Lab Exercise:

Note:

Ip address should have their roll no.
Eg.192.168.20.24 (Your roll no: 22k2024)

Exercise 1:

Apply OSPF on given topology.
Attach screenshots of each step.

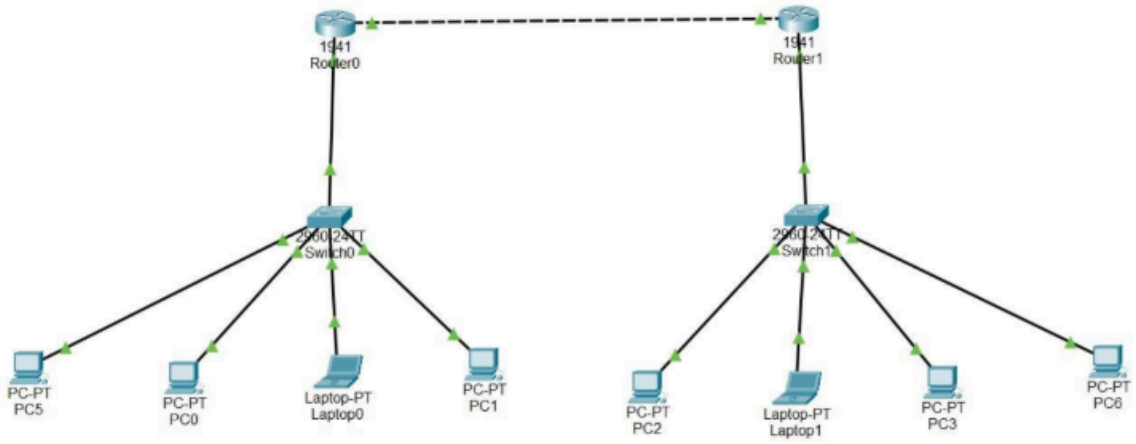
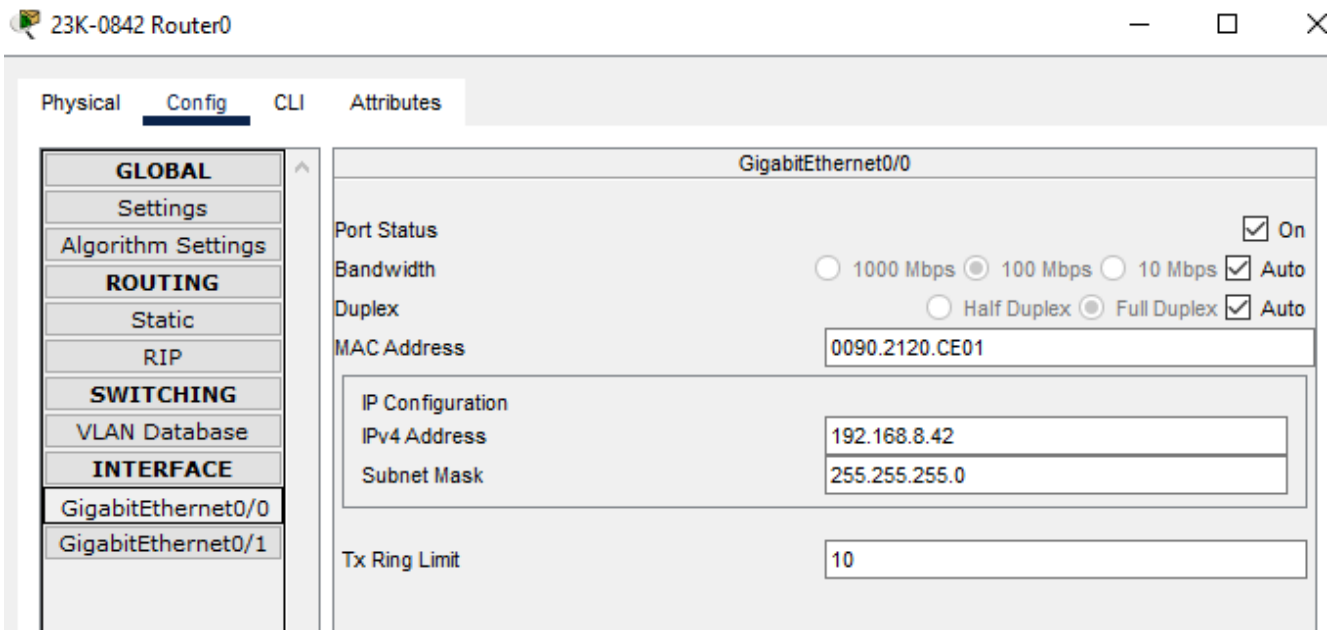
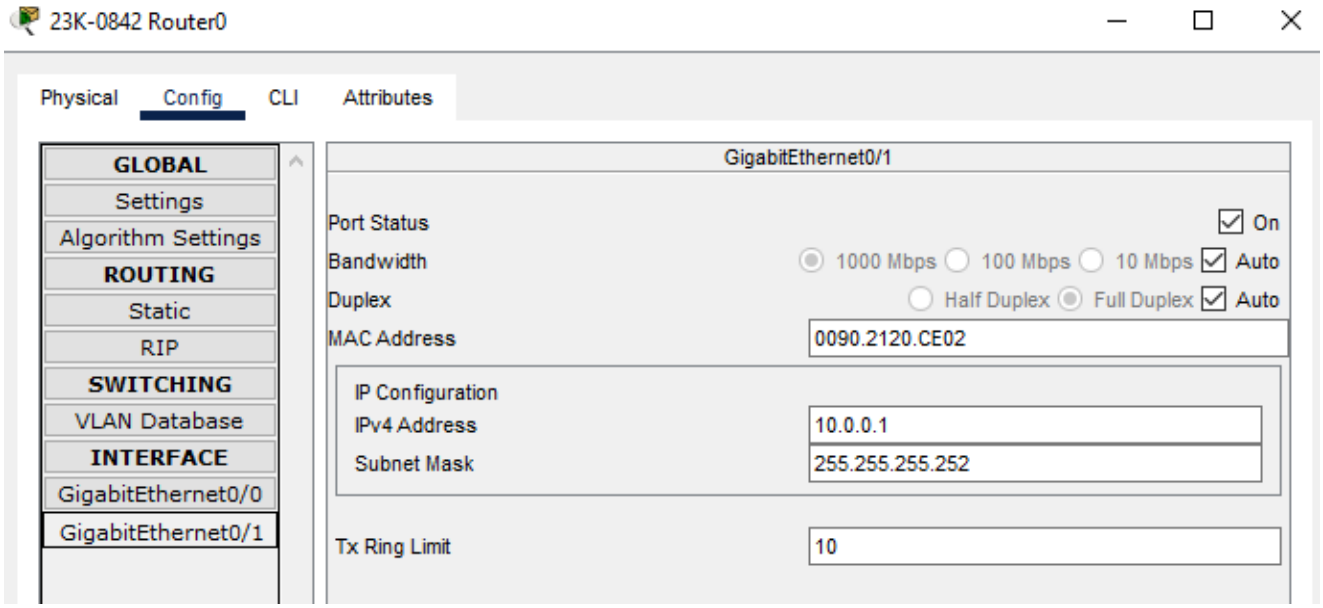
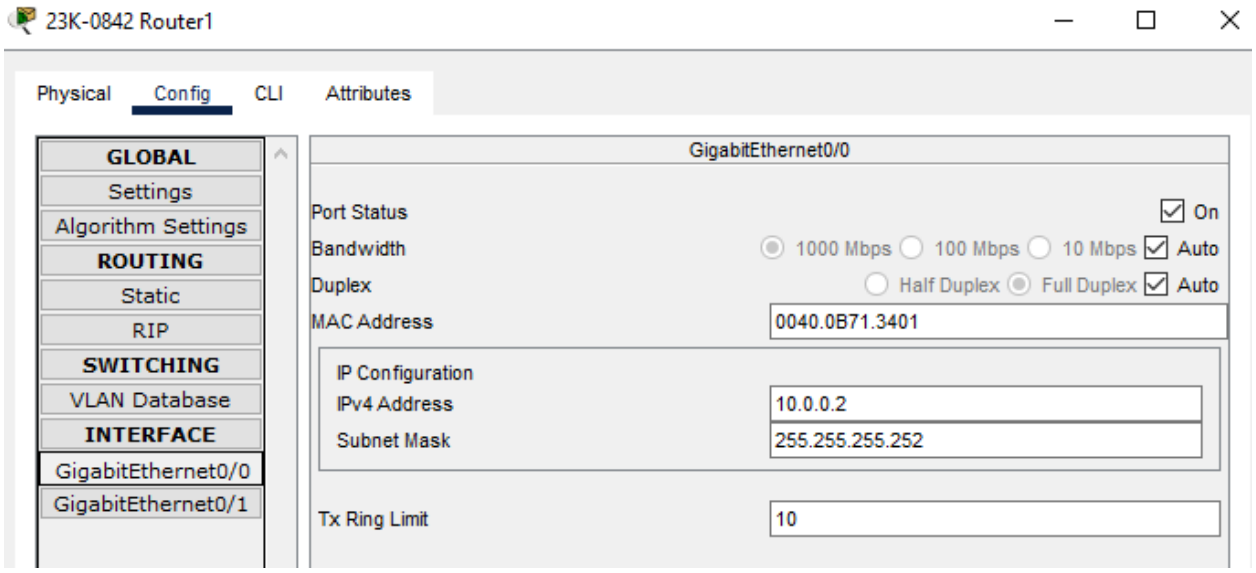
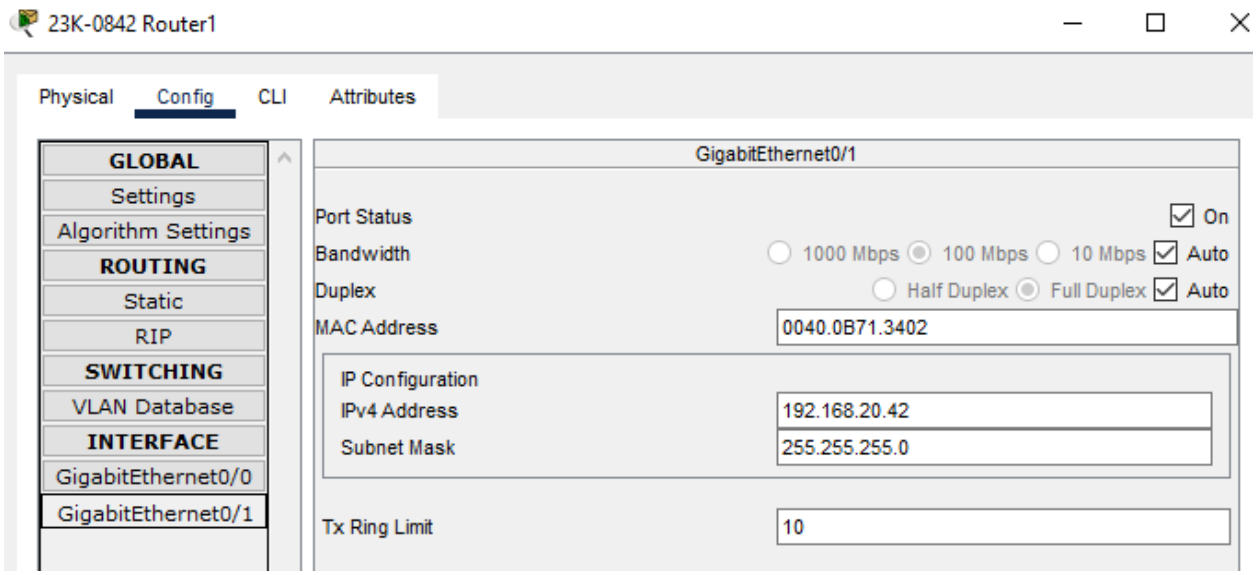


Figure 1

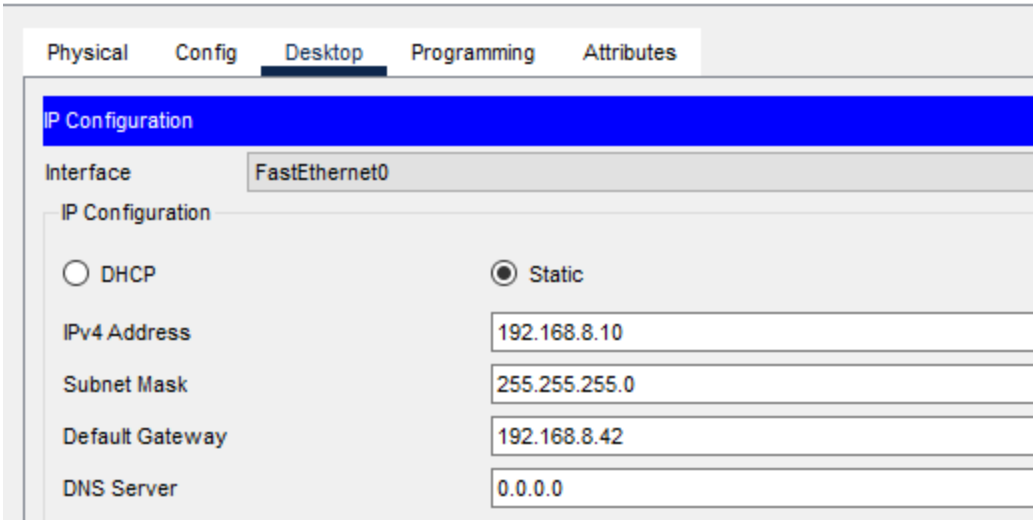

23K-0842 Router0
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/0
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0090.2120.CE01
IP Configuration
IPv4 Address
192.168.8.42
Subnet Mask
255.255.255.0
Tx Ring Limit
10


23K-0842 Router0
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/1
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0090.2120.CE02
IP Configuration
IPv4 Address
10.0.0.1
Subnet Mask
255.255.255.252
Tx Ring Limit
10

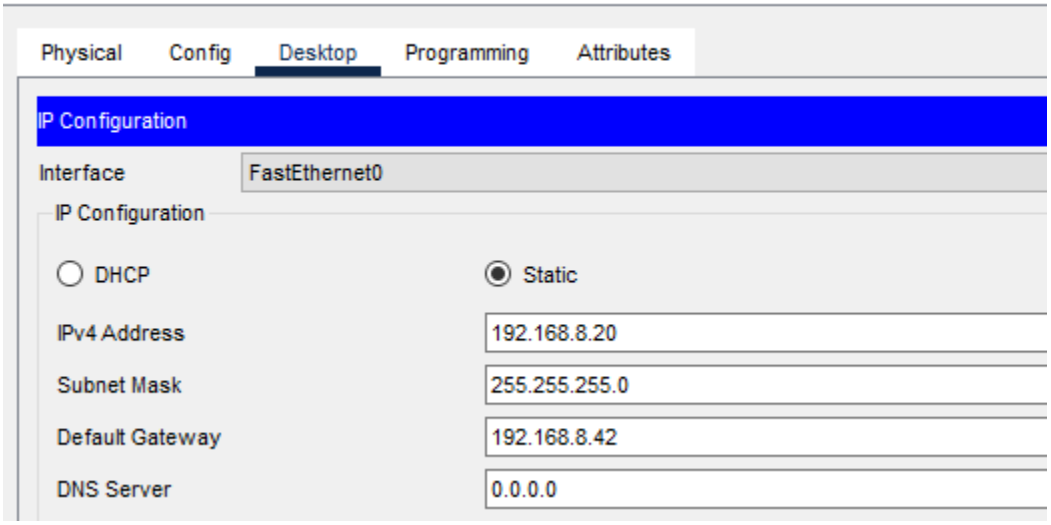

23K-0842 Router1
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/0
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0040.0B71.3401
IP Configuration
IPv4 Address
10.0.0.2
Subnet Mask
255.255.255.252
Tx Ring Limit
10


23K-0842 Router1
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/1
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0040.0B71.3402
IP Configuration
IPv4 Address
192.168.20.42
Subnet Mask
255.255.255.0
Tx Ring Limit
10

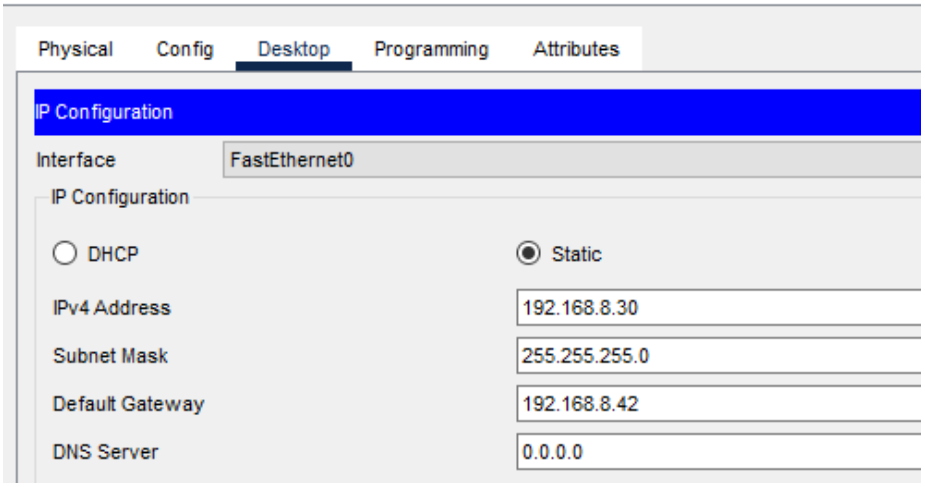
23K-0842 PC5



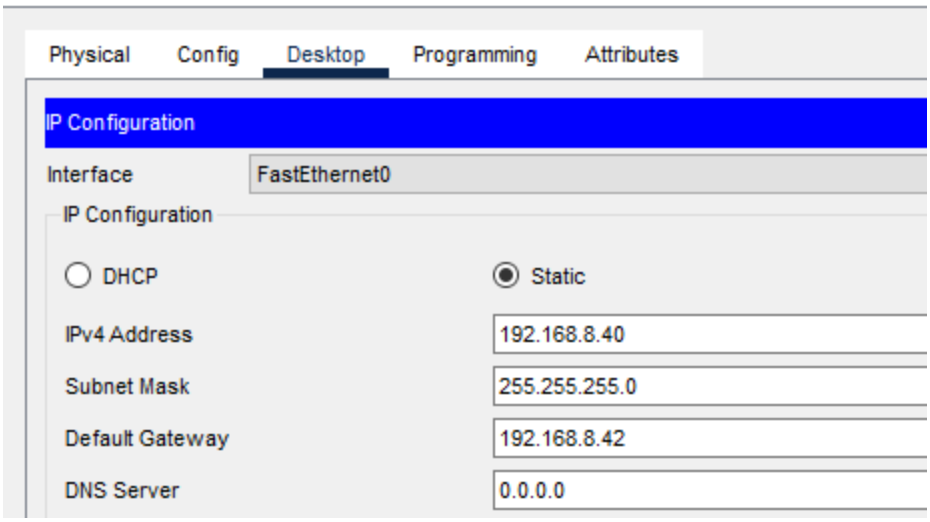
23K-0842 PC0



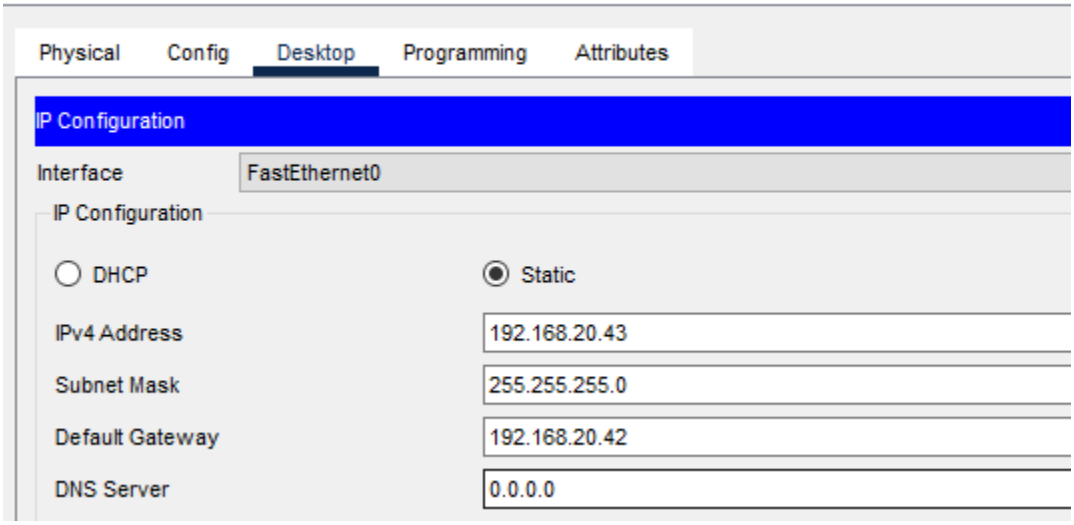
23K-0842 Laptop0



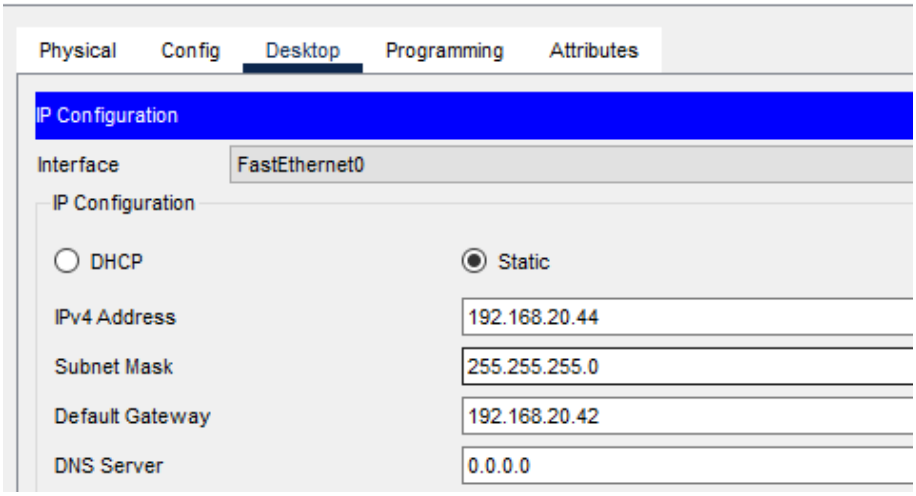
23K-0842 PC1

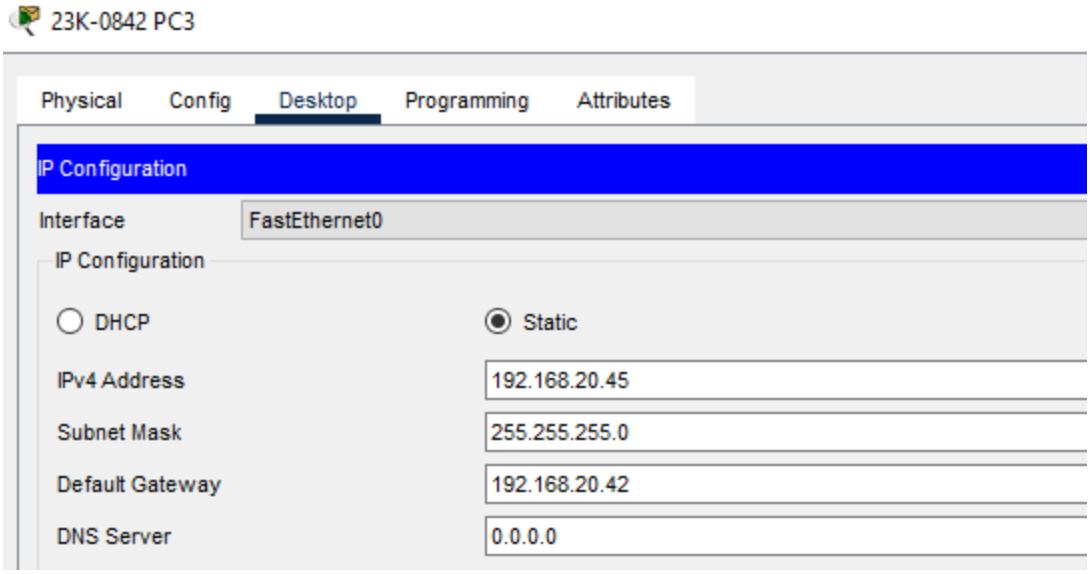


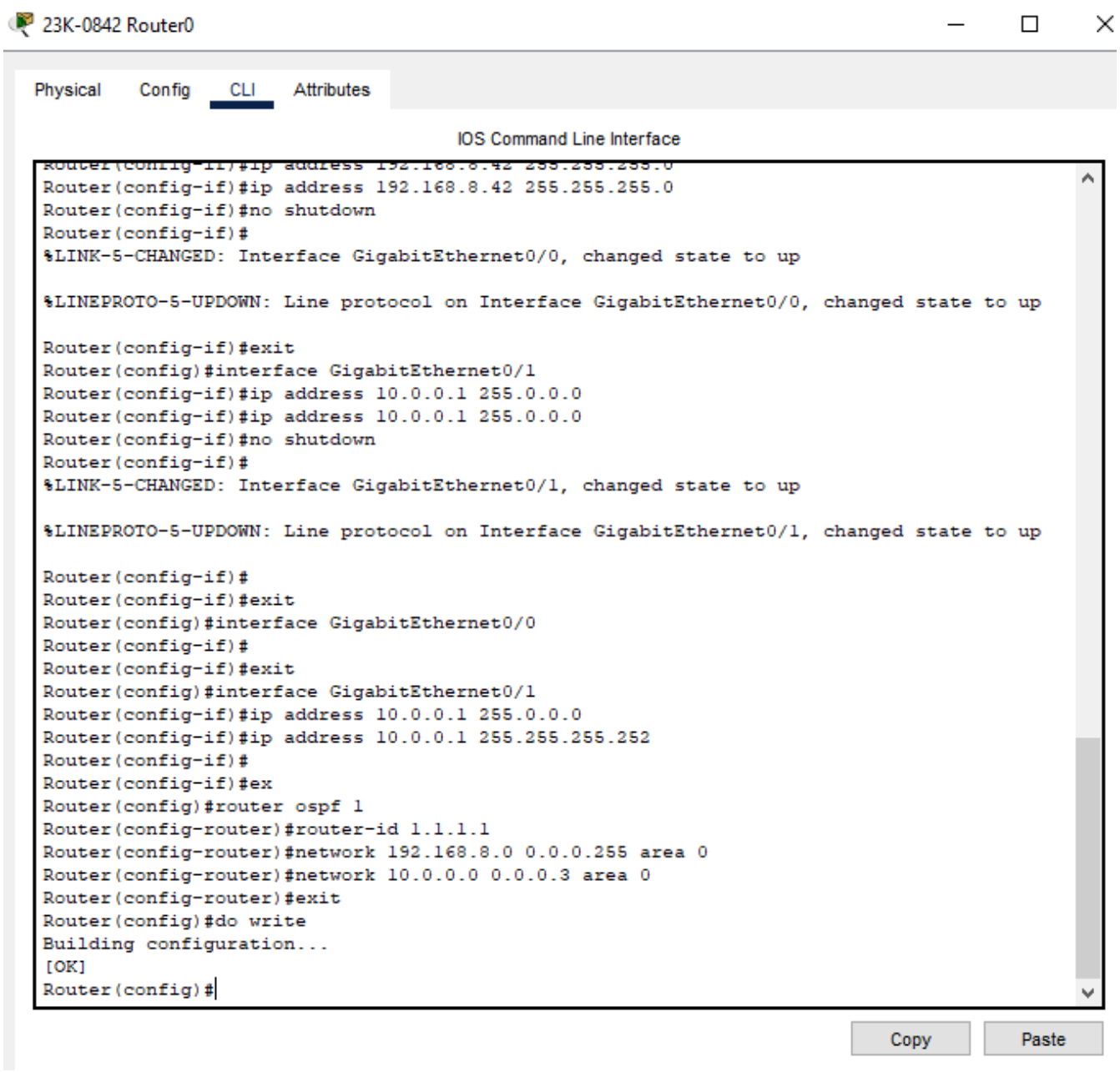
23K-0842 PC2

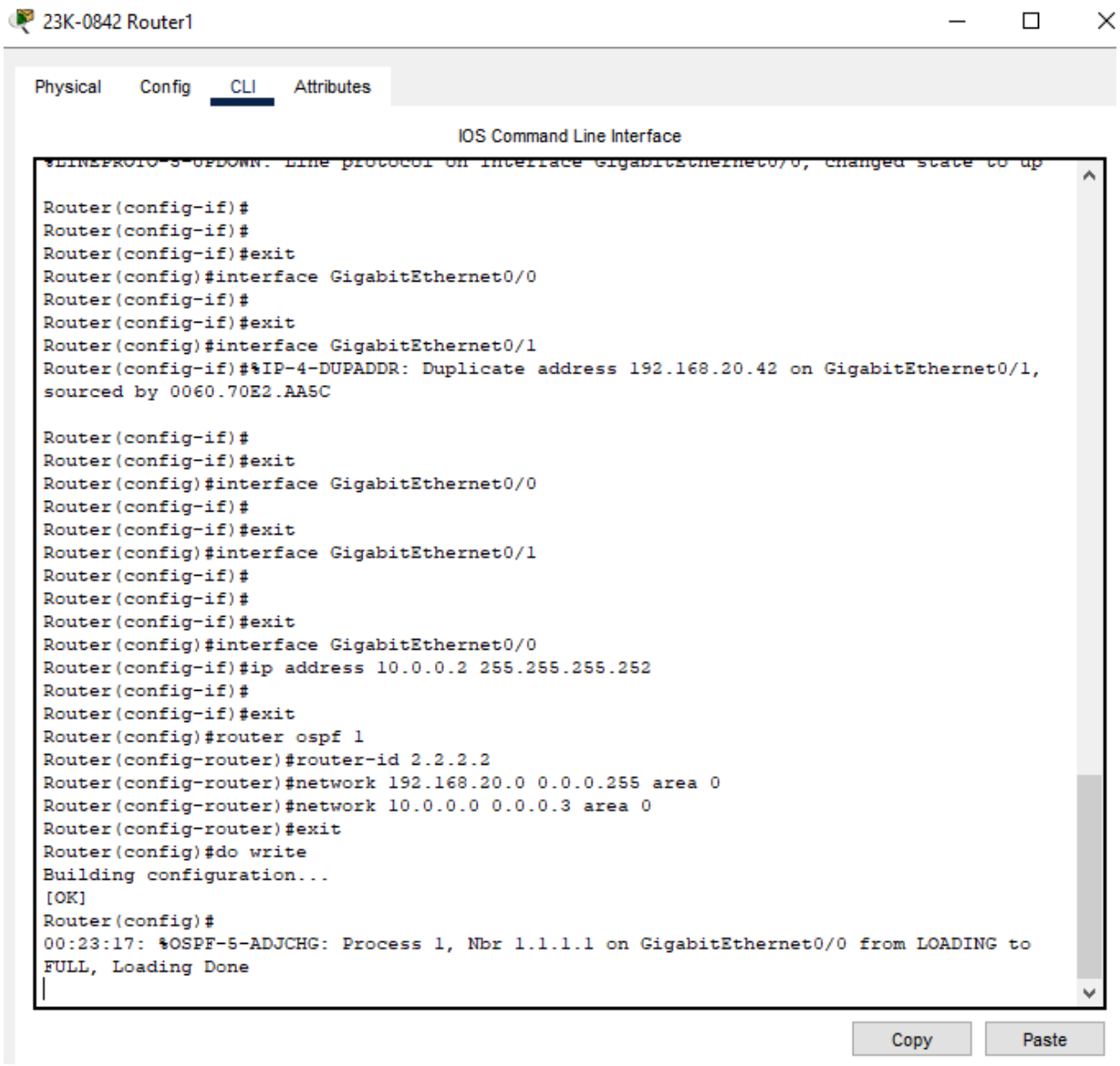


23K-0842 Laptop1




23K-0842 PC3
Physical
Config
Desktop
Programming
Attributes
IP Configuration
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.20.45
Subnet Mask
255.255.255.0
Default Gateway
192.168.20.42
DNS Server
0.0.0.0


23K-0842 Router0
Physical
Config
CLI
Attributes
IOS Command Line Interface
Router(config-if)#ip address 192.168.8.42 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/1
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/1
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#ip address 10.0.0.1 255.255.255.252
Router(config-if)#
Router(config-if)#ex
Router(config)#router ospf 1
Router(config-router)#router-id 1.1.1.1
Router(config-router)#network 192.168.8.0 0.0.0.255 area 0
Router(config-router)#network 10.0.0.0 0.0.0.3 area 0
Router(config-router)#exit
Router(config)#do write
Building configuration...
[OK]
Router(config)#
Copy
Paste


23K-0842 Router1
Physical
Config
CLI
Attributes
IOS Command Line Interface
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up
Router(config-if)#
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/1
Router(config-if)#%IP-4-DUPADDR: Duplicate address 192.168.20.42 on GigabitEthernet0/1,
sourced by 0060.70E2.AA5C
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/1
Router(config-if)#
Router(config-if)#
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/0
Router(config-if)#ip address 10.0.0.2 255.255.255.252
Router(config-if)#
Router(config-if)#exit
Router(config)#router ospf 1
Router(config-router)#router-id 2.2.2.2
Router(config-router)#network 192.168.20.0 0.0.0.255 area 0
Router(config-router)#network 10.0.0.0 0.0.0.3 area 0
Router(config-router)#exit
Router(config)#do write
Building configuration...
[OK]
Router(config)#
00:23:17: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on GigabitEthernet0/0 from LOADING to
FULL, Loading Done
Copy
Paste

23K-0842 Router0

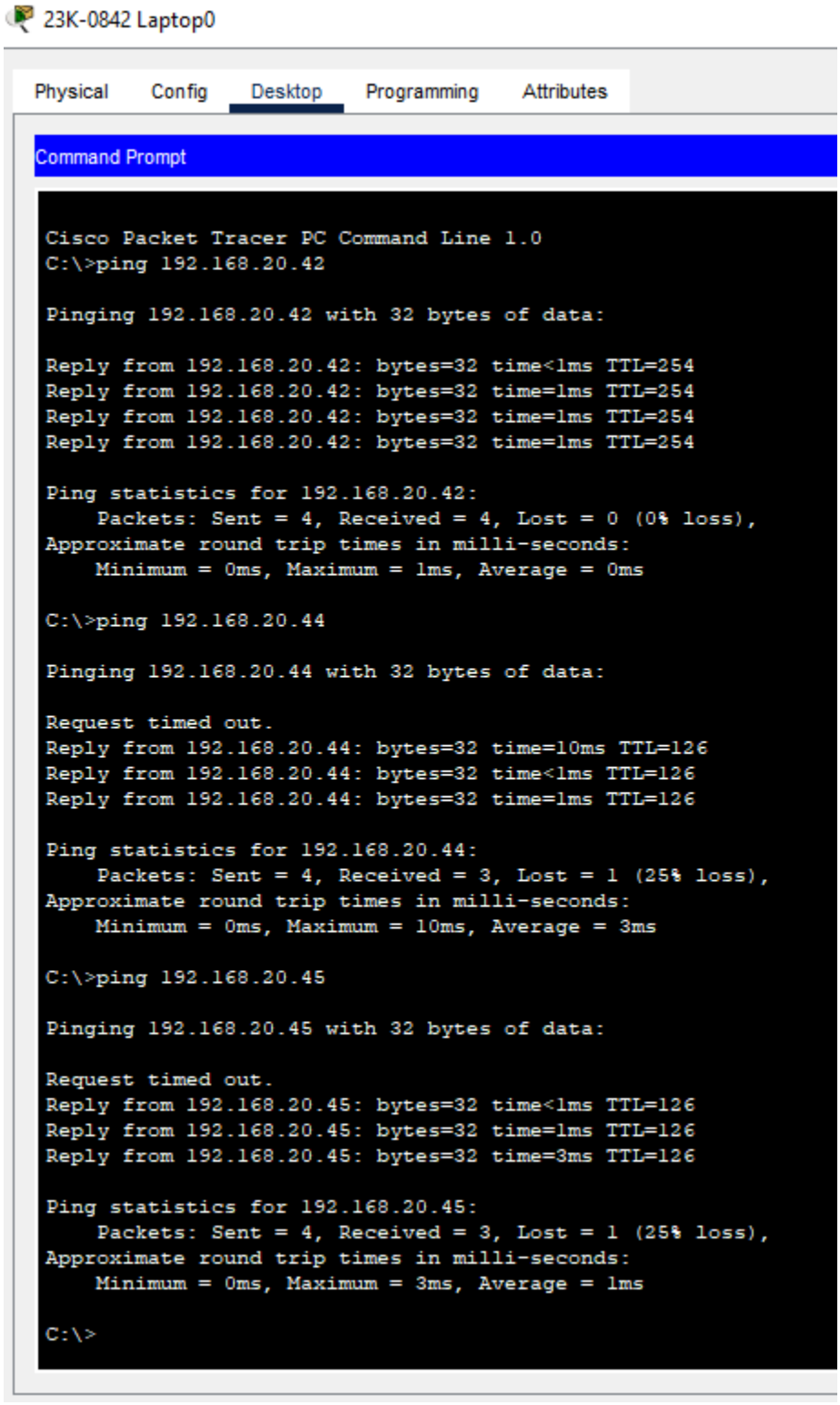
Physical Config CLI Attributes

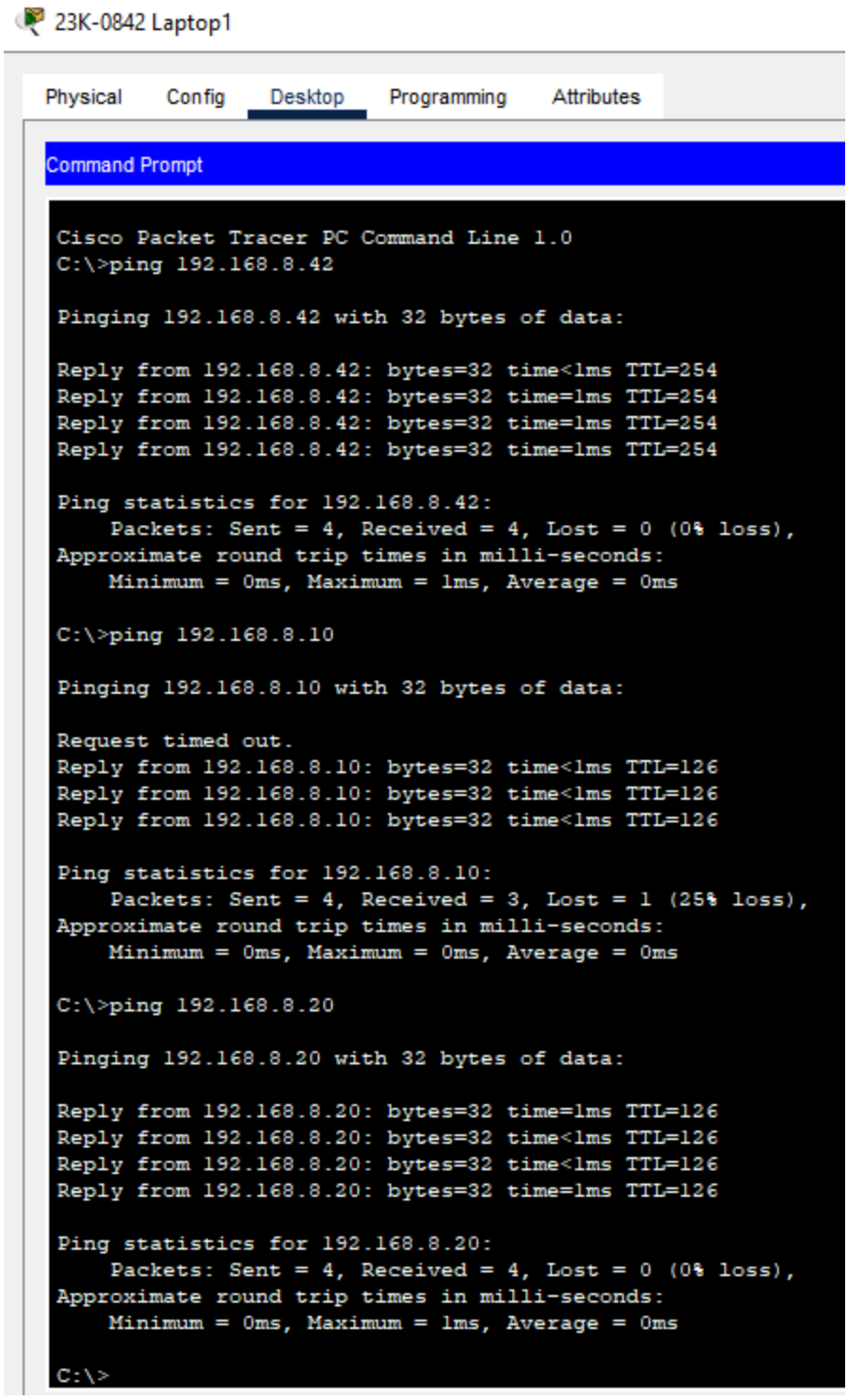
IOS Command Line Interface

```
Router(config-if)#exit
Router(config)#interface GigabitEthernet0/1
Router(config-if)#
Router(config-if)#ex
Router(config)#ex
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#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 are
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.0.0.0/30 is directly connected, GigabitEthernet0/1
L       10.0.0.1/32 is directly connected, GigabitEthernet0/1
     192.168.8.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.8.0/24 is directly connected, GigabitEthernet0/0
L       192.168.8.42/32 is directly connected, GigabitEthernet0/0
O    192.168.20.0/24 [110/2] via 10.0.0.2, 00:20:25, GigabitEthernet0/1
```

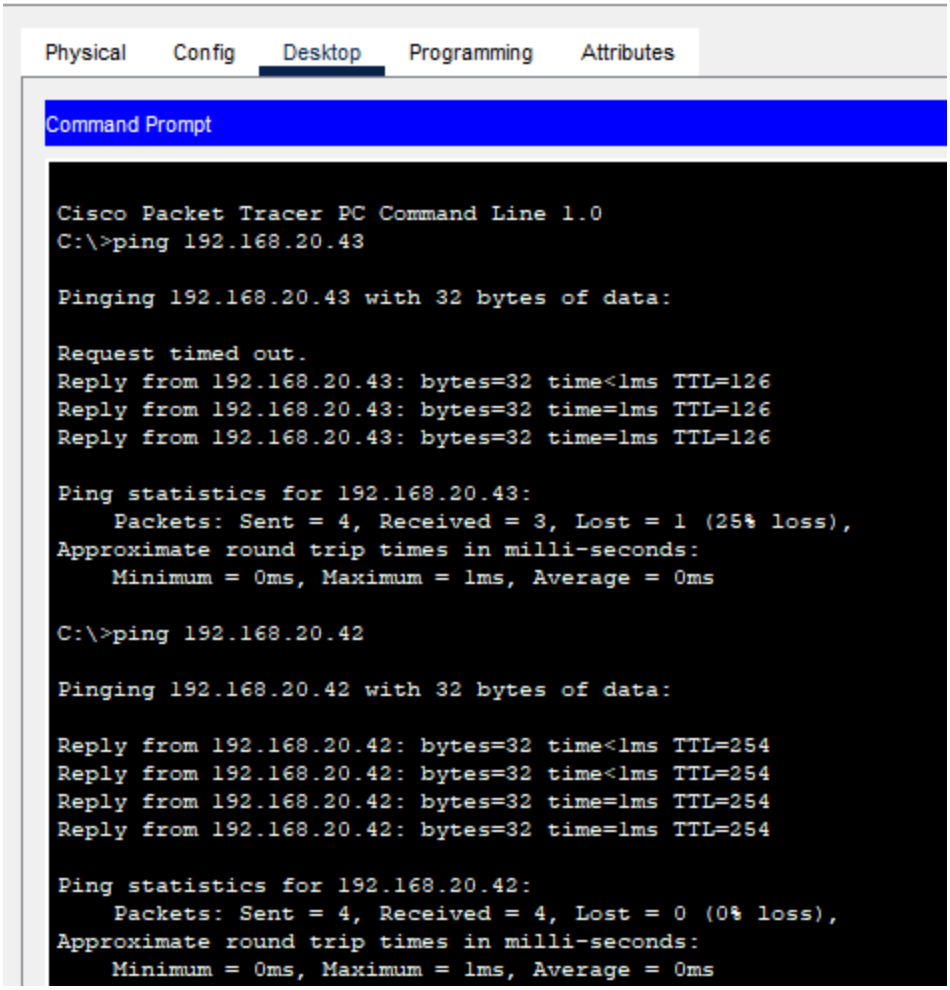
23K-0842 Router1

```
Router(config-if)#ex
Router(config)#ex
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#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

     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.0.0.0/30 is directly connected, GigabitEthernet0/0
L       10.0.0.2/32 is directly connected, GigabitEthernet0/0
O    192.168.8.0/24 [110/2] via 10.0.0.1, 00:21:18, GigabitEthernet0/0
     192.168.20.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.20.0/24 is directly connected, GigabitEthernet0/1
L       192.168.20.42/32 is directly connected, GigabitEthernet0/1

Router#
```

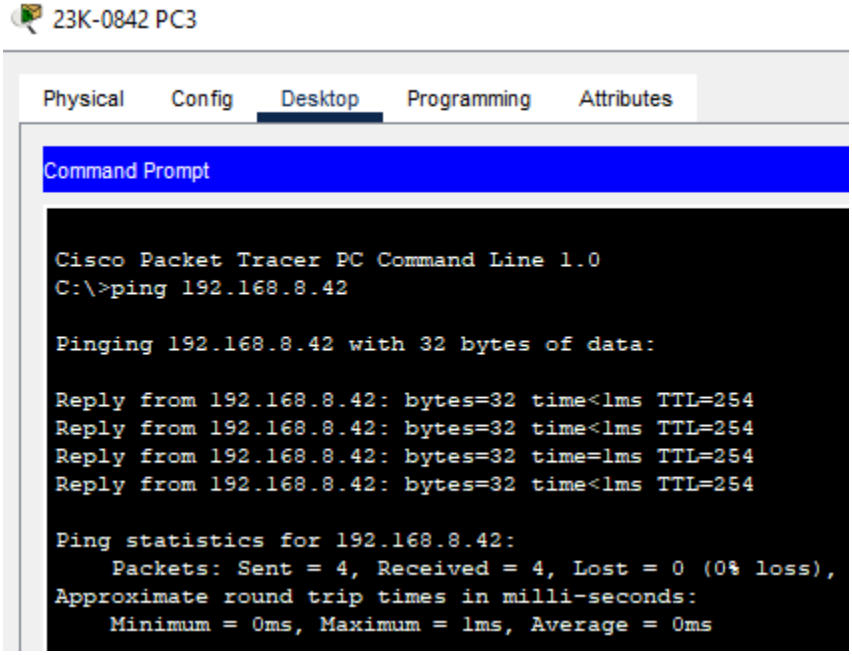

23K-0842 Laptop0
Physical
Config
Desktop
Programming
Attributes
Command Prompt
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.20.42
Pinging 192.168.20.42 with 32 bytes of data:
Reply from 192.168.20.42: bytes=32 time<1ms TTL=254
Reply from 192.168.20.42: bytes=32 time=1ms TTL=254
Reply from 192.168.20.42: bytes=32 time=1ms TTL=254
Reply from 192.168.20.42: bytes=32 time=1ms TTL=254
Ping statistics for 192.168.20.42:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>ping 192.168.20.44
Pinging 192.168.20.44 with 32 bytes of data:
Request timed out.
Reply from 192.168.20.44: bytes=32 time=10ms TTL=126
Reply from 192.168.20.44: bytes=32 time<1ms TTL=126
Reply from 192.168.20.44: bytes=32 time=1ms TTL=126
Ping statistics for 192.168.20.44:
Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 10ms, Average = 3ms
C:\>ping 192.168.20.45
Pinging 192.168.20.45 with 32 bytes of data:
Request timed out.
Reply from 192.168.20.45: bytes=32 time<1ms TTL=126
Reply from 192.168.20.45: bytes=32 time=1ms TTL=126
Reply from 192.168.20.45: bytes=32 time=3ms TTL=126
Ping statistics for 192.168.20.45:
Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 3ms, Average = 1ms
C:\>

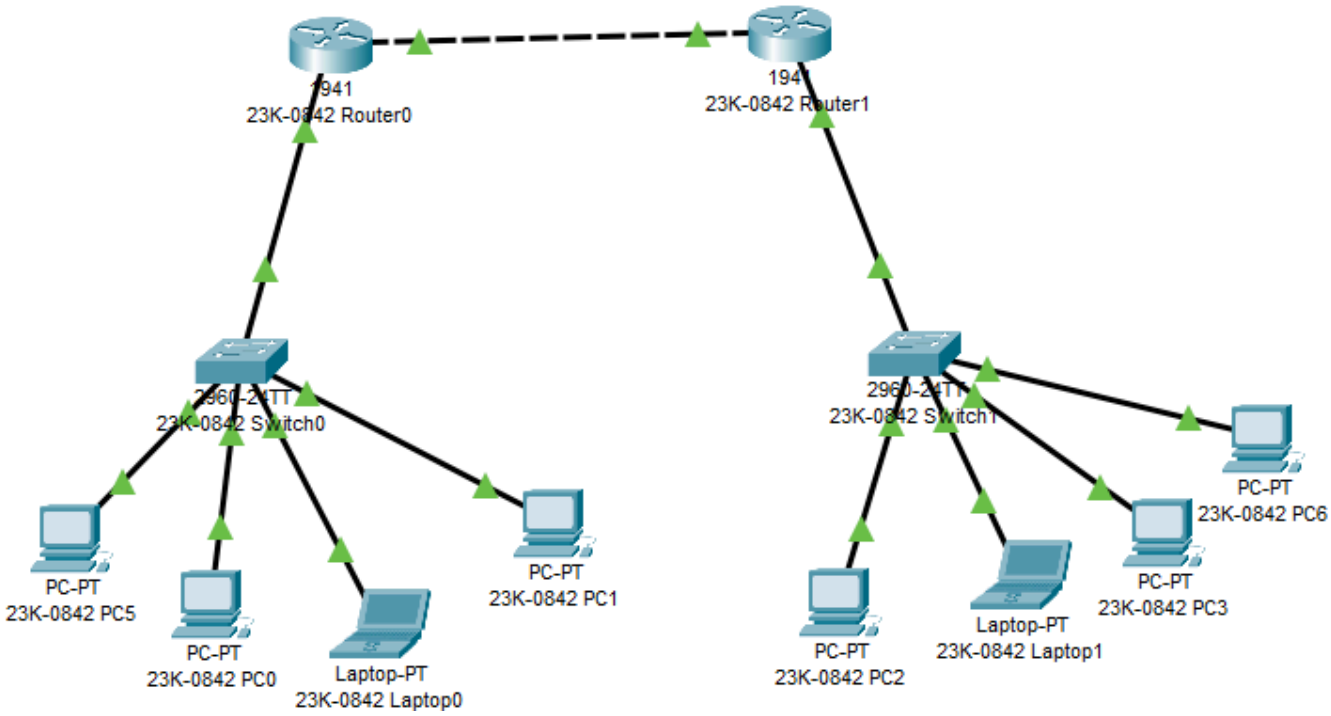

23K-0842 Laptop1
Physical
Config
Desktop
Programming
Attributes
Command Prompt
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.8.42
Pinging 192.168.8.42 with 32 bytes of data:
Reply from 192.168.8.42: bytes=32 time<1ms TTL=254
Reply from 192.168.8.42: bytes=32 time=1ms TTL=254
Reply from 192.168.8.42: bytes=32 time=1ms TTL=254
Reply from 192.168.8.42: bytes=32 time=1ms TTL=254
Ping statistics for 192.168.8.42:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>ping 192.168.8.10
Pinging 192.168.8.10 with 32 bytes of data:
Request timed out.
Reply from 192.168.8.10: bytes=32 time<1ms TTL=126
Reply from 192.168.8.10: bytes=32 time<1ms TTL=126
Reply from 192.168.8.10: bytes=32 time<1ms TTL=126
Ping statistics for 192.168.8.10:
Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>ping 192.168.8.20
Pinging 192.168.8.20 with 32 bytes of data:
Reply from 192.168.8.20: bytes=32 time=1ms TTL=126
Reply from 192.168.8.20: bytes=32 time<1ms TTL=126
Reply from 192.168.8.20: bytes=32 time<1ms TTL=126
Reply from 192.168.8.20: bytes=32 time=1ms TTL=126
Ping statistics for 192.168.8.20:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>

23K-0842 PC1



23K-0842 PC3



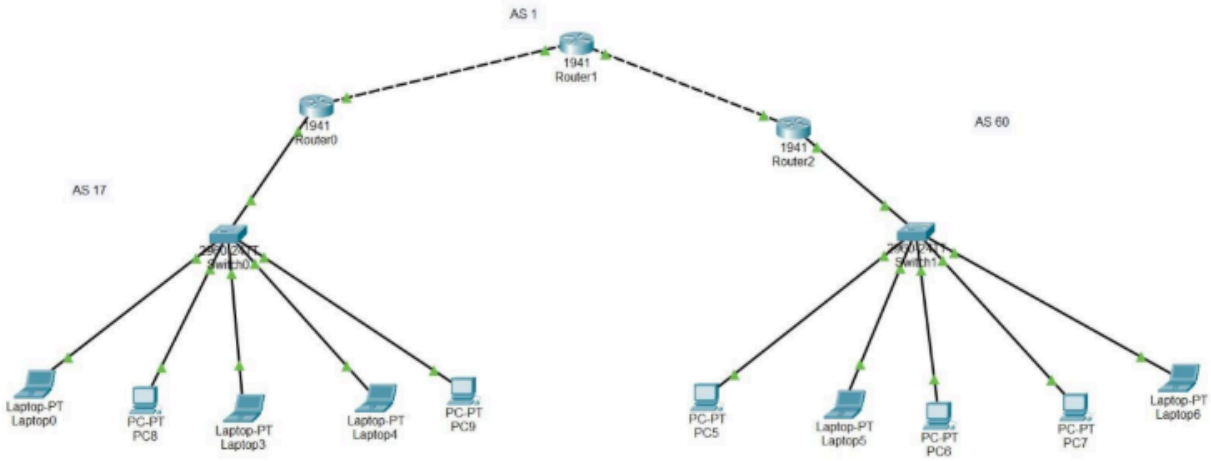


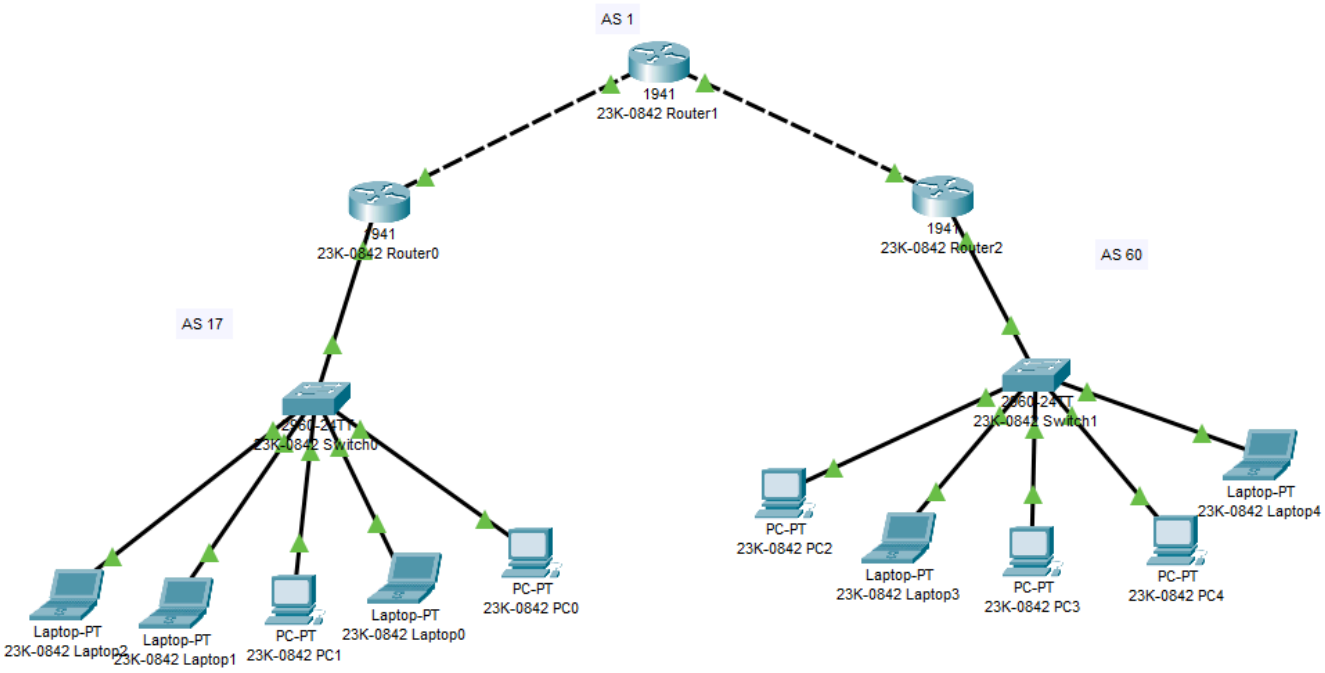
O 192.168.8.0/24 [110/2] via 10.0.0.1, 00:04:40, GigabitEthernet0/0 on router 1 n

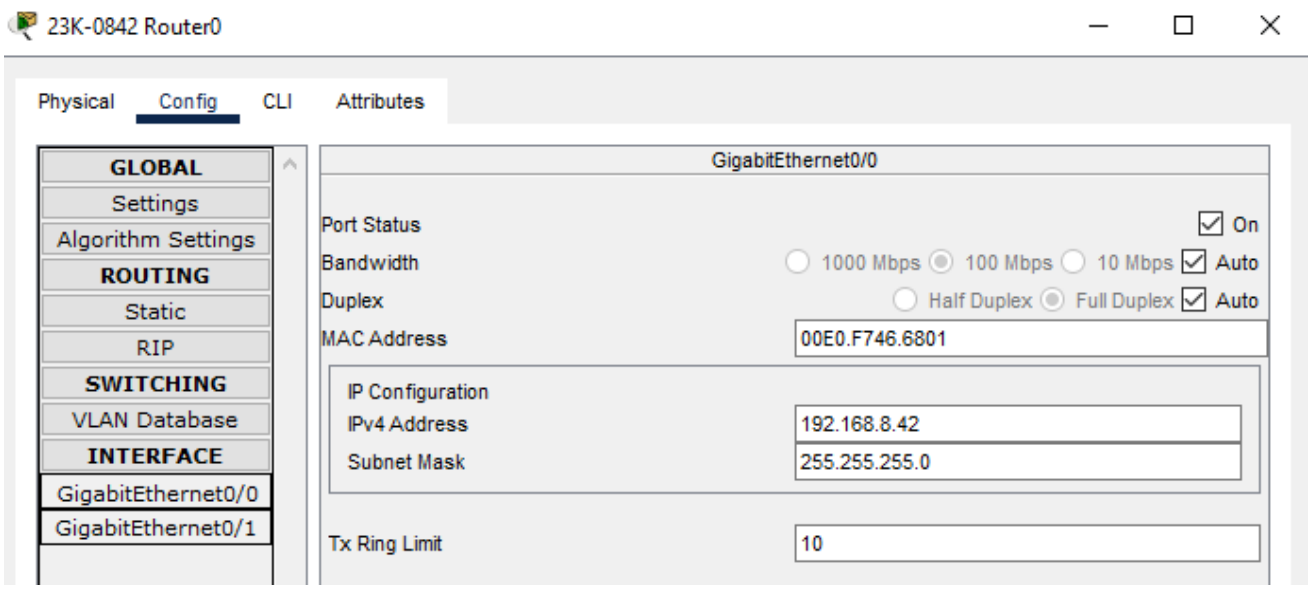
O 192.168.20.0/24 [110/2] via 10.0.0.2, 00:03:48, GigabitEthernet0/1 on router 0

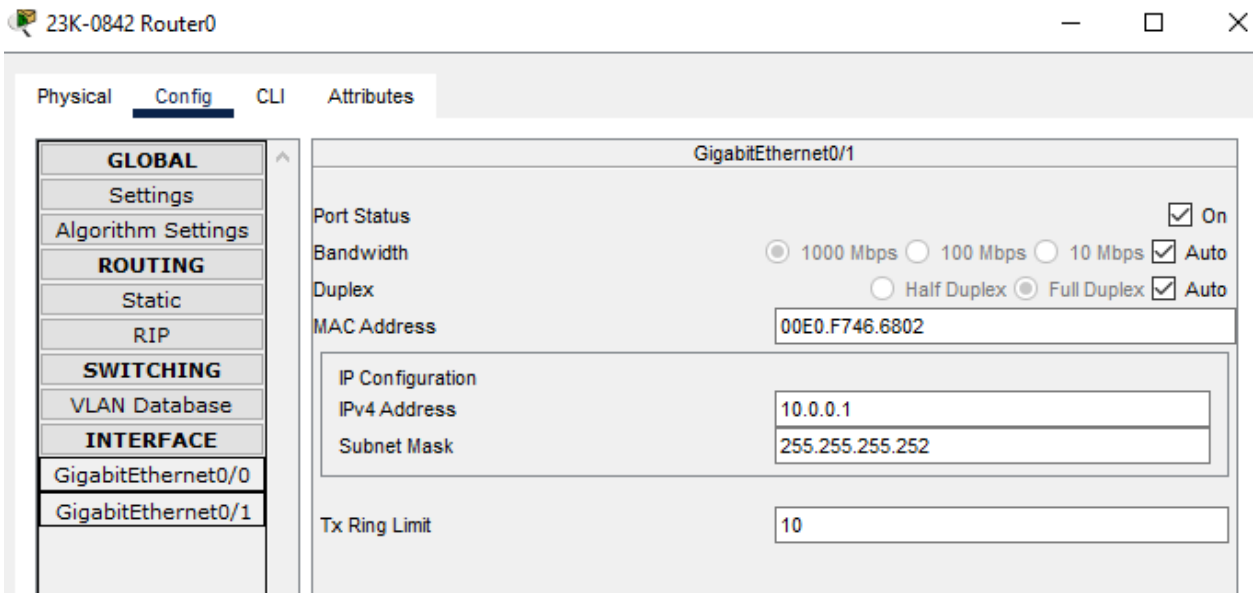
Exercise 2:

Apply BGP on given topology.
Attach screenshots of each step.

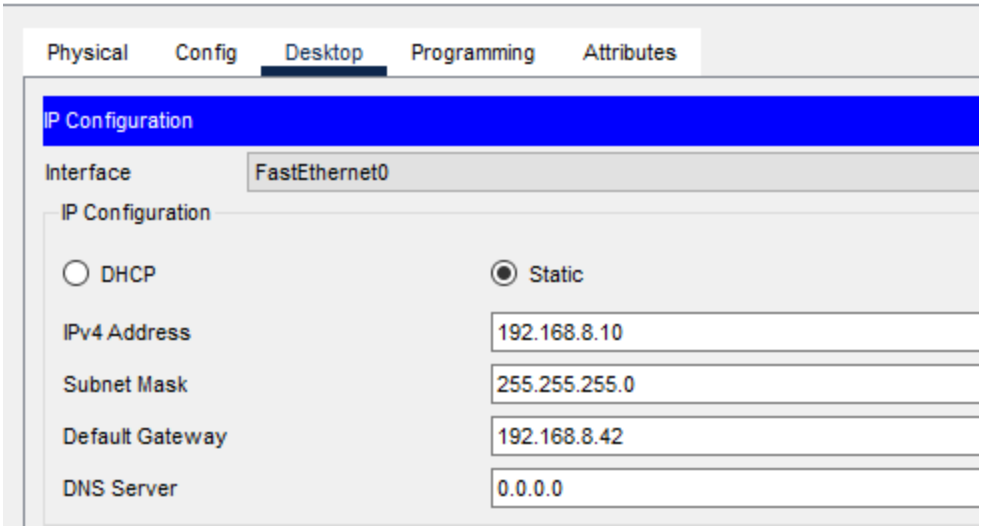




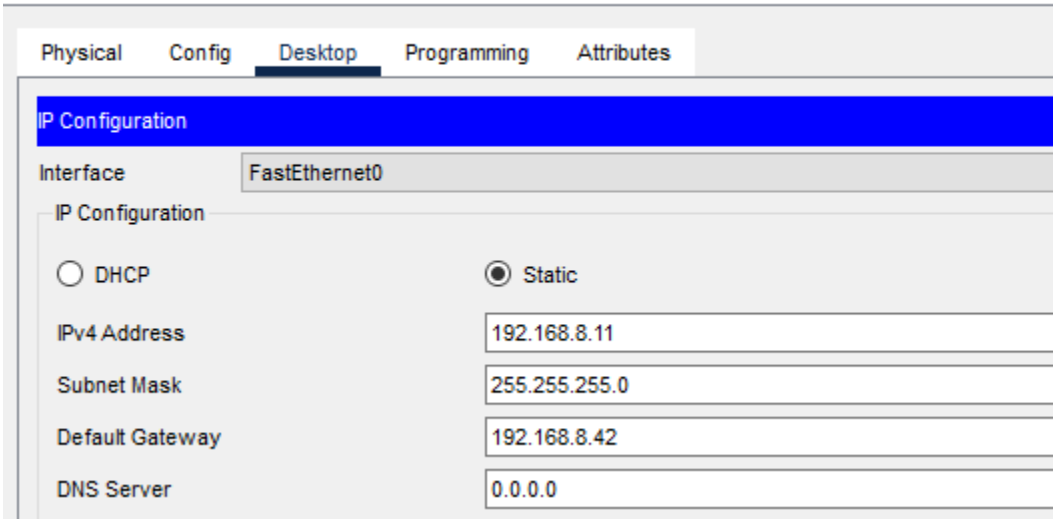

23K-0842 Router0
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/0
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
00E0.F746.6801
IP Configuration
IPv4 Address
192.168.8.42
Subnet Mask
255.255.255.0
Tx Ring Limit
10


23K-0842 Router0
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/1
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
00E0.F746.6802
IP Configuration
IPv4 Address
10.0.0.1
Subnet Mask
255.255.255.252
Tx Ring Limit
10

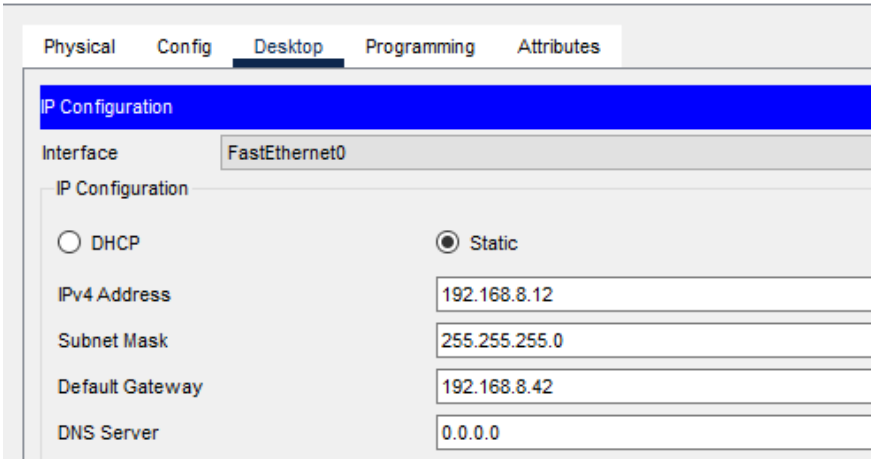
23K-0842 Laptop2



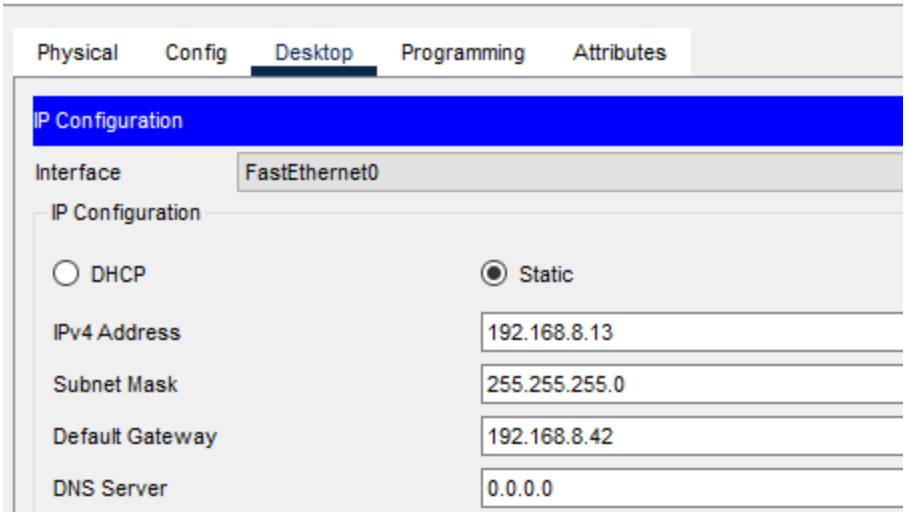
23K-0842 Laptop1



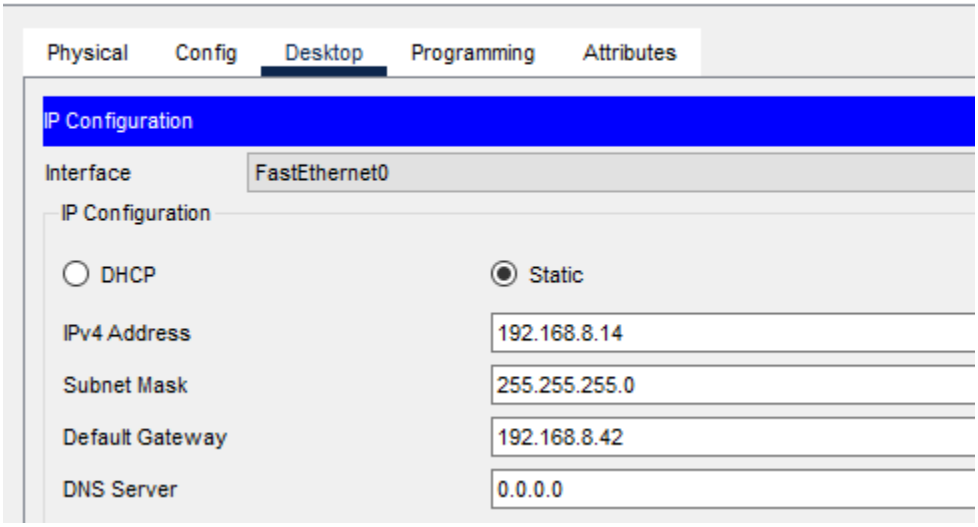
23K-0842 PC1



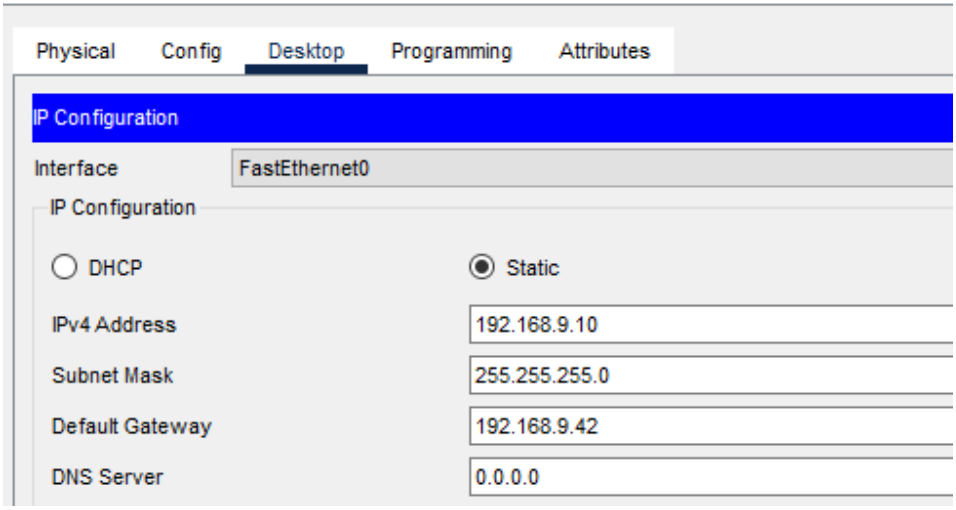
23K-0842 Laptop0



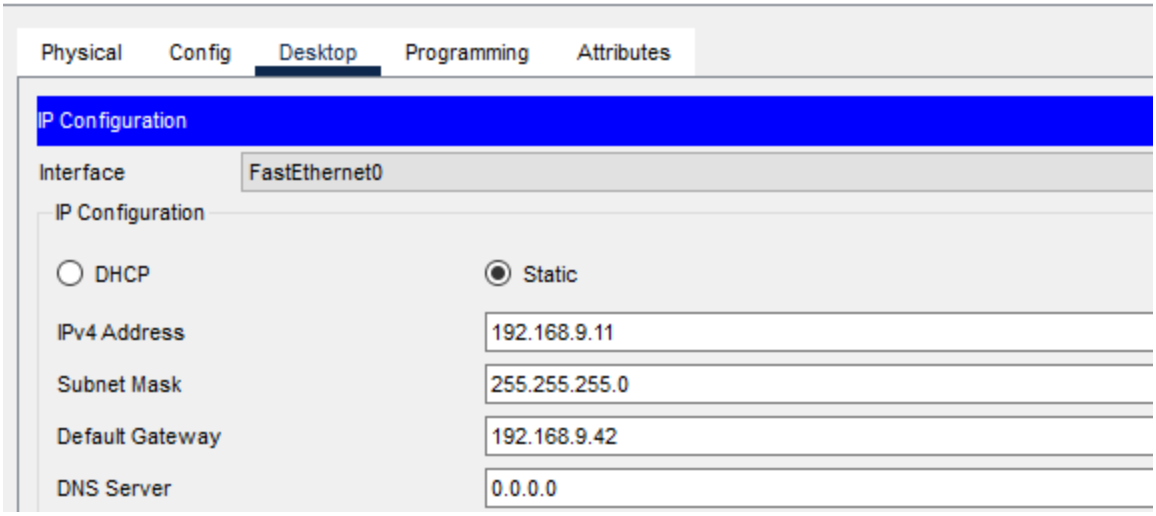
23K-0842 PC0



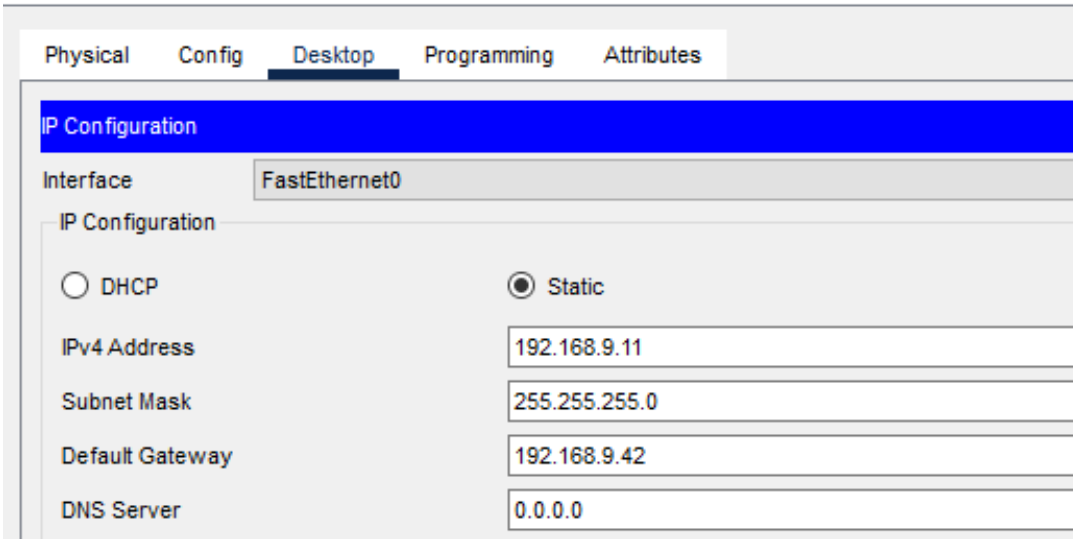
23K-0842 PC2



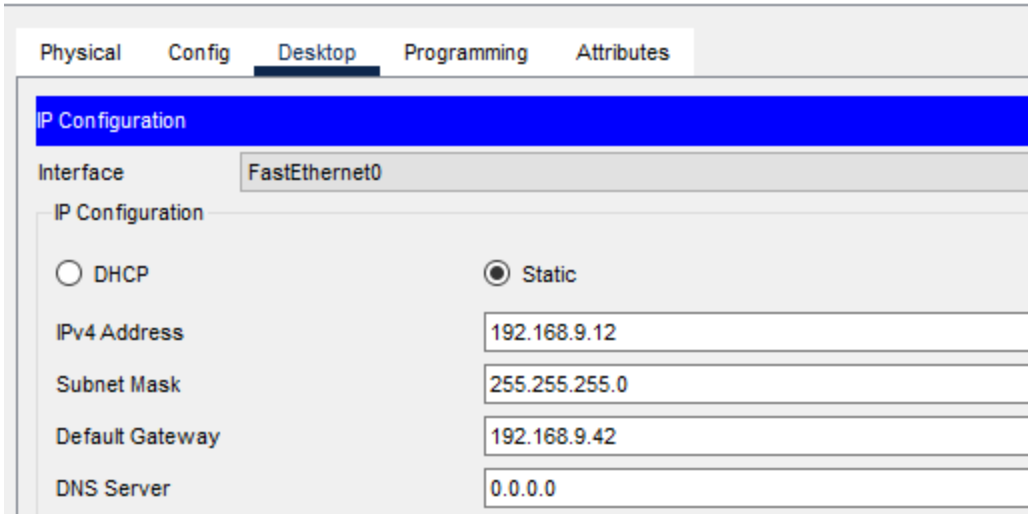
23K-0842 Laptop3



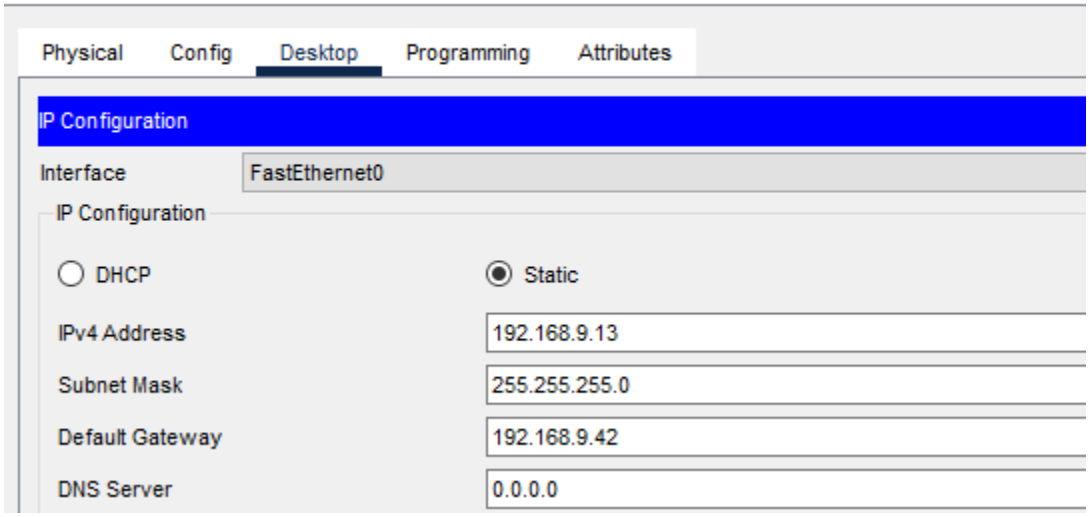
23K-0842 Laptop3

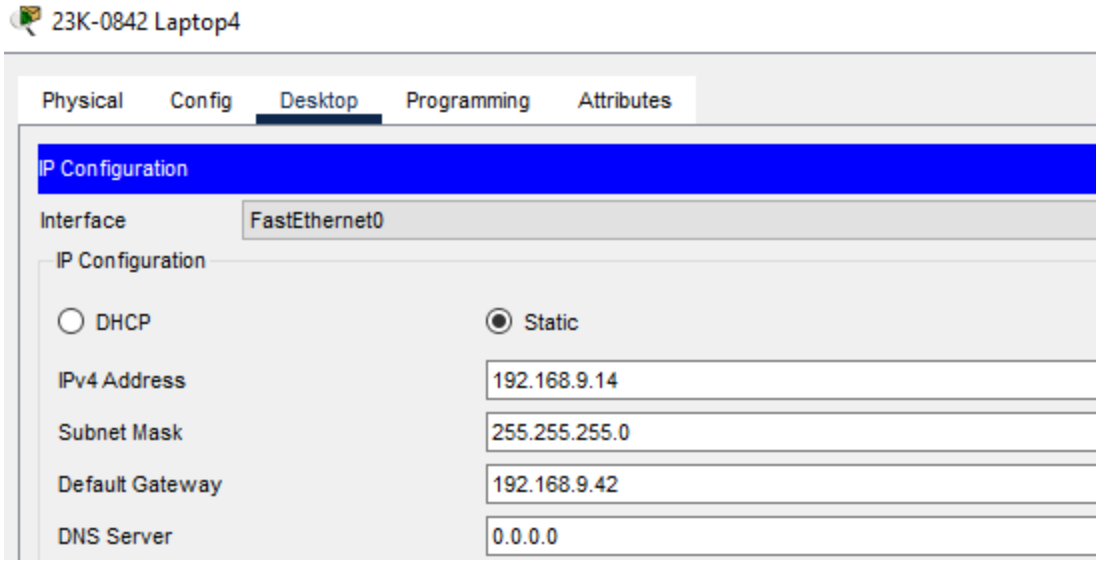


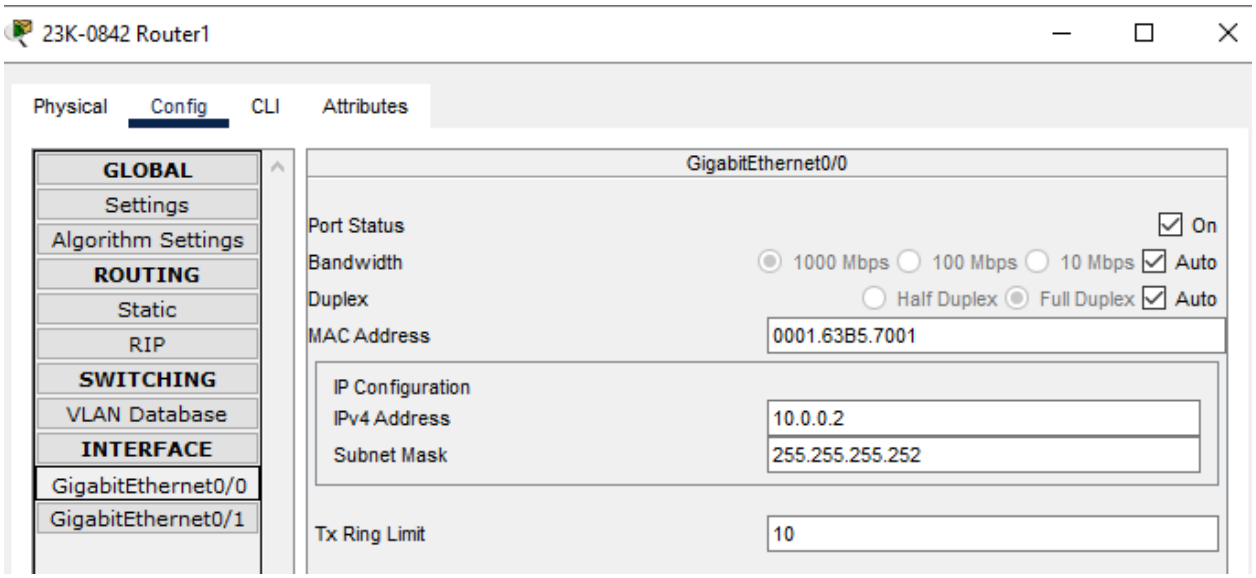
23K-0842 PC3

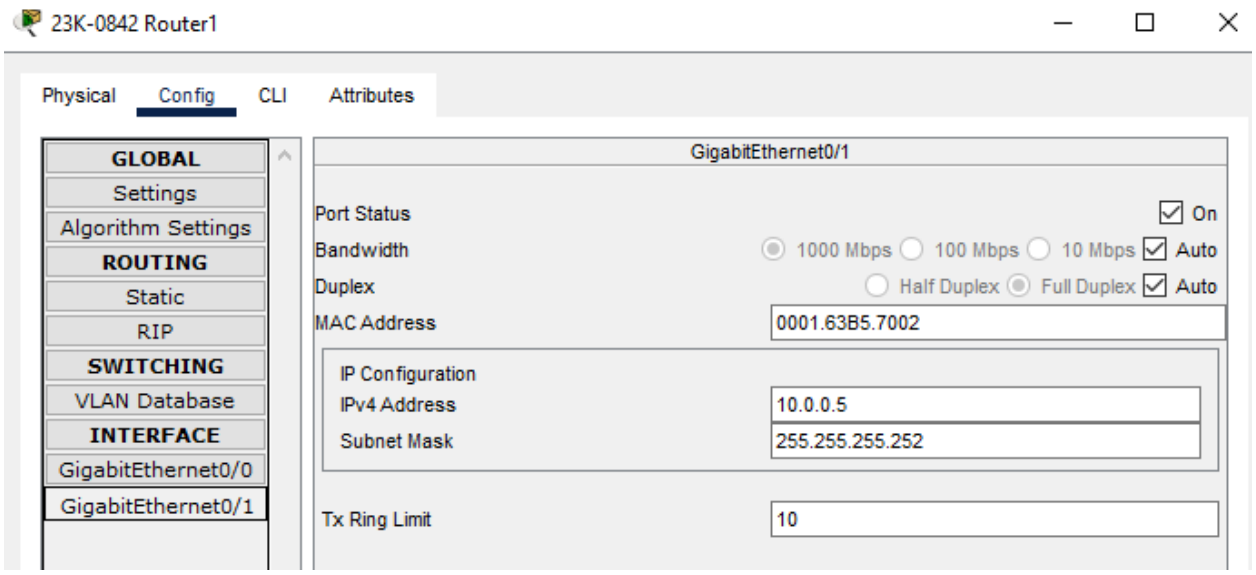


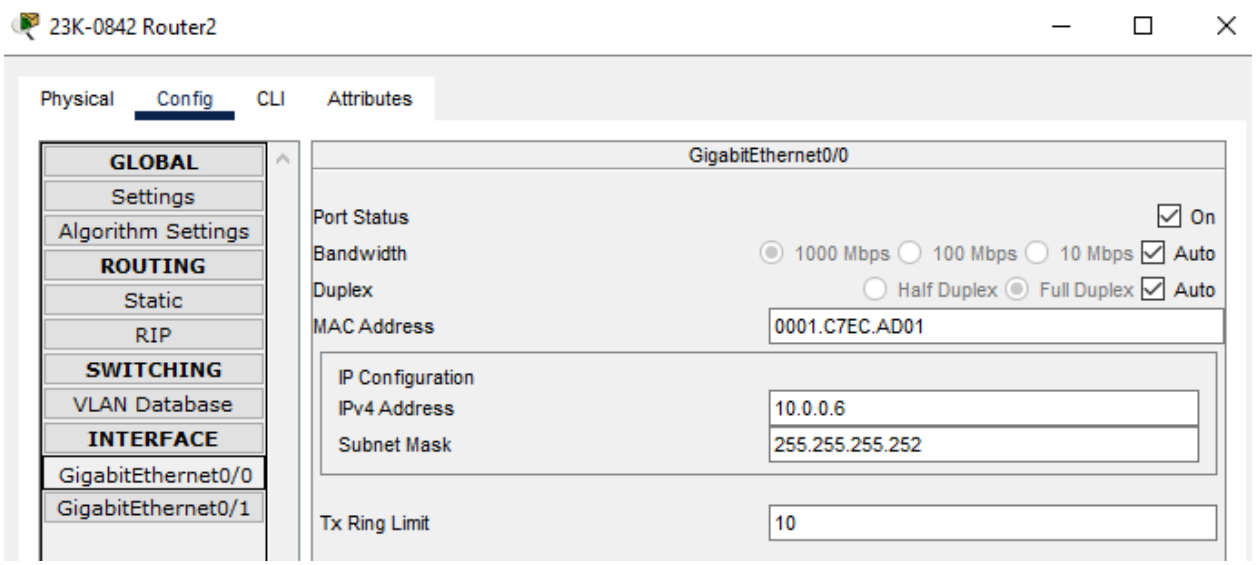
23K-0842 PC4

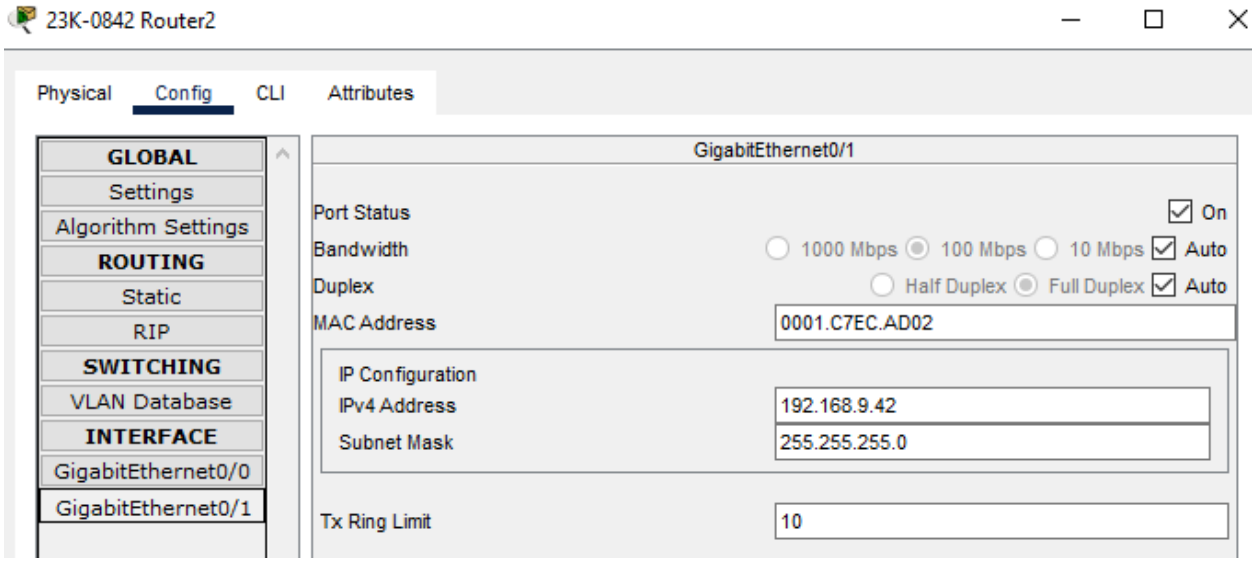



23K-0842 Laptop4
Physical
Config
Desktop
Programming
Attributes
IP Configuration
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.9.14
Subnet Mask
255.255.255.0
Default Gateway
192.168.9.42
DNS Server
0.0.0.0


23K-0842 Router1
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/0
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0001.63B5.7001
IP Configuration
IPv4 Address
10.0.0.2
Subnet Mask
255.255.255.252
Tx Ring Limit
10


23K-0842 Router1
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/1
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0001.63B5.7002
IP Configuration
IPv4 Address
10.0.0.5
Subnet Mask
255.255.255.252
Tx Ring Limit
10


23K-0842 Router2
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/0
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0001.C7EC.AD01
IP Configuration
IPv4 Address
10.0.0.6
Subnet Mask
255.255.255.252
Tx Ring Limit
10


23K-0842 Router2
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
SWITCHING
VLAN Database
INTERFACE
GigabitEthernet0/0
GigabitEthernet0/1
GigabitEthernet0/1
Port Status
On
Bandwidth
1000 Mbps
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0001.C7EC.AD02
IP Configuration
IPv4 Address
192.168.9.42
Subnet Mask
255.255.255.0
Tx Ring Limit
10

Router0

```
Router(config)#EX
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#router bgp 17
              ^
% Invalid input detected at '^' marker.

Router#ENABLE
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router bgp 17
Router(config-router)#bgp log-neighbor-changes
Router(config-router)#neighbor 10.0.0.2 remote-as 1
Router(config-router)#network 192.168.8.0 0.0.0.255
                                          ^
% Invalid input detected at '^' marker.

Router(config-router)#network 192.168.8.0 mask 0.0.0.255
Router(config-router)#exit
Router(config)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

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

Copy

Router1

Physical Config CLI Attributes

IOS Command Line Interface

```
Router#
Router#enable
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#bgp log-neighbor-changes
              ^
% Invalid input detected at '^' marker.

Router(config)#router bgp 1
Router(config-router)#bgp log-neighbor-changes
Router(config-router)#neighbor 10.0.0.1 remote -as 17
                                        ^
% Invalid input detected at '^' marker.

Router(config-router)#neighbor 10.0.0.1 remote-as 17
Router(config-router)#%BGP-5-ADJCHANGE: neighbor 10.0.0.1 Up

Router(config-router)#neighbor 10.0.0.6 remote-as 60
Router(config-router)#ex
Router(config)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

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

Copy Paste

Router2

```
Router(config)#
Router(config)#router bgp 60
Router(config-router)#bgp log-neighbor-changes
Router(config-router)#neighbor 10.0.0.2 remote-as 1
Router(config-router)#network 192.168.8.0 mask 255.255.255.0
Router(config-router)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

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

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Verify on each router:

1. Show ip bgp sumary

Router0

```
Router>show ip bgp summary
BGP router identifier 192.168.8.42, local AS number 17
BGP table version is 1, main routing table version 6
0 network entries using 0 bytes of memory
0 path entries using 0 bytes of memory
0/0 BGP path/bestpath attribute entries using 0 bytes of memory
0 BGP AS-PATH entries using 0 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
Bitfield cache entries: current 1 (at peak 1) using 32 bytes of memory
BGP using 32 total bytes of memory
BGP activity 0/0 prefixes, 0/0 paths, scan interval 60 secs

Neighbor        V    AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.0.0.2        4     1       9       9        1    0    0 00:07:30        4

Router>
```

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Router1

```
Router#show ip bgp summary
BGP router identifier 10.0.0.5, local AS number 1
BGP table version is 1, main routing table version 6
0 network entries using 0 bytes of memory
0 path entries using 0 bytes of memory
0/0 BGP path/bestpath attribute entries using 0 bytes of memory
0 BGP AS-PATH entries using 0 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
Bitfield cache entries: current 1 (at peak 1) using 32 bytes of memory
BGP using 32 total bytes of memory
BGP activity 0/0 prefixes, 0/0 paths, scan interval 60 secs

Neighbor        V    AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.0.0.1        4    17      10      10        1    0    0 00:08:46        4
10.0.0.6        4    60       0       0        1    0    0 00:27:23        4

Router#
```

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Router2

```
Router#show ip bgp summary
BGP router identifier 192.168.9.42, local AS number 60
BGP table version is 1, main routing table version 6
0 network entries using 0 bytes of memory
0 path entries using 0 bytes of memory
0/0 BGP path/bestpath attribute entries using 0 bytes of memory
0 BGP AS-PATH entries using 0 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
Bitfield cache entries: current 1 (at peak 1) using 32 bytes of memory
BGP using 32 total bytes of memory
BGP activity 0/0 prefixes, 0/0 paths, scan interval 60 secs

Neighbor        V    AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.0.0.2        4     1       0       0        1    0    0 00:28:24        4

Router#
```

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2. show ip bgp

Router0

```
Router>show ip bgp
BGP table version is 1, local router ID is 192.168.8.42
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path

Router>
```

Copy Paste

Router1

```
Router#show ip bgp
BGP table version is 1, local router ID is 10.0.0.5
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path

Router#
```

Copy Paste

Router2

```
Router#show ip bgp
BGP table version is 1, local router ID is 192.168.9.42
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path

Router#
```

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3. show ip route

Router0

```
Router>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

     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.0.0.0/30 is directly connected, GigabitEthernet0/1
L       10.0.0.1/32 is directly connected, GigabitEthernet0/1
     192.168.8.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.8.0/24 is directly connected, GigabitEthernet0/0
L       192.168.8.42/32 is directly connected, GigabitEthernet0/0

Router>
```

Copy Paste

Router1

```
Router#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

     10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
C       10.0.0.0/30 is directly connected, GigabitEthernet0/0
L       10.0.0.2/32 is directly connected, GigabitEthernet0/0
C       10.0.0.4/30 is directly connected, GigabitEthernet0/1
L       10.0.0.5/32 is directly connected, GigabitEthernet0/1

Router#
```

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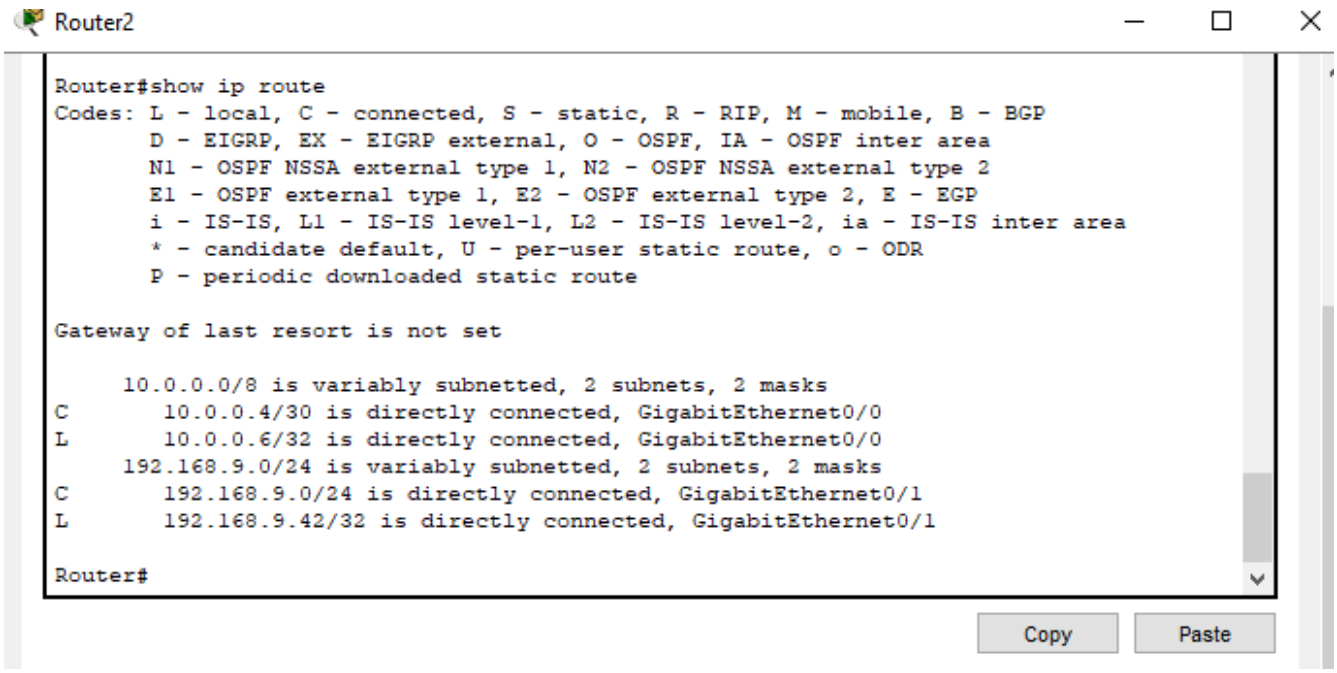
Router2
Router#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, 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
10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C 10.0.0.4/30 is directly connected, GigabitEthernet0/0
L 10.0.0.6/32 is directly connected, GigabitEthernet0/0
192.168.9.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.168.9.0/24 is directly connected, GigabitEthernet0/1
L 192.168.9.42/32 is directly connected, GigabitEthernet0/1
Router#
Copy
Paste

23K-0842 Router0

Physical Config CLI Attributes

IOS Command Line Interface

```
Router#show ip bgp neighbors
BGP neighbor is 10.0.0.2,  remote AS 1, external link
  BGP version 4, remote router ID 10.0.0.5
  BGP state = Established, up for 00:25:43
  Last read 00:25:43, last write 00:25:43, hold time is 180, keepalive interval is 60
seconds
  Neighbor capabilities:
    Route refresh: advertised and received(new)
    Address family IPv4 Unicast: advertised and received
  Message statistics:
    InQ depth is 0
    OutQ depth is 0

                         Sent       Rcvd
    Opens:                  1          1
    Notifications:          0          0
    Updates:                0          0
    Keepalives:            26         26
    Route Refresh:          0          0
    Total:                 27         27
  Default minimum time between advertisements runs is 30 seconds

 For address family: IPv4 Unicast
  BGP table version 1, neighbor version 6/0
  Output queue size : 0
  Index 1, Offset 0, Mask 0x2
  1 update-group member
                               Sent       Rcvd
  Prefix activity:             ----       ----
    Prefixes Current:             0          0 (Consumes 0 bytes)
    Prefixes total:               0          0
    Implicit Withdraw:            0          0
    Explicit Withdraw:            0          0
    Used as bestpath:           n/a          1
    Used as multipath:          n/a          0

                                     Outbound    Inbound
      Local Policy Denied Prefixes:  --------    -------

Router#show ip bgp
BGP table version is 1, local router ID is 192.168.8.42
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path

Router#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     192.168.8.42    YES manual up                    up
GigabitEthernet0/1     10.0.0.1        YES manual up                    up
```

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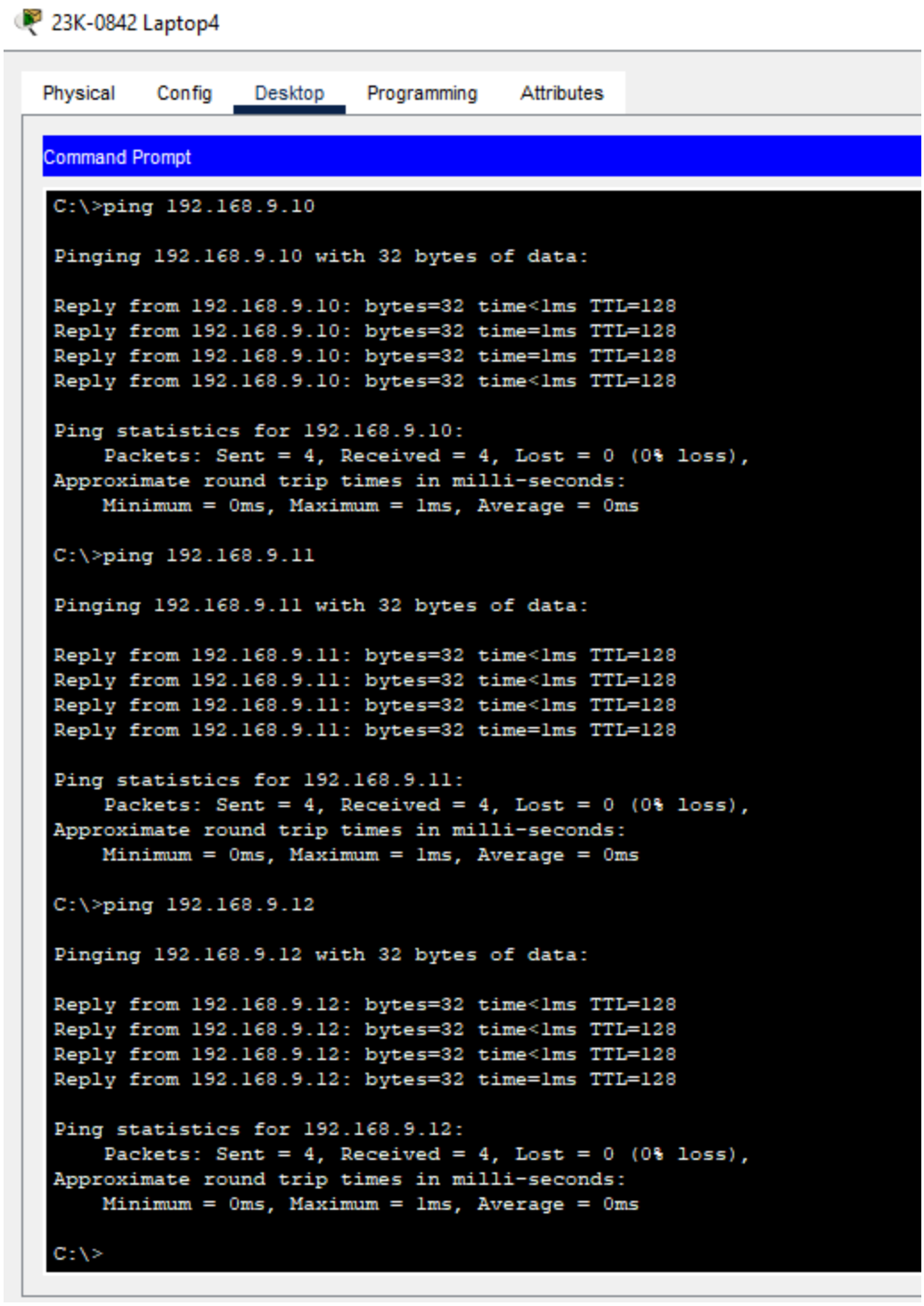
23K-0842 Laptop4
Physical
Config
Desktop
Programming
Attributes
Command Prompt
C:\>ping 192.168.9.10
Pinging 192.168.9.10 with 32 bytes of data:
Reply from 192.168.9.10: bytes=32 time<1ms TTL=128
Reply from 192.168.9.10: bytes=32 time=1ms TTL=128
Reply from 192.168.9.10: bytes=32 time=1ms TTL=128
Reply from 192.168.9.10: bytes=32 time<1ms TTL=128
Ping statistics for 192.168.9.10:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>ping 192.168.9.11
Pinging 192.168.9.11 with 32 bytes of data:
Reply from 192.168.9.11: bytes=32 time<1ms TTL=128
Reply from 192.168.9.11: bytes=32 time<1ms TTL=128
Reply from 192.168.9.11: bytes=32 time<1ms TTL=128
Reply from 192.168.9.11: bytes=32 time=1ms TTL=128
Ping statistics for 192.168.9.11:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>ping 192.168.9.12
Pinging 192.168.9.12 with 32 bytes of data:
Reply from 192.168.9.12: bytes=32 time<1ms TTL=128
Reply from 192.168.9.12: bytes=32 time<1ms TTL=128
Reply from 192.168.9.12: bytes=32 time<1ms TTL=128
Reply from 192.168.9.12: bytes=32 time=1ms TTL=128
Ping statistics for 192.168.9.12:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>

23K-0842 Laptop1

Physical Config Desktop Programming Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.8.42

Pinging 192.168.8.42 with 32 bytes of data:

Reply from 192.168.8.42: bytes=32 time<1ms TTL=255
Reply from 192.168.8.42: bytes=32 time<1ms TTL=255
Reply from 192.168.8.42: bytes=32 time<1ms TTL=255
Reply from 192.168.8.42: bytes=32 time<1ms TTL=255

Ping statistics for 192.168.8.42:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.8.11

Pinging 192.168.8.11 with 32 bytes of data:

Reply from 192.168.8.11: bytes=32 time=4ms TTL=128
Reply from 192.168.8.11: bytes=32 time<1ms TTL=128
Reply from 192.168.8.11: bytes=32 time=3ms TTL=128
Reply from 192.168.8.11: bytes=32 time=6ms TTL=128

Ping statistics for 192.168.8.11:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 6ms, Average = 3ms

C:\>ping 192.168.8.12

Pinging 192.168.8.12 with 32 bytes of data:

Reply from 192.168.8.12: bytes=32 time<1ms TTL=128
Reply from 192.168.8.12: bytes=32 time<1ms TTL=128
Reply from 192.168.8.12: bytes=32 time<1ms TTL=128
Reply from 192.168.8.12: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.8.12:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

Verification commands:

On each router:

1. Check BGP neighbor status

show ip bgp summary

Expected: neighbors 10.0.0.2 (on R0), 10.0.0.1 & 10.0.0.6 (on R1), 10.0.0.5 (on R2) should be **Established**.

2. See BGP table entries

show ip bgp

Expected: you should see advertised networks 192.168.8.0/24 and 192.168.9.0/24 learned on the opposite side.

3. Check routing table

show ip route

Expected: each router should have routes to the remote LAN via BGP (you'll see B or bgp entries), e.g. on R0:

B 192.168.9.0/24 [20/0] via 10.0.0.2

and on R2:

B 192.168.8.0/24 [20/0] via 10.0.0.5

4. Ping tests
   From left host (192.168.8.10):

ping 192.168.9.10

From Router0:

ping 192.168.9.10

Expect successful replies if BGP is up and routes installed.

5. Troubleshooting (if neighbor NOT up)

show ip bgp neighbors 10.0.0.2 ! detailed neighbor state
debug ip bgp ! (use with caution, PT may show lots of output)
show ip interface brief