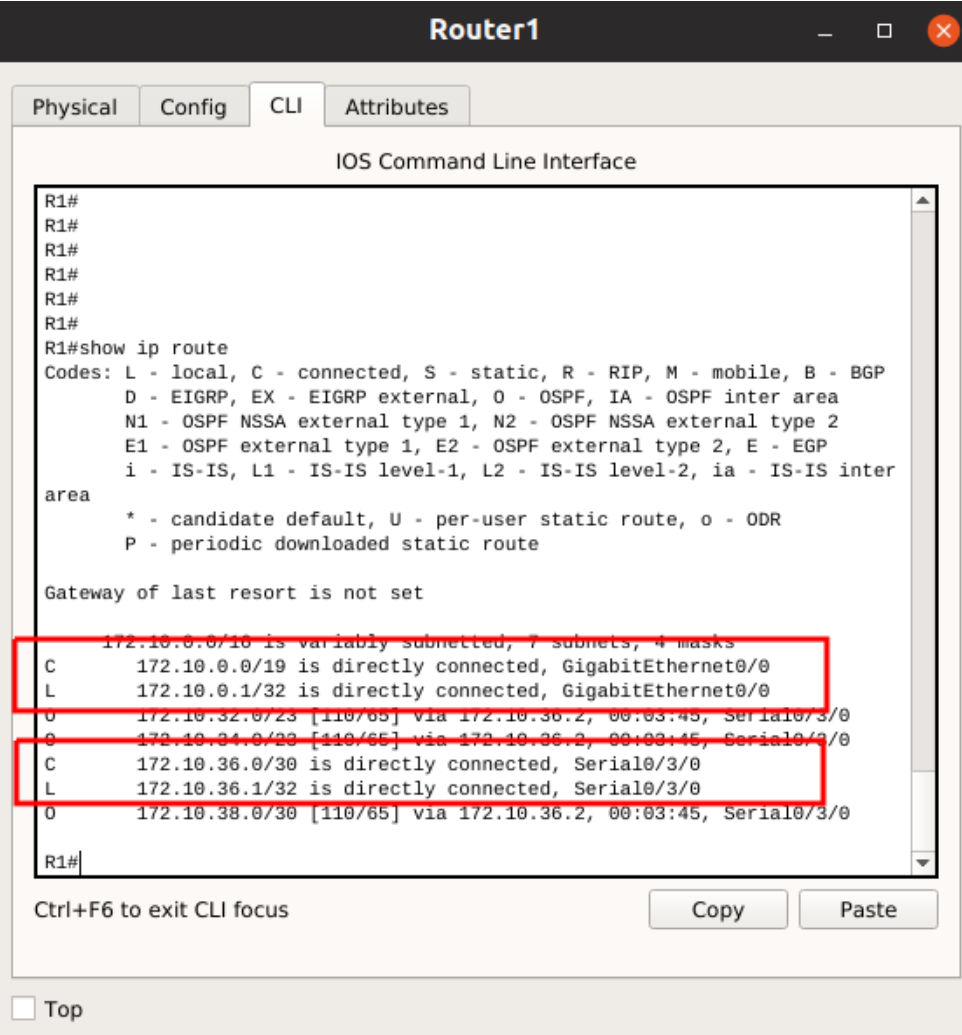R1 show ip ospf neighbor

R2 show ip protocols

R2 show ip ospf neighbor

Step 2. Verify the routing table and answer the following questions.

The output of `show ip route` command:

```
                              Router1                    _   □   ✕

  Physical    Config    CLI   Attributes

                        IOS Command Line Interface

  R1#
  R1#
  R1#
  R1#
  R1#
  R1#
  R1#show ip route
  Codes: L - local, C - connected, S - static, 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

       172.10.0.0/16 is variably subnetted, 7 subnets, 4 masks
  C        172.10.0.0/19 is directly connected, GigabitEthernet0/0
  L        172.10.0.1/32 is directly connected, GigabitEthernet0/0
  O        172.10.32.0/23 [110/65] via 172.10.36.2, 00:03:45, Serial0/3/0
  O        172.10.34.0/23 [110/65] via 172.10.36.2, 00:03:45, Serial0/3/0
  C        172.10.36.0/30 is directly connected, Serial0/3/0
  L        172.10.36.1/32 is directly connected, Serial0/3/0
  O        172.10.38.0/30 [110/65] via 172.10.36.2, 00:03:45, Serial0/3/0

  R1#

  Ctrl+F6 to exit CLI focus                        Copy        Paste


  ☐ Top
```

```
                                    Router2                    _   □   ✕

    Physical    Config    CLI    Attributes

                         IOS Command Line Interface
   R2#
   R2#
   R2#
   R2#
   R2#show ip route
   Codes: L - local, C - connected, S - static, 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

         172.10.0.0/16 is variably subnetted, 9 subnets, 4 masks
   O        172.10.0.0/19 [110/65] via 172.10.36.1, 00:02:59, Serial0/3/0
   C        172.10.32.0/23 is directly connected, GigabitEthernet0/0.2
   L        172.10.32.1/32 is directly connected, GigabitEthernet0/0.2
   C        172.10.34.0/23 is directly connected, GigabitEthernet0/0.3
   L        172.10.34.1/32 is directly connected, GigabitEthernet0/0.3
   C        172.10.36.0/30 is directly connected, Serial0/3/0
   L        172.10.36.2/32 is directly connected, Serial0/3/0
   C        172.10.38.0/30 is directly connected, GigabitEthernet0/0.1
   L        172.10.38.1/32 is directly connected, GigabitEthernet0/0.1

   R2#

   Ctrl+F6 to exit CLI focus                         Copy        Paste


    ☐ Top
```

What are the directly connected networks of R1?

```
                              Router1          _   □   ✕

  Physical    Config    CLI    Attributes

                        IOS Command Line Interface

  R1#                                                                        ▲
  R1#
  R1#
  R1#
  R1#
  R1#
  R1#show ip route
  Codes: L - local, C - connected, S - static, 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

        172.10.0.0/16 is variably subnetted, 7 subnets, 4 masks
  C        172.10.0.0/19 is directly connected, GigabitEthernet0/0
  L        172.10.0.1/32 is directly connected, GigabitEthernet0/0
  O        172.10.32.0/23 [110/65] via 172.10.36.2, 00:03:45, Serial0/3/0
  O        172.10.34.0/23 [110/65] via 172.10.36.2, 00:03:45, Serial0/3/0
  C        172.10.36.0/30 is directly connected, Serial0/3/0
  L        172.10.36.1/32 is directly connected, Serial0/3/0
  O        172.10.38.0/30 [110/65] via 172.10.36.2, 00:03:45, Serial0/3/0

  R1#                                                                        ▼

  Ctrl+F6 to exit CLI focus                          Copy        Paste


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```

What are the networks R1 learned via OSPF advertisements?
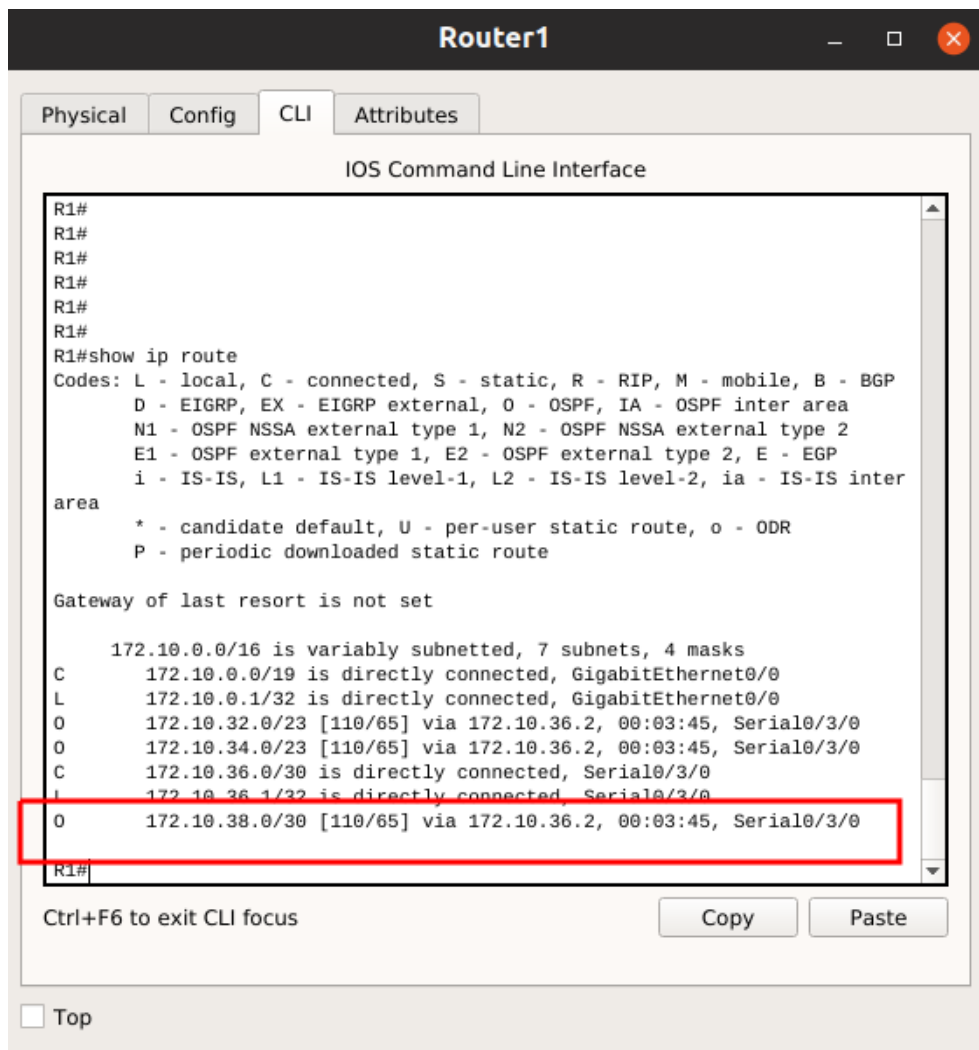
R1 learns the network 172.10.36.0 via OSPF advertisements.

Step 3. Verify the OSPF protocol using appropriate 'show' commands.
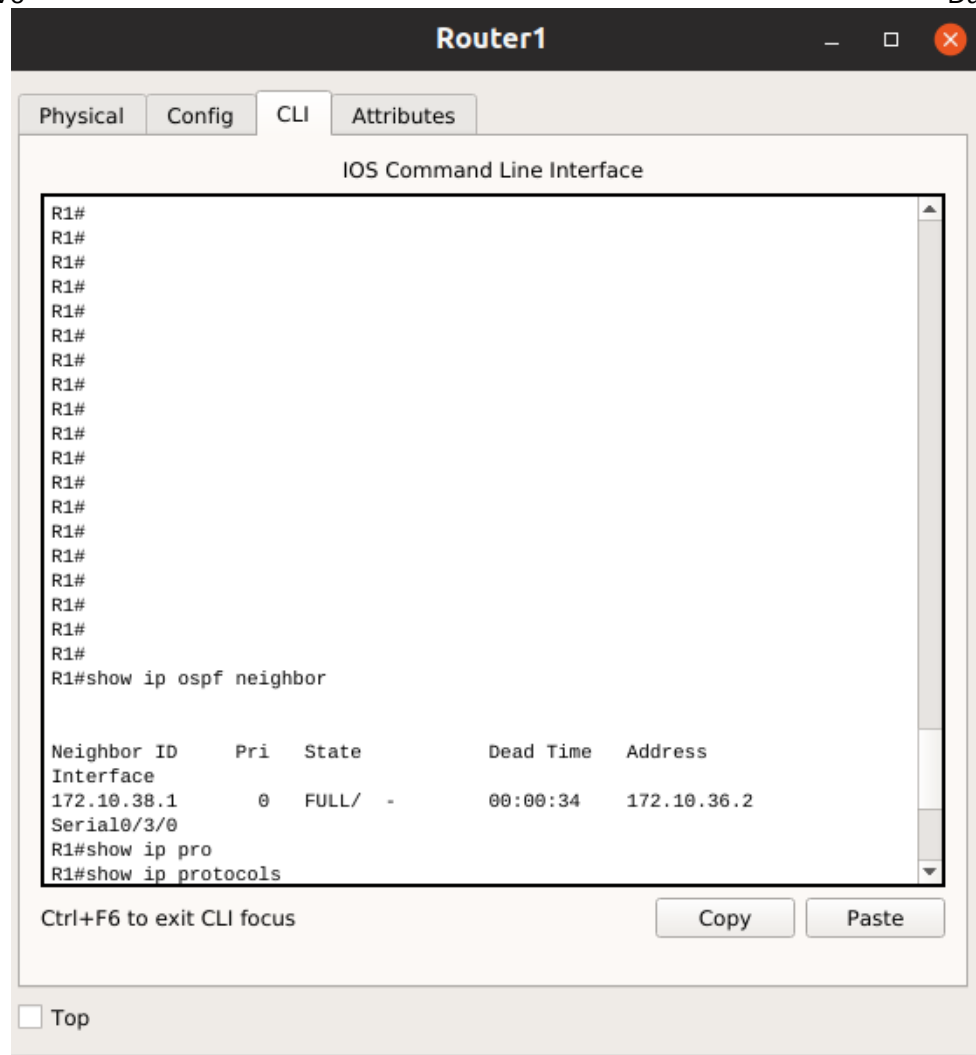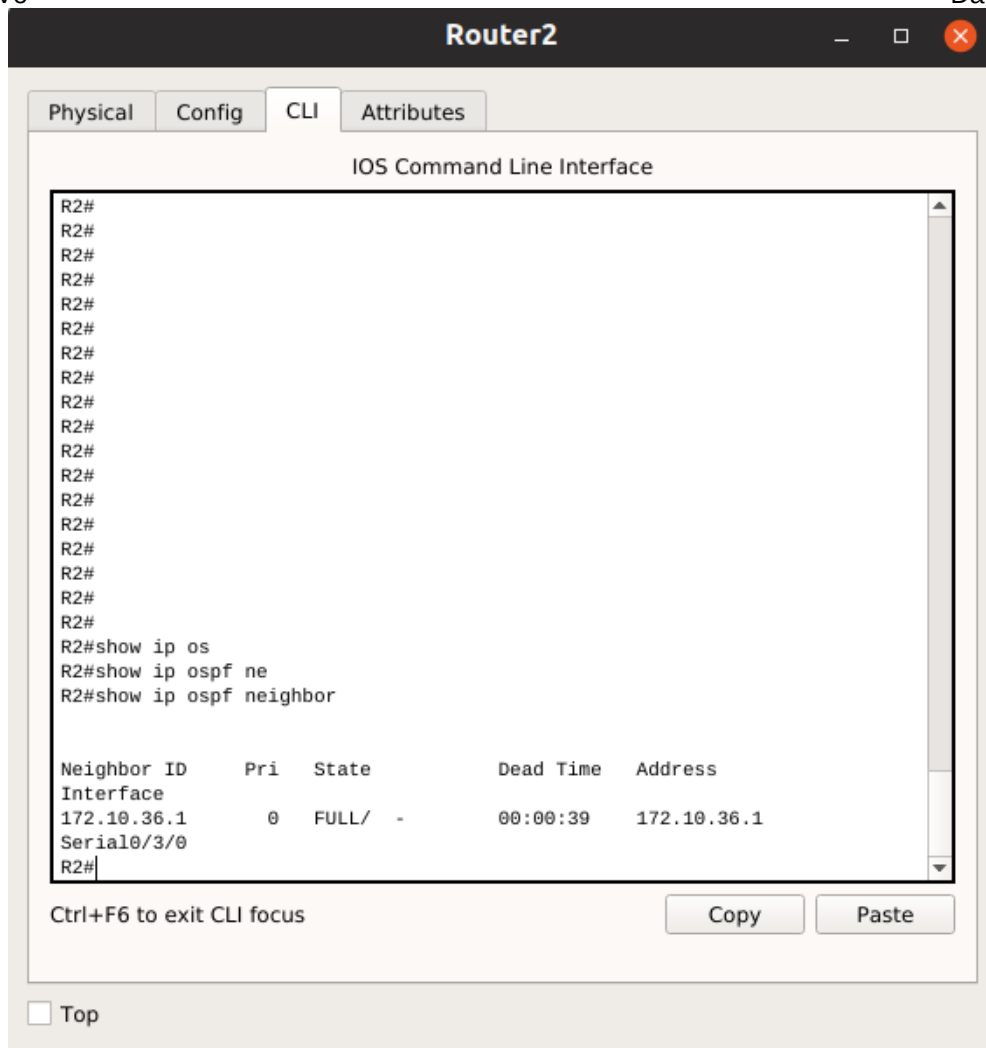
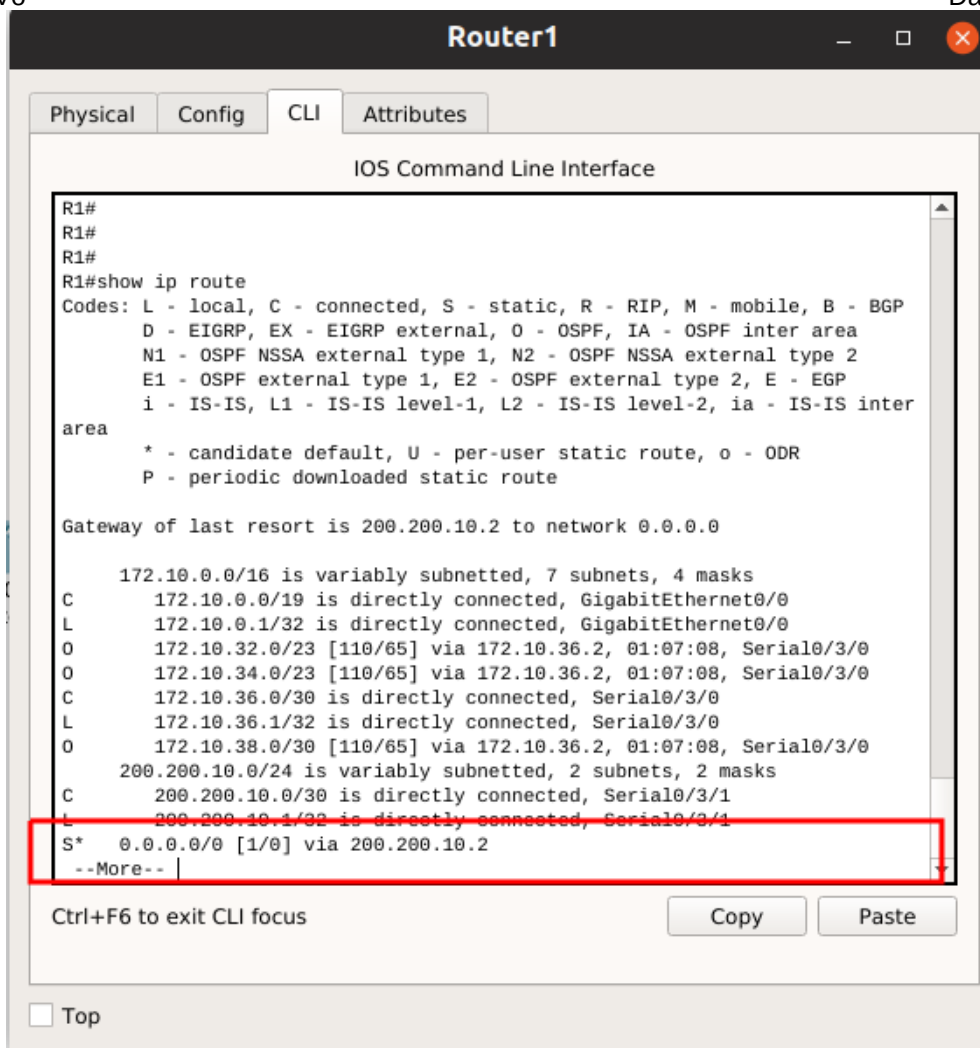**Step 4.** Using ping command to test the connection between PCs, Web server, switch and routers in different LANs/VLANs.

Step 5. Configure default route on R1 to send the traffic to the internet and distributes this default route into the OSPF domain.

Step 6. Show the routing tables of R1 and R2 and explain the new entries in the routing table.

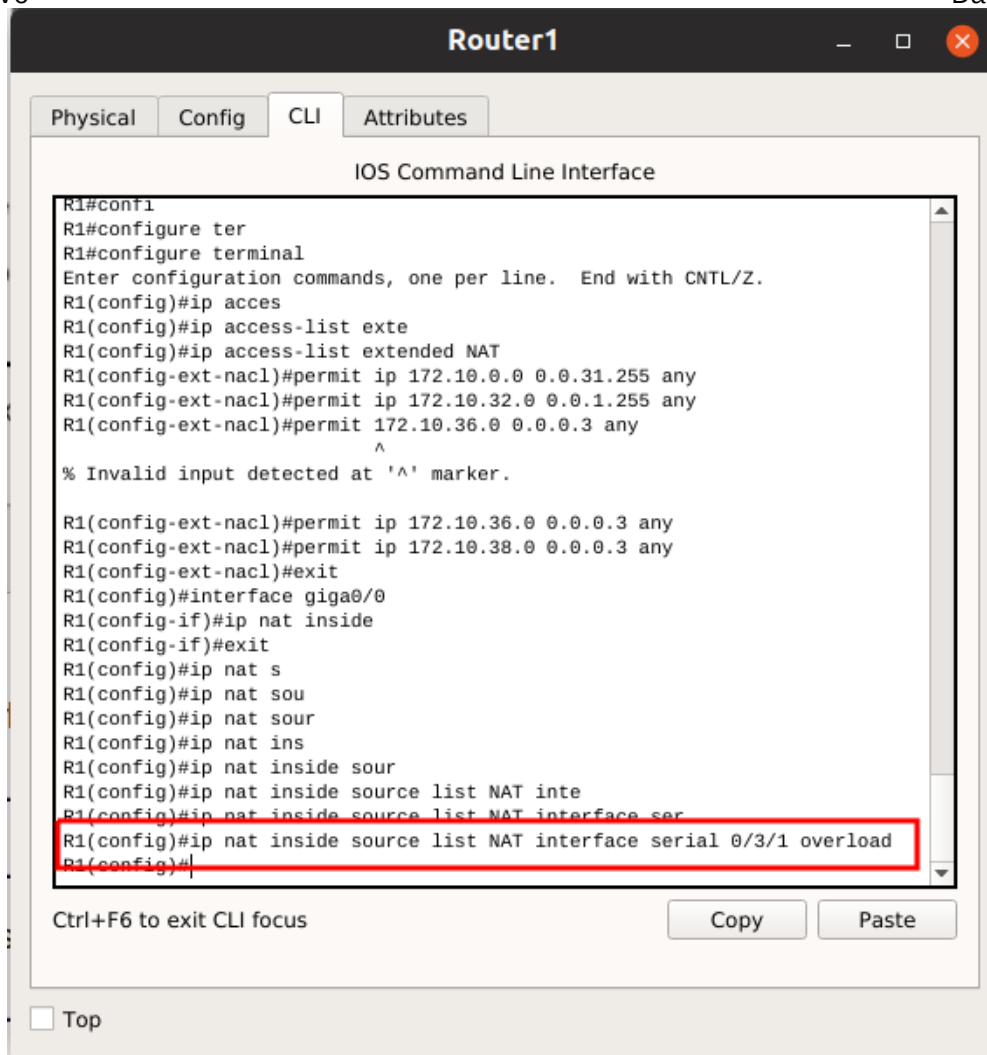**Step 7.** Ping from PCs, server in LANs/VLANs to the Internet.

Until NAT is configured, the static route will lead to an unknown network, causing the pings from PC2 and Server to fail.

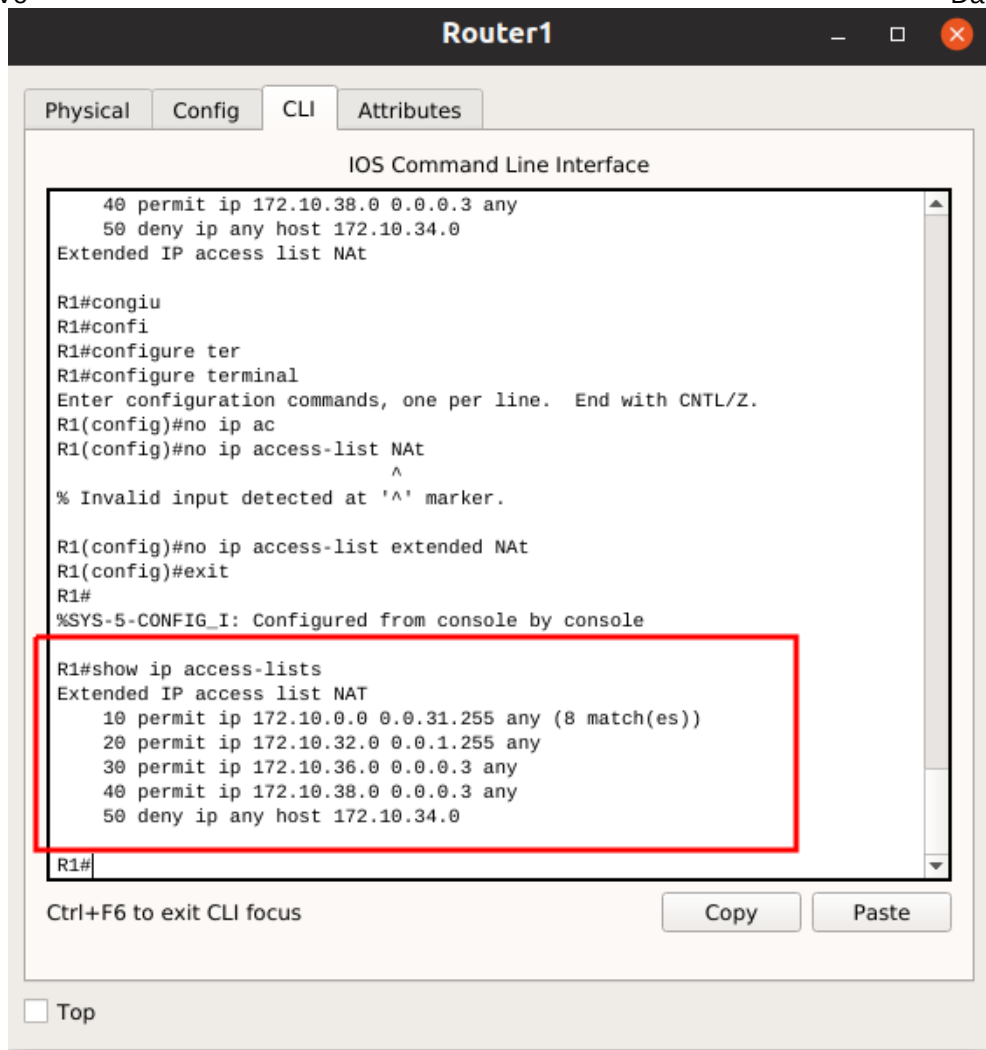# Task 5: (15 points) NAT and ACL

Step 1. Configure NAT on R1 to static map Web server to a public IP address 100.100.100.100. Verify the configuration.
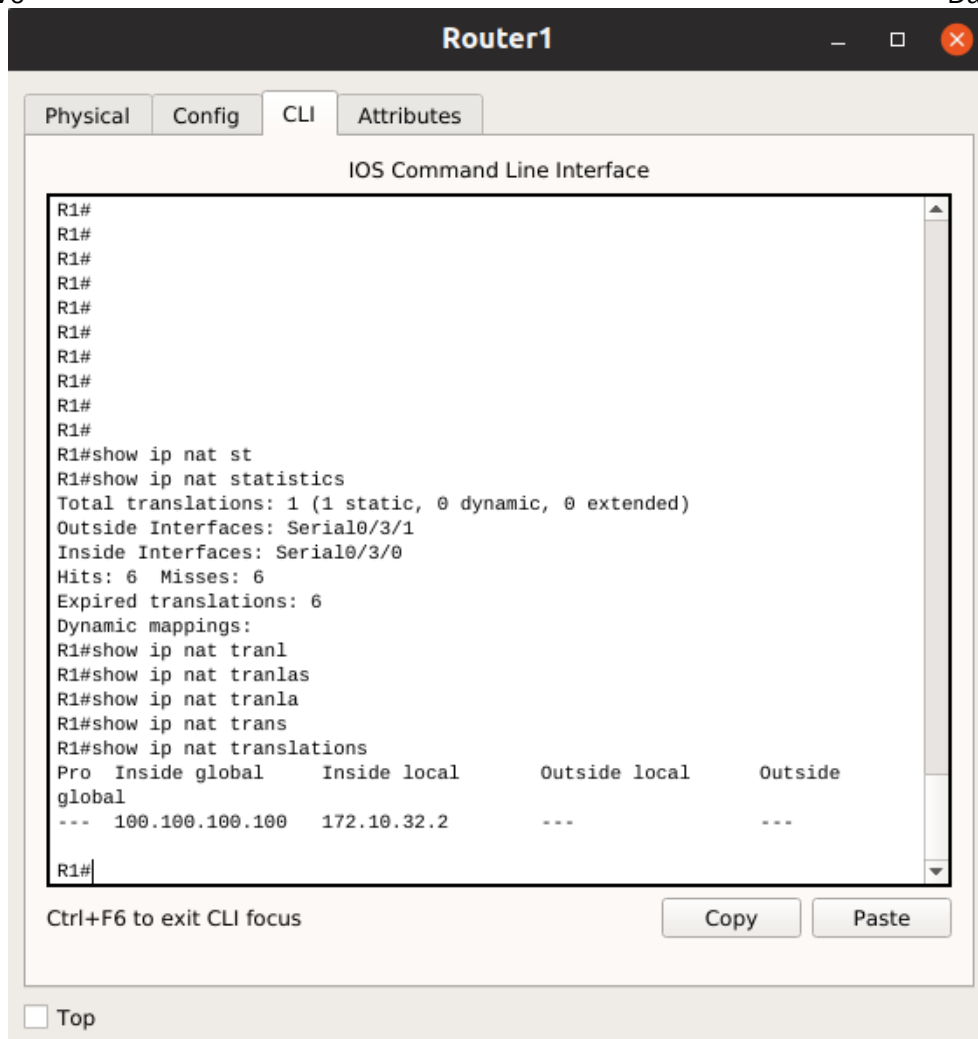
Step 2. Configure NAT overload to allow inside users to reuse a public IP address.

Step 3. Configure access-list to deny all the traffic from VLAN Staff to the Internet.

Ping results:

VLAN Staff cannot access the Internet

Task 6: Document your report and submit

Step 1: On each router, capture the following command output to a text file and attaché to the end of your report.

- Running configuration of witch, routers
- Routing configuration on routers
- Interface summarization
- VLANs and trunking on switch
- NAT and ACL on routers

Step 2: Submit your final report to Blackboard.

END