1. With reference to Figure 2-1 and Figure 2-2, all the routers had been configured with Open Shortest Path First (OSPF) configurations and the routers have reached the convergence state.

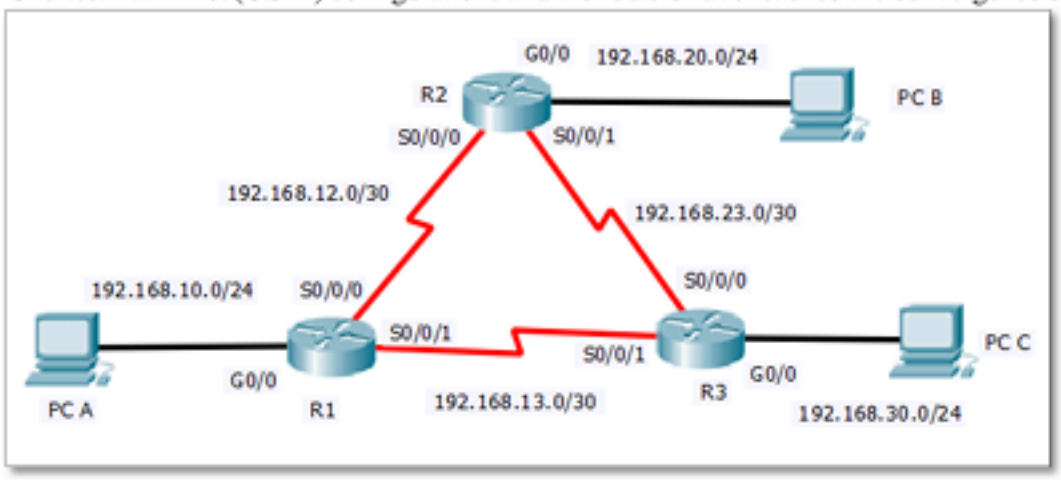

Figure 2-1: A network topology

```
R1#show ip int brief
Interface      IP-Address      OK?  Method  Status                    Protocol
Gigabit0/0     192.168.10.1    YES  NVRAM   up                        up
Gigabit0/1     unassigned      YES  unset   administratively down     down
Serial0/0/0    192.168.12.1    YES  NVRAM   up                        up
Serial0/0/1    192.168.13.1    YES  NVRAM   up                        up
```

```
R2#show ip int brief
Interface      IP-Address      OK?  Method Status                    Protocol
Gigabit0/0     192.168.20.1    YES  NVRAM   up                        up
Gigabit0/1     unassigned      YES  unset   administratively down     down
Loopback0      50.50.50.1      YES  NVRAM   up                        up
Loopback1      60.60.60.1      YES  NVRAM   up                        up
Serial0/0/0    192.168.12.2    YES  NVRAM   up                        up
Serial0/0/1    192.168.23.1    YES  NVRAM   up                        up
```

```
R3#show ip int brief
Interface      IP-Address      OK?  Method Status                    Protocol
Gigabit0/0     192.168.30.1    YES  NVRAM   up                        up
Gigabit0/1     unassigned      YES  unset   administratively down     down
Loopback0      200.10.10.1     YES  NVRAM   up                        up
Loopback1      200.10.10.10    YES  NVRAM   up                        up
Serial0/0/0    192.168.23.2    YES  NVRAM   up                        up
Serial0/0/1    192.168.13.2    YES  NVRAM   up                        up
```

```
R3# show ip protocols
Routing Protocol is "ospf 1"
    Router ID 10.10.10.1
        Number of areas in this router is 1. 1 normal 0 stub 0 nssa
        Maximum path: 4
      Routing for Networks:
         192.168.30.0 0.0.0.255 area 0
         192.168.13.0 0.0.0.3 area 0
         192.168.23.0 0.0.0.3 area 0
   -  Output omitted -
```

Figure 2-2: Status of R1, R2 and R3 interfaces

(i) Describes the precedence how the router derives router ID. (6 marks)

1. *The router ID is explicitly configured using the OSPF router-id rid router configuration mode command. This is the recommended method to assign a router ID.*
2. *The router chooses the highest IPv4 address of any of configured loopback interfaces.*
3. *The router chooses the highest active IPv4 address of any of its physical interfaces*

(ii) Identify the router ID for R1, R2 and R3. Justify your answer. (9 marks)

R1: 192.168.13.1, No configured OSPF router-id and loopback interface. Use the highest ip address of the physical interface, which is the ip address of S0/0/1.

R2: 60.60.60.1, No configured OSPF router-id but have loopback interface. Use the highest ip address of the loopback interface, which is the ip address of loopback1.

R3: 10.10.10.1, Configured for OSPF router-id, direct look on the router-id that was configured.

(iii) Refer to the network topology shown in Figure 2-1, will a Designated Router (DR) and a Backup Designated Router (BDR) be elected? Justify your answer. (4 marks)

No, because this network is a point-to-point OSPF network as it does not have any ethernet or multiaccess.

The DR / BDR election is unnecessary as there can only be two routers between two routers on the point-to-point network such as between R1 and R2.

2. Refer to the OSPF configuration shown in Figure 3-1 and the network topology shown in Figure 3-2, answer the following questions:

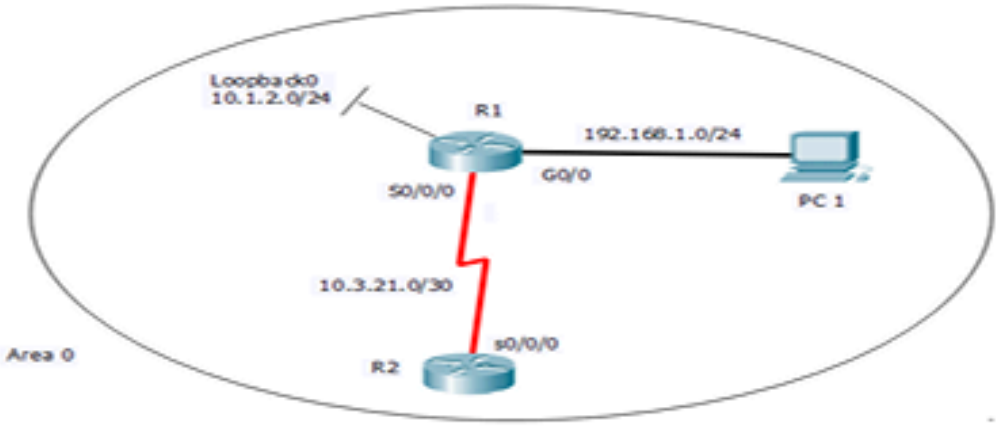

Figure 3-2: A network topology

```
R1#  show running-config
<output omitted>
interface loopback0
ip address 10.1.2.1  255.255.255.0
!
interface GigabitEthernet0/0
ip address 192.168.1.1  255.255.255.0
!
interface Serial0/0/0
ip address 10.3.21.1  255.255.255.252
clock rate 2000000
!
router ospf 1
  network 10.1.2.0 0.0.0.255 area 0
  network 192.168.1.0 0.0.0.255 area 0
  network 10.3.2.0 0.0.0.255 area 0
!
```

Figure 3-1: OSPF configuration

a. Determine the router ID for R1 in Figure 3-1. Justify your answer.

10.1.2.1. In R1 no configured OSPF router-id but have the loopback interface so we use the highest ip address of loopback interface which is 10.1.20.1

b. Refer to both Figure 3-1 and Figure 3-2, identify and rectify any OSPF configuration error(s).

The wildcard mask for the network 10.3.2.0 has configured incorrectly as 0.0.0.255, it is supposed to be 0.0.0.3 because the subnet mask of this network is /30 (255.255.255.252). 255.255.255.255- 255.255.255.252 = 0.0.0.3

c. (i) Refer to the network topology shown in Figure 3-1, which router interfaces are recommended to set passive interface.

- *The interface G0/0 of R1 is recommended to be set as a passive interface*

(ii) Provide **TWO (2)** reasons why it is recommended to implement passive interfaces

- *The message only needs to be sent out interfaces that are connecting to other OSPF-enabled routers.*
- *The interface only links with the end user.*

3. Multiaccess networks can create two challenges for OSPF regarding the flooding of LSAs. What are these challenges?

- *Creation of multiple adjacencies*
  - *Internet can connect with many OSPF routers over a common link*
  - *Creating adjacencies with every router would lead to an excessive number of LSAs exchanged between routers on the same network.*
- *Extensive flooding of LSAs*
  - *Link-state routers flood their LSAs any time OSPF is initialized*
  - *or when have change in the topology*

4. In a multiarea environment, it is normal that the link-state update overhead is high and the SPF calculation run frequently across all the routers running Open Shortest Path First (OSPF). Justify your answer. (6 marks)

- *No, the link-state update overhead should be more lower than single-area OSPF as multiarea environment can reduce the link-state update overhead*
- *Because the multiarea OSPF is implemented using multiple areas, it separates a big area to multiple smaller areas.*
- *This minimizes processing and memory requirements.*

5. With reference to the Figure 5-1, answer the following questions.

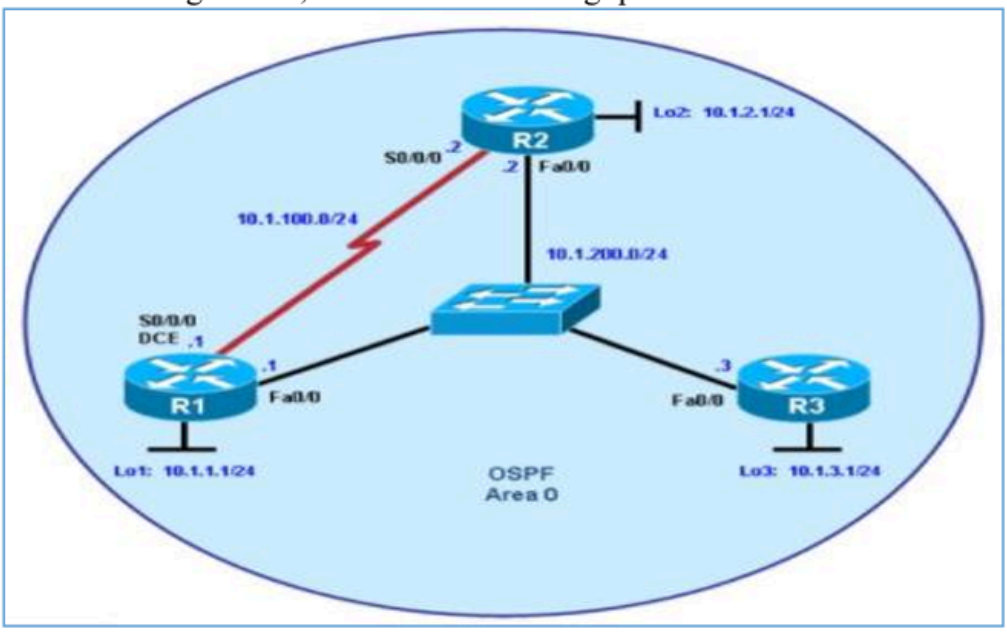

Figure 5-1: An OSPF network

(i) What is the default interface priority for R1, R2 and R3?

I guess

R1: 1

R2: 1

R3: 1

(ii) What is the router ID for R1, R2 and R3?

R1: 10.1.1.1

R2: 10.1.2.1

R3: 10.1.3.1

(iii) Which router are DR, BDR and DRothers?

I guess

DR: R3

BDR: R2

DR others: R1

**When interface priority are same, the highest router-ID become DR, second highest become BDR and the rest is DRother*

(iv) Modify the interface priorities to make R1 a DR and R3 a BDR.

I guess

R1(config)# interface F0/0

R1(config-if)# ip ospf priority 10

R3(config)# interface F0/0

R3(config-if)# ip ospf priority 3

6. Implement **Open Shortest Path First (OSPF)** configurations using network command with wildcard mask based on subnet mask in **Router1** and **Router2** in the network topology shown in Figure 1-2. Use OSPF **process-id 888** and **area-id 0.** Propagate the default routes in **Router1** to **Router2** for **LAN_1** and **LAN_2** to forward the traffic to ISP. Assume pre-configuration of default route in the Router1 and static routes in ISP were completed. Use Table 1-1 to document your answer.

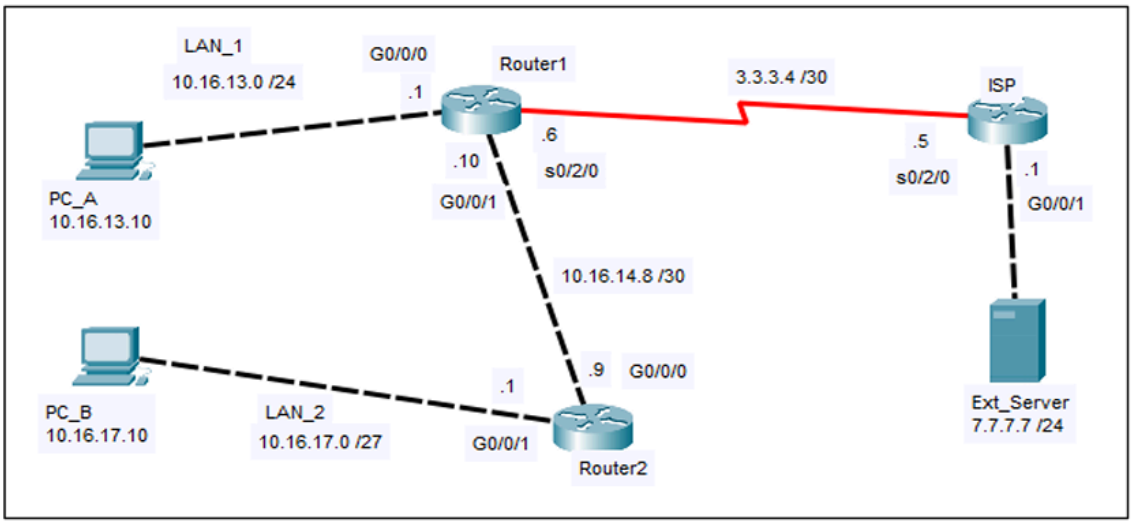

Figure 1-2: A network topology

Table 1-1: Documentation Table

Router name	Configurations
(	

Router name	***Configurations***
R1	*ip route 0.0.0.0 0.0.0.0 3.3.3.4 s0/2/0* *router ospf 888* *network 10.16.13.0 0.0.0.255 area 0* *network 10.16.14.8 0.0.0.3 area 0* *network 3.3.3.4 0.0.0.3 area 0* *default-information originate*
R2	*router ospf 888* *network 10.16.13.0 0.0.0.255 area 0* *network 10.16.14.8 0.0.0.3 area 0*