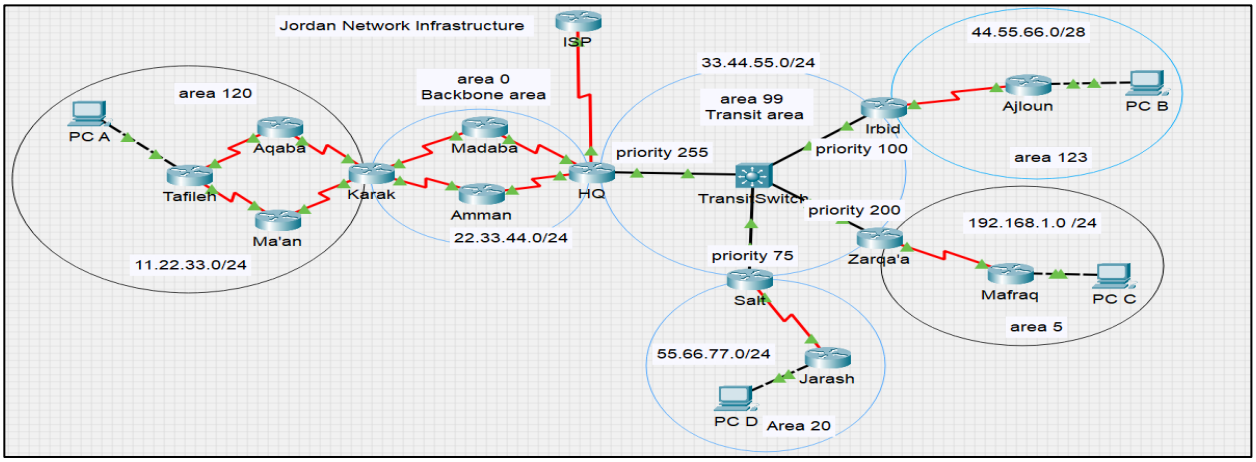
```
Gateway of last resort is 0.0.0.0 to network 0.0.0.0

     11.0.0.0/28 is subnetted, 5 subnets
O IA    11.22.33.0 [110/257] via 22.33.44.49, 00:00:49, Serial0/0/0
                   [110/257] via 22.33.44.33, 00:00:49, Serial0/0/1
O IA    11.22.33.16 [110/256] via 22.33.44.49, 00:00:49, Serial0/0/0
                    [110/256] via 22.33.44.33, 00:00:49, Serial0/0/1
O IA    11.22.33.32 [110/256] via 22.33.44.49, 00:00:49, Serial0/0/0
                    [110/256] via 22.33.44.33, 00:00:49, Serial0/0/1
O IA    11.22.33.48 [110/192] via 22.33.44.49, 00:00:59, Serial0/0/0
                    [110/192] via 22.33.44.33, 00:00:59, Serial0/0/1
O IA    11.22.33.64 [110/192] via 22.33.44.49, 00:00:59, Serial0/0/0
                    [110/192] via 22.33.44.33, 00:00:59, Serial0/0/1
     22.0.0.0/28 is subnetted, 4 subnets
O       22.33.44.0 [110/128] via 22.33.44.49, 00:00:59, Serial0/0/0
O       22.33.44.16 [110/128] via 22.33.44.33, 00:01:09, Serial0/0/1
C       22.33.44.32 is directly connected, Serial0/0/1
C       22.33.44.48 is directly connected, Serial0/0/0
     33.0.0.0/24 is subnetted, 1 subnets
C       33.44.55.0 is directly connected, FastEthernet0/0
     44.0.0.0/28 is subnetted, 2 subnets
O IA    44.55.66.0 [110/65] via 33.44.55.252, 00:00:04, FastEthernet0/0
O IA    44.55.66.16 [110/66] via 33.44.55.252, 00:00:04, FastEthernet0/0
     55.0.0.0/28 is subnetted, 2 subnets
O IA    55.66.77.0 [110/65] via 33.44.55.250, 00:00:04, FastEthernet0/0
O IA    55.66.77.16 [110/66] via 33.44.55.250, 00:00:04, FastEthernet0/0
     200.200.100.0/30 is subnetted, 1 subnets
C       200.200.100.0 is directly connected, Serial0/1/0
S*   0.0.0.0/0 is directly connected, Serial0/1/0
```

The University of Jordan, Comp. Eng. Dept.
Spring 2023: Networks lab: Experiment 7
OSPFv2 and OSPFv3 (Problem Sheet)

Student Name:	**ID:**	**Section Number:**

<u>Problem 1:</u> Configuring OSPFv2 (IPv4) routing protocol

In this activity (i.e., Exp_7_Problem_1_OSPFv2.pka), you are requested to configure the OSPF for IPv4 routing protocol with multiple areas and virtual links, which were discussed thoroughly in the handout. Then, you are requested to configure the static and default routing for Internet access and ensure full connectivity



between all devices in the network. Figure 1 shows the topology that you want to configure. The PCs and routers' interfaces are configured for you. Accordingly, routers have information about the direct networks that they have on their own interfaces. Routers will not exchange this information between themselves. We need to implement the OSPF routing protocol, which will insist they share this information. Tables 1 and 2 show the addressing of the networks and interfaces, respectively.

Figure 1. Network topology for problem 1.

Table 1: Network address for IPv4 configuration for problem 1

Routers	Network Address
Tafileh and PC A	11.22.33.0/28
Tafileh and Ma'an	11.22.33.16/28
Tafileh and Aqaba	11.22.33.32/28
Aqaba and Karak	11.22.33.64/28
Ma'an and Karak	11.22.33.48/28
Karak and Madaba	22.33.44.0/28
Karak and Amman	22.33.44.16/28
Madaba and HQ	22.33.44.48/28
Amman and HQ	22.33.44.32/28
HQ and Transient switch	33.44.55.0/24
Irbid and Transient switch	33.44.55.0/24
Irbid and Ajloun	44.55.66.0/28
Ajloun and PC B	44.55.66.16/28
Zarqa'a and Transient switch	33.44.55.0/24
Zarqa'a and Mafraq	192.168.1.0/30
Mafraq and PC C	192.168.1.4/30
Salt and Transient switch	33.44.55.0/24
Salt and Jarash	55.66.77.0/28
Jarash and PC D	55.66.77.16/28

Part 1: Configuring OSPF for IPv4 on all routers except ISP router using the following instructions:

1) Verify IP addressing and interfaces. Use the `show ip interface brief` command to verify that the IP addressing is correct and that the interfaces are active.
2) Configure all routers with OSPF routing except the ISP. In your configuration, make sure you do the following:
   - Enable the OSPF routing process on each router using a process ID number of 1.
   - Advertise directly connected networks with the correct wild mask and correct area number.
   - Configure LAN interfaces to not advertise OSPF updates as a passive interface on all routers.
   - To see the adjacency formed, type the following command: `log-adjacency-changes.`
   - Set a default route from the HQ router to the ISP using the exit interface.
   - Redistribute the default route from HQ router.
3) Set the OSPF priority on the interface Fast Ethernet 0/0 and the router ID as shown in the following table.

Router Name	OSPF priority	router ID
HQ router	255	33.44.55.254
Irbid router	100	44.55.66.1
Zarqa'a router	200	33.44.55.253
Salt router	75	55.66.77.1

4) The clear ip ospf process command is used to activate the RID on a router that is already running OSPF: `Router# clear ip ospf process`.
5) Configure **a summarized static route on the ISP** using the directly connected option. **Tip**: Each area has a summarized network address as shown in Figure 1.

Part 2: Verify Configurations

1) Verify full connectivity to all destinations between area 0 and other areas.
   - Every device between area 120, area 99, and area 0 should now be able to ping every other device inside this area. In addition, all devices should be able to ping the ISP.
     - ✓ Ping between the PC A and HQ router.
     - ✓ Ping between the PC A and Irbid router.
     - ✓ Ping between the PC A and Zaraqa'a router.
     - ✓ Ping between the PC A and Salt router.

   What is the result of ping?

   Answer:

   - Now try to ping between:
     - ✓ Ping between the PC A and PC B.
     - ✓ Ping between the PC A and PC C.
     - ✓ Ping between the PC A and PC D.

   What is the result of ping? Justify your answer?

   Answer:

2) View the routing tables using the appropriate command to view the routing table for HQ. Notice that HQ router has a full listing of all the networks. You also see the default route listed.
   - How does the OSPF appear in the routing table? **Take screen shot of HQ router'routing table.**

Answer:

```
Gateway of last resort is 0.0.0.0 to network 0.0.0.0

     11.0.0.0/28 is subnetted, 5 subnets
O IA    11.22.33.0 [110/257] via 22.33.44.49, 00:00:49, Serial0/0/0
                   [110/257] via 22.33.44.33, 00:00:49, Serial0/0/1
O IA    11.22.33.16 [110/256] via 22.33.44.49, 00:00:49, Serial0/0/0
                    [110/256] via 22.33.44.33, 00:00:49, Serial0/0/1
O IA    11.22.33.32 [110/256] via 22.33.44.49, 00:00:49, Serial0/0/0
                    [110/256] via 22.33.44.33, 00:00:49, Serial0/0/1
O IA    11.22.33.48 [110/192] via 22.33.44.49, 00:00:59, Serial0/0/0
                    [110/192] via 22.33.44.33, 00:00:59, Serial0/0/1
O IA    11.22.33.64 [110/192] via 22.33.44.49, 00:00:59, Serial0/0/0
                    [110/192] via 22.33.44.33, 00:00:59, Serial0/0/1
     22.0.0.0/28 is subnetted, 4 subnets
O       22.33.44.0 [110/128] via 22.33.44.49, 00:00:59, Serial0/0/0
O       22.33.44.16 [110/128] via 22.33.44.33, 00:01:09, Serial0/0/1
C       22.33.44.32 is directly connected, Serial0/0/1
C       22.33.44.48 is directly connected, Serial0/0/0
     33.0.0.0/24 is subnetted, 1 subnets
C       33.44.55.0 is directly connected, FastEthernet0/0
     44.0.0.0/28 is subnetted, 2 subnets
O IA    44.55.66.0 [110/65] via 33.44.55.252, 00:00:04, FastEthernet0/0
O IA    44.55.66.16 [110/66] via 33.44.55.252, 00:00:04, FastEthernet0/0
     55.0.0.0/28 is subnetted, 2 subnets
O IA    55.66.77.0 [110/65] via 33.44.55.250, 00:00:04, FastEthernet0/0
O IA    55.66.77.16 [110/66] via 33.44.55.250, 00:00:04, FastEthernet0/0
     200.200.100.0/30 is subnetted, 1 subnets
C       200.200.100.0 is directly connected, Serial0/1/0
S*   0.0.0.0/0 is directly connected, Serial0/1/0
```

   - Write the code and the AD for OSPF and for the default route listed in the routing table.

Answer: Ad => 1

3) View neighbors.
   - On the HQ, use the `show ip ospf neighbor` command to view the neighbor table and verify that OSPF has established an adjacency with the other routers. You should be able to see the Neighbor ID, priority value, state, and the interface of each adjacent router used to reach that OSPF neighbor. **Take screen shots of HQ router's neighbors table.**

Answer:

```
HQ#show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
55.66.77.1        0   FULL/  -        00:00:30    33.44.55.250    OSPF_VL0
44.55.66.1        0   FULL/  -        00:00:35    33.44.55.252    OSPF_VL1
33.44.55.253      0   FULL/  -        00:00:35    33.44.55.253    OSPF_VL4
22.33.44.33       0   FULL/  -        00:00:31    22.33.44.33     Serial0/0/1
22.33.44.49       0   FULL/  -        00:00:30    22.33.44.49     Serial0/0/0
55.66.77.1       75   FULL/DROTHER    00:00:35    33.44.55.250
FastEthernet0/0
44.55.66.1      100   FULL/BDR        00:00:35    33.44.55.252
FastEthernet0/0
33.44.55.253    200   FULL/DROTHER    00:00:35    33.44.55.253
FastEthernet0/0
HQ#
```

   - On the Irbid, use the `show ip ospf neighbor` command to view the neighbor table and verify that OSPF has established an adjacency with the other routers. You should be able to see the Neighbor ID, priority value, state, and the interface of each adjacent router used to reach that OSPF neighbor. **Take screen shots of Irbid router's neighbors' table.**

Answer:

```
Irbid>en
Irbid#show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
33.44.55.254      0   FULL/  -        00:00:37    33.44.55.254    OSPF_VL0
55.66.77.1       75   FULL/DROTHER    00:00:37    33.44.55.250
FastEthernet0/0
33.44.55.254    255   FULL/DR         00:00:37    33.44.55.254
FastEthernet0/0
33.44.55.253    200   FULL/DROTHER    00:00:37    33.44.55.253
FastEthernet0/0
44.55.66.17       0   FULL/  -        00:00:32    44.55.66.14     Serial0/0/0
Irbid#
```

4) View routing protocol information.
   - On the HQ router, use the `show ip protocols` command to view information about the routing protocol operation.
   - Answer the following questions?
     - ✓ What is the process ID of OSPF?_____1_____
     - ✓ What is the router ID?____ 33.44.55.254 _____
     - ✓ What is the number of areas?___ Number of areas in this router is 2 _____-

How do you know about the static route that is being distributed?_____ It is an autonomous system boundary router

- ✓ Redistributing External Routes from _____

5) View the database. **Take screen shot of the HQ router' database.**

Answer:

```
                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
22.33.44.18     22.33.44.18     777         0x80000006 0x009cee 4
22.33.44.49     22.33.44.49     772         0x80000005 0x003ef0 4
22.33.44.33     22.33.44.33     772         0x80000005 0x008cc1 4
33.44.55.254    33.44.55.254    712         0x80000009 0x0054ca 7
55.66.77.1      55.66.77.1      722         0x80000002 0x00d5e8 1
44.55.66.1      44.55.66.1      717         0x80000002 0x008975 1
33.44.55.253    33.44.55.253    727         0x80000002 0x005de8 1

                Summary Net Link States (Area 0)
Link ID         ADV Router      Age         Seq#       Checksum
11.22.33.64     22.33.44.18     782         0x80000001 0x00b87d
11.22.33.48     22.33.44.18     782         0x80000002 0x0057ed
33.44.55.0      33.44.55.254    767         0x80000001 0x006bea
11.22.33.32     22.33.44.18     752         0x80000003 0x00789b
11.22.33.16     22.33.44.18     752         0x80000004 0x00170c
11.22.33.0      22.33.44.18     752         0x80000005 0x00bf71
33.44.55.0      55.66.77.1      767         0x80000001 0x004dc4
55.66.77.0      55.66.77.1      767         0x80000002 0x004e50
55.66.77.16     55.66.77.1      757         0x80000003 0x00b5d6
33.44.55.0      44.55.66.1      767         0x80000001 0x0056dc
44.55.66.0      44.55.66.1      767         0x80000002 0x00e4fb
44.55.66.16     44.55.66.1      767         0x80000003 0x004c82
33.44.55.0      33.44.55.253    772         0x80000001 0x0071e5
192.168.1.0     33.44.55.253    772         0x80000002 0x0039fa
192.168.1.4     33.44.55.253    767         0x80000003 0x001915

                Summary ASB Link States (Area 0)
Link ID         ADV Router      Age         Seq#       Checksum
33.44.55.254    44.55.66.1      717         0x80000004 0x004ce3
33.44.55.254    33.44.55.254    712         0x80000002 0x0065ef
33.44.55.254    55.66.77.1      712         0x80000004 0x0043cb
33.44.55.254    33.44.55.253    712         0x80000004 0x0067ec

                Router Link States (Area 99)

Link ID         ADV Router      Age         Seq#       Checksum Link count
33.44.55.254    33.44.55.254    737         0x80000006 0x003b04 1
55.66.77.1      55.66.77.1      722         0x80000005 0x00b10c 1
33.44.55.253    33.44.55.253    727         0x80000007 0x00350e 1
44.55.66.1      44.55.66.1      717         0x80000005 0x006598 1

                Net Link States (Area 99)
Link ID         ADV Router      Age         Seq#       Checksum
33.44.55.254    33.44.55.254    732         0x80000003 0x002537

                Summary Net Link States (Area 99)
Link ID         ADV Router      Age         Seq#       Checksum
22.33.44.48     33.44.55.254    767         0x80000001 0x0035e1
22.33.44.32     33.44.55.254    767         0x80000002 0x00d352
22.33.44.16     33.44.55.254    767         0x80000003 0x00f5fe
44.55.66.0      44.55.66.1      767         0x80000001 0x00e6fa
44.55.66.16     44.55.66.1      767         0x80000002 0x004e81
55.66.77.0      55.66.77.1      767         0x80000001 0x00504f
55.66.77.16     55.66.77.1      757         0x80000002 0x00b7d5
192.168.1.0     33.44.55.253    767         0x80000001 0x003bf9
192.168.1.4     33.44.55.253    762         0x80000002 0x001b14
22.33.44.0      33.44.55.254    697         0x80000005 0x009171
11.22.33.64     33.44.55.254    697         0x80000006 0x001d85
11.22.33.48     33.44.55.254    697         0x80000007 0x00bbf5
11.22.33.32     33.44.55.254    697         0x80000008 0x00dba4
11.22.33.16     33.44.55.254    697         0x80000009 0x007a15
11.22.33.0      33.44.55.254    697         0x8000000a 0x00237a

                Summary ASB Link States (Area 99)
Link ID         ADV Router      Age         Seq#       Checksum
33.44.55.254    33.44.55.254    712         0x80000004 0x0061f1
33.44.55.254    55.66.77.1      712         0x80000003 0x0045ca
33.44.55.254    44.55.66.1      712         0x80000003 0x004ee2
33.44.55.254    33.44.55.253    702         0x80000003 0x0069eb

                Type-5 AS External Link States
Link ID         ADV Router      Age         Seq#       Checksum Tag
```

6) On Salt Router, issue the `show ip route ospf | include 0.0.0.0` command to view statements specific to the default route. How is the static default route represented in the output? What is the administrative distance (AD) for the propagated route? Write here the statement.

Answer:
O*E2 0.0.0.0/0 [110/1] via 33.44.55.254, 00:13:31, FastEthernet0/0

Part 3: Configuring virtual links:

1) We configure the virtual link between ABRs, and we use the `area [area #]virtual-link router-id` command.
2) To get start with the correct configuration of the virtual links:
   - Identify isolated areas that need to connect to area 0.

     Answer:
   - Identify appropriate ABRs and make sure the above requirements are met.

     Answer:
   - After determining these areas, you need **configure the virtual links between the ABRs of isolated areas and the HQ** under the OSPF process using the above command.
   - You must specify the router ID of ABRs. Use the following command `show ip ospf interface f0/0.` You need to configure the OSPF router ID and NOT the IP address of the ABR. If everything is OK, the isolated area will be directly connected to area 0 through our virtual link. Keep this in mind, that we configure the router ID for HQ manually.
   - **Important note:** In case that your activity does not correct the virtual links on the HQ router, do the following steps to reset the OSPF process: go the HQ router, in the privileged mode type `show run` command, copy the commands that related to the OSPF, then go to configuration mode, and type the `no router ospf 1`, then paste your commands.

Part 4: Verification of the configuration:

- Verify the configuration of virtual links on HQ, by using this command `show ip ospf virtual-links.` **Take screen shot of HQ's output.**

  Answer:

```
HQ#show ip ospf virtual-links
Virtual Link OSPF_VL1 to router 44.55.66.1 is up
  Run as demand circuit
  Transit area 99, via interface FastEthernet0/0, Cost of using 1
  Transmit Delay is 1 sec, State POINT_TO_POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:09
    Adjacency State FULL
    Index 1/2, retransmission queue length 0, number of retransmission 0
        First 0x0(0)/0x0(0) Next 0x0(0)/0x0(0)
        Last retransmission scan length is 0, maximum is 0
        Last retransmission scan time is 0 msec, maximum is 0 msec
Virtual Link OSPF_VL0 to router 55.66.77.1 is up
  Run as demand circuit
  Transit area 99, via interface FastEthernet0/0, Cost of using 1
  Transmit Delay is 1 sec, State POINT_TO_POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:09
    Adjacency State FULL
    Index 1/2, retransmission queue length 0, number of retransmission 0
        First 0x0(0)/0x0(0) Next 0x0(0)/0x0(0)
        Last retransmission scan length is 0, maximum is 0
        Last retransmission scan time is 0 msec, maximum is 0 msec
Virtual Link OSPF_VL4 to router 33.44.55.253 is up
  Run as demand circuit
  Transit area 99, via interface FastEthernet0/0, Cost of using 1
  Transmit Delay is 1 sec, State POINT_TO_POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:04
    Adjacency State FULL
    Index 1/2, retransmission queue length 0, number of retransmission 0
        First 0x0(0)/0x0(0) Next 0x0(0)/0x0(0)
        Last retransmission scan length is 0, maximum is 0
        Last retransmission scan time is 0 msec, maximum is 0 msec
```

- Verify the configuration of virtual links on Irbid router by using this command `show ip ospf virtual-links.` **Take screen shot of Irbid's router output.**

Answer:

```
Irbid>en
Irbid#show ip ospf virtual-links
Virtual Link OSPF_VL0 to router 33.44.55.254 is up
  Run as demand circuit
  Transit area 99, via interface FastEthernet0/0, Cost of using 1
  Transmit Delay is 1 sec, State POINT_TO_POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:00
    Adjacency State FULL
    Index 1/2, retransmission queue length 0, number of retransmission 0
        First 0x0(0)/0x0(0) Next 0x0(0)/0x0(0)
        Last retransmission scan length is 0, maximum is 0
        Last retransmission scan time is 0 msec, maximum is 0 msec
```

- Verify the OSPF neighbors on the HQ router. **Take a screen shot of the output.** Explain how the virtual links appears.

Answer:

The virtual link is configured by specifying the router ID of the OSPF router that will act as transit router. The transit router must be connected to both the non-backbone area and Area

The virtual link is then created by specifying the OSPF process ID, the transit router ID, and non-backbone area ID in the OSPF router configuration.

- On Zaraq'a router verify whether OSPF routes are learnt by using this command `show ip route ospf.` **Take a screen shot of the output.**

Answer:

```
Zarqa'a#show ip route ospf
     11.0.0.0/28 is subnetted, 5 subnets
O IA    11.22.33.0 [110/258] via 33.44.55.254, 00:25:01, FastEthernet0/0
O IA    11.22.33.16 [110/257] via 33.44.55.254, 00:25:01, FastEthernet0/0
O IA    11.22.33.32 [110/257] via 33.44.55.254, 00:25:01, FastEthernet0/0
O IA    11.22.33.48 [110/193] via 33.44.55.254, 00:25:01, FastEthernet0/0
O IA    11.22.33.64 [110/193] via 33.44.55.254, 00:25:01, FastEthernet0/0
     22.0.0.0/28 is subnetted, 4 subnets
O       22.33.44.0 [110/129] via 33.44.55.254, 00:25:01, FastEthernet0/0
O       22.33.44.16 [110/129] via 33.44.55.254, 00:25:01, FastEthernet0/0
O       22.33.44.32 [110/65] via 33.44.55.254, 00:25:01, FastEthernet0/0
O       22.33.44.48 [110/65] via 33.44.55.254, 00:25:01, FastEthernet0/0
     44.0.0.0/28 is subnetted, 2 subnets
O IA    44.55.66.0 [110/66] via 33.44.55.252, 00:25:01, FastEthernet0/0
O IA    44.55.66.16 [110/67] via 33.44.55.252, 00:25:01, FastEthernet0/0
     55.0.0.0/28 is subnetted, 2 subnets
O IA    55.66.77.0 [110/66] via 33.44.55.250, 00:25:01, FastEthernet0/0
O IA    55.66.77.16 [110/67] via 33.44.55.250, 00:25:01, FastEthernet0/0
     192.168.1.0/30 is subnetted, 2 subnets
O       192.168.1.4 [110/65] via 192.168.1.2, 00:26:16, Serial0/0/0
O*E2 0.0.0.0/0 [110/1] via 33.44.55.254, 00:25:36, FastEthernet0/0
```

- If you look at the LSDB on the HQ router you will see that the virtual link shows up as a type 1 router LSA. You can also see DNA which means do not age. by using this command `show ip ospf database.` **Take a screen shot of the output.**

Answer:

```
Link ID         ADV Router      Age         Seq#       Checksum Link count
33.44.55.254    33.44.55.254    1626        0x80000006 0x003b04 1
55.66.77.1      55.66.77.1      1611        0x80000005 0x00b10c 1
33.44.55.253    33.44.55.253    1616        0x80000007 0x00350e 1
44.55.66.1      44.55.66.1      1606        0x80000005 0x006598 1
```

Part 4: Verification of the configuration:

- Ping ISP from PC A.
- Ping PC B from PC A.
- Ping PC C from PC A.
- Ping PC D from PC A.

Table 2: Addressing table for IPv4 configuration for problem 1

Device	Interface	Area	IPv4 Address	Subnet mask	Default Gateway	Connected with
PC A	Fa0/0	120	11.22.33.14/28	255.255.255.240	11.22.33.1	FastEthernet0/0 of Tafileh Router
Tafileh Router	FastEthernet0/0	120	11.22.33.1	255.255.255.240	--	PC X
	Serial0/0/0	120	11.22.33.38	255.255.255.240	--	Serial0/0/0 of Aqaba Router
	Serial0/0/1	120	11.22.33.18	255.255.255.240	--	Serial0/0/1of Ma'an Router
Aqaba Router	Serial0/0/0	120	11.22.33.39	255.255.255.240	--	Serial0/0/0 of Tafileh Router
	Serial0/0/1	120	11.22.33.65	255.255.255.240	--	Serial0/0/1 of Karak Router
Ma'an Router	Serial0/0/0	120	11.22.33.49	255.255.255.240	--	Serial0/0/0 of Karak Router
	Serial0/0/1	120	11.22.33.19	255.255.255.240	--	Serial0/0/0 of Tafileh Router
Karak Router	Serial0/0/0	120	11.22.33.62	255.255.255.240	--	Serial0/0/0 of Ma'an Router
	Serial0/0/1	120	11.22.33.78	255.255.255.240	--	Serial0/0/1 of Aqaba Router
	Serial0/1/0	0	22.33.44.1	255.255.255.240	--	Serial0/1/0 of Madaba Router
	Serial0/1/1	0	22.33.44.18	255.255.255.240	--	Serial0/1/1 of Amman Router
Madaba Router	Serial0/0/0	0	22.33.44.49	255.255.255.240	--	HQ Router
	Serial0/1/0	0	22.33.44.2	255.255.255.240	--	Serial0/1/0 of Karak Router
Amman Router	Serial0/0/1	0	22.33.44.33	255.255.255.240	--	HQ Router
	Serial0/1/1	0	22.33.44.19	255.255.255.240	--	Serial0/1/1 of Karak Router
HQ Router	FastEthernet0/0	99	33.44.55.254	255.255.255.0	--	FastEthernet0/1 of Transient Switch
	Serial0/0/0	0	22.33.44.62	255.255.255.240	--	Madaba Router
	Serial0/0/1	0	22.33.44.46	255.255.255.240	--	Amman Router
	Serial0/1/0	--	200.200.100.2	255.255.255.252	--	ISP Router
Irbid Router	FastEthernet0/0	99	33.44.55.252	255.255.255.0	--	FastEthernet0/2 Transient Switch
	Serial0/0/0	123	44.55.66.1	255.255.255.240	--	Serial0/0/0 of Ajloun Router
Ajloun Router	FastEthernet0/0	123	44.55.66.17	255.255.255.240	--	PC Y
	Serial0/0/0	123	44.55.66.14	255.255.255.240	--	Serial0/0/0 of Irbid Router
PC B	Fa0/0	123	44.55.66.30	255.255.255.240	44.55.66.17	FastEthernet0/0 of Ajloun Router
Zarqa'a Router	FastEthernet0/0	99	33.44.55.253	255.255.255.0	--	FastEthernet0/3 Transient Switch
	Serial0/0/0	5	192.168.1.1	255.255.255.252	--	Serial0/3/0 of Mafraq Router
Mafraq Router	FastEthernet0/0	5	192.168.1.6	255.255.255.252		PC C
	Serial0/3/0	5	192.168.1.2	255.255.255.252	--	Serial0/0/0 of Zarqa'a Router
PC C	Fa0/0	5	192.168.1.5	255.255.255.252	192.168.1.6	FastEthernet0/0 of Mafraq Router
Salt Router	FastEthernet0/0	99	33.44.55.250	255.255.255.0	--	FastEthernet0/4 Transient Switch
	Serial0/0/0	20	55.66.77.1	255.255.255.240	--	Serial0/0/0 of Jarash Router
Jarash Router	FastEthernet0/0	20	55.66.77.17	255.255.255.240	--	PC D
	Serial0/0/0	20	55.66.77.14	255.255.255.240	--	Serial0/0/0 of Salt Router
PC D	Fa0/0	20	55.66.77.30	255.255.255.240	55.66.77.17	FastEthernet0/0 of Jarash Router
ISP Router	Serial0/0/0	--	200.200.100.1	255.255.255.252	--	Serial0/1/0 of HQ Router

Problem 2: Configuring OSPV3 (IPv6) routing protocol

In this activity, you will configure an IPv6 network with the OSPFv3 routing protocol using the instructions and information given in Figure 2 and Table 3. In a few words, in this activity (Exp 7_Problem_2_OSPFv3.pka), you will build an IPv6 routing table by OSPFv3. This is a configuration activity for a normal OSPF process. The IPv6 addresses provided in Table 3. Figure 2 shows the topology that you want to configure.

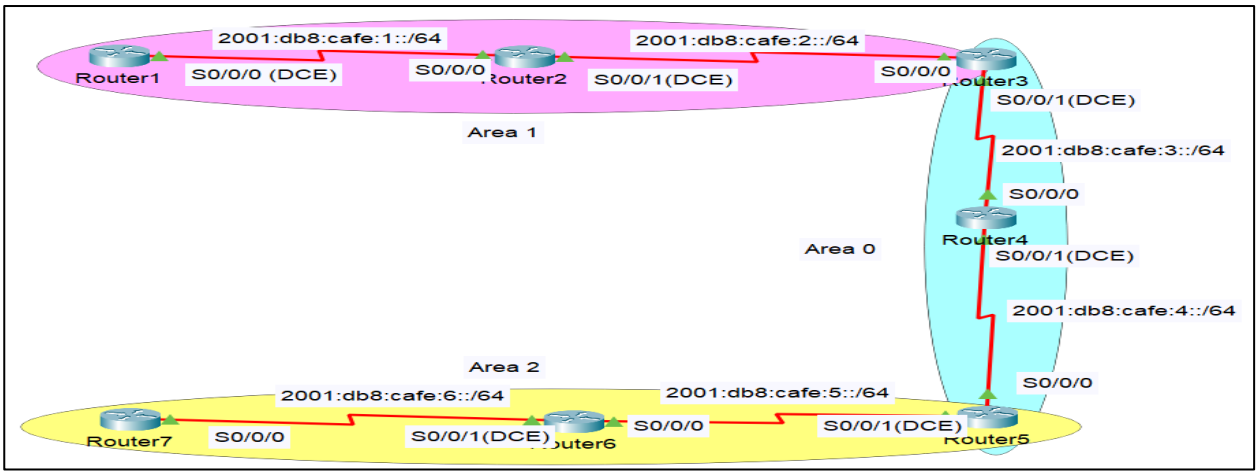


Figure 2. Network topology for problem 2.

Table 2: Addressing table for IPv6 configuration for problem 2

Device	Interface	IPv6 address	Link-local
Router 1	S0/0/0 (DCE)	2001:db8:cafe:1::1/64	FE80::1
	Loopback0	2001:100:1::1/64	FE80::1
Router 2	S0/0/0	2001:db8:cafe:1::2/64	FE80::2
	S0/0/1 (DCE)	2001:db8:cafe:2::1/64	FE80::2
	Loopback0	2001:100:2::2/64	FE80::2
Router 3	S0/0/0	2001:db8:cafe:2::2/64	FE80::3
	S0/0/1 (DCE)	2001:db8:cafe:3::1/64	FE80::3
	Loopback0	2001:100:3::3/64	FE80::3
Router 4	S0/0/0	2001:db8:cafe:3::2/64	FE80::4
	S0/0/1 (DCE)	2001:db8:cafe:4::1/64	FE80::4
	Loopback0	2001:100:4::4/64	FE80::4
Router 5	S0/0/0	2001:db8:cafe:4::2/64	FE80::5
	S0/0/1 (DCE)	2001:db8:cafe:5::1/64	FE80::5
	Loopback0	2001:100:5::5/64	FE80::5
Router 6	S0/0/0	2001:db8:cafe:5::2/64	FE80::6
	S0/0/1 (DCE)	2001:db8:cafe:6::1/64	FE80::6
	Loopback0	2001:100:6::6/64	FE80::6
Router 7	S0/0/0	2001:db8:cafe:6::2/64	FE80::7
	Loopback0	2001:100:7::7/64	FE80::7

Part 1: Configuring a network with IPv6 and OSPV3:

1. **On all routers, configure the following:**
   - Enable IPv6 routing.
   - Make sure that the Loopback0 prefix of each router is registered in the routing table with a prefix length of /64.

- Configure the loopback interface for each router with the assigned IPv6 link-local address, and global unicast IPv6 address, as shown in Table 2.
- Other routers' interfaces were configured for you with the assigned IPv6 link-local address, and global unicast IPv6 address, and the clock rate for serial DCE interfaces were set to 64000. Moreover, the interfaces were enabled.

Part 2: Configuration and Verification

1. **Enabling OSPFv3 on each router:**
   - Enable OSPFv3 for each router interface with process ID equal to 1.
   - Set the router ID of each router will be X.X.X.X, where X is the Router number (i.e., for router 1 the router ID is 1.1.1.1, and so on). Since it is considered that some routers do not have IPv4 addresses, **the router ID is basically configured statically in OSPFv3.**
   - Type the following command: `log-adjacency-changes`
2. **Enabling OSPFv3 on each router' interfaces:**
   - Enable OSPFv3 based on the area layout shown in Figure 2 for each router interface with process ID equal to 1.
3. **Verify Neighbors:**
   - Verify that OSPFv3 neighbors have been established by using the `show ipv6 ospf neighbor` command on Router 3. **Take a screen shot of the output.**

Answer:
4. **Verify OSPFv3 routes**
   - Use the appropriate command to show the routing table of Router 5. OSPF now appears with connected (C) and local (L) routes in the routing table. All networks have an entry. Verify whether OSPFv3 routes can be learned by using the `show ipv6 route ospf` command on Router 5. **Take a screen shot of the output.**

Answer:
5. **Verify full connectivity to all destinations.**
   - Every device should now be able to ping every other device inside the network. Try to ping this IPv6 address 2001:db8:cafe:1::1 from Router 7. **Take a screen shot of the output.**

Answer: