

**ICT259**

**Computer Networking**

**July 2022**

|  |  |
| --- | --- |
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**Submission to Vocareum**

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| --- |
| # Screenshot of datetime stamp of submission to Vocareum  **Graphical user interface, application  Description automatically generated** |

**Question 1 (25 marks)**

**Question 1(a) (4 marks)**

According to the diagram, both Host A and Host B are connected within the same network and this is because the data link source address which is categorically managed in the layer 2 of the OSI model which is known as the data link layer is represented by the source MAC address. Meanwhile the data link destination address which also layer 2 is represented by the destination MAC address.

Therefore based on this information, the end-to end devices are the same in comparison with their point-to-point counterpart devices.

There would be no modifications to the respective layer 2 and layer 3 headers that are encapsulated in the data frame once the headers have been encapsulated at Host A.

The Ethernet header which is categorically stored in the layer 2 of the OSI model which is known as the data link layer will be encapsulated within the frame that is transmitted from Host A to Host B stores both the source MAC address of Host A which is 20.30.0.2 and the destination MAC address of Host B which is 00-11-11-44-44-44.

The Internet Protocol (IP) header which is categorically stored in the layer 3 of the OSI model which is known as the network layer will be encapsulated within the frame transmitted from Host A to Host B stores both the source IP address of Host A which is 20.30.0.2 and the destination IP address of Host B which is 20.30.0.3.

|  |  |
| --- | --- |
| **Source IP Address** | 20.30.0.2 |
| **Destination IP Address** | 20.30.0.3 |
| **Source MAC Address** | 00-11-11-33-33-33 |
| **Destination MAC Address** | 00-11-11-44-44-44 |

**Question 1(b)(i) (4 marks)**

**Learning Process:**

Firstly, PC2 will transmit a frame to the switch.

In the process known as learning, the switch learns that the frame was transmitted by PC2 from Fa0/2.

The switch would then identify the source MAC address stored in the frame layer 2 Ethernet header.

Since the source MAC address from the frame is not stored in the switch MAC address table, the switch will therefore store the frame MAC address and its respective assigned port value which are AA-BB-CC-22-22-22 and Fa/02 into the MAC address table.

|  |  |
| --- | --- |
| **Switch MAC Address Table** | |
| **Host MAC Address** | **Port** |
| AA-BB-CC-22-22-22 | Fa0/2 |

**Forwarding Process:**

As part of the forwarding process, the switch will search for the destination MAC address by searching for a possible match from within the MAC address table.

However in the situation where a destination MAC address match cannot be found in the MAC address table, the switch would transmit the frame to all of its respective ports which are Fa0/1 and Fa0/3 excluding the incoming port Fa0/2.

**Question 1(b)(ii) (3 marks)**

**Learning Process**

Firstly, PC4 will transmit a frame to the switch.

In the process learning, the switch learns that the frame was transmitted by PC4 from Fa0/3.

The switch would then identify the source MAC address stored in the frame layer 2 Ethernet header.

Since the source MAC address from the frame is not stored in the switch MAC address table, subsequently the switch therefore would then store the respective frame MAC address and its respective port and in this case is port value Fa0/3 to the MAC address table.

|  |  |
| --- | --- |
| **Switch MAC Address Table** | |
| **Host MAC Address** | **Port** |
| AA-BB-CC-22-22-22 | Fa0/2 |
| AA-BB-CC-44-44-44 | Fa0/3 |

**Forwarding Process:**

As part of the forwarding process, subsequently the switch would perform a search for the destination MAC address by searching for a possible destination MAC address match from within the MAC address table. In a situation where a match has been found in the MAC address table of the switch, therefore the switch would transmit the reply in the form of a frame by the port Fa0/2 to PC2.

**Question 1(b)(iii) (3 marks)**

**Learning MAC Addresses**

Firstly, PC3 will transmit a frame to the switch.

In the process of learning, the switch learns that the frame was transmitted by PC3 from Fa0/2.

The switch would then identify the source MAC address stored in the frame layer 2 Ethernet header.

Since the source MAC address from the frame is not stored in the switch MAC address table, subsequently the switch therefore would store the frame MAC address and its respective port value and in this case is Fa0/3 to the MAC address table.

|  |  |
| --- | --- |
| **Switch MAC Address Table** | |
| **Host MAC Address** | **Port** |
| AA-BB-CC-22-22-22 | Fa0/2 |
| AA-BB-CC-44-44-44 | Fa0/3 |
| AA-BB-CC-33-33-33 | Fa0/2 |

**Frames Filtering**

As part of the frame filtering process, the switch will search for the destination MAC address by searching for a possible destination MAC address match from within the MAC address table. In a situation where a match has been found in the MAC address table of the switch and incoming port being used is the exact same as the destination port, the switch would then instead filter the frame by discarding it and transmitting it to PC2 without causing any damage to PC2 as it already has received the frame.

**Question 1(b)(iv) (3 marks)**

**Learning MAC Addresses**

Firstly, PC1 will transmit a multicast frame to the switch.

In the process of learning, the switch learns that the multicast frame was transmitted by PC1 from its respective port value Fa0/1.

The switch would then identify the source MAC address stored in the multicast frame layer 2 Ethernet header.

Since the source MAC address from the multicast frame is not stored in the switch MAC address table, the switch will therefore store the frame MAC address and its respective port value and in this case is Fa0/1 to the MAC address table.

|  |  |
| --- | --- |
| **Switch MAC Address Table** | |
| **Host MAC Address** | **Port** |
| AA-BB-CC-22-22-22 | Fa0/2 |
| AA-BB-CC-44-44-44 | Fa0/3 |
| AA-BB-CC-33-33-33 | Fa0/2 |
| AA-BB-CC-11-11-11 | Fa0/1 |

**Forwarding A Multicast Frame:**

As part of the forwarding process, the switch would determine whether the frame is a multicast or broadcast frame by checking its destination MAC address. Since in this situation it is a multicast frame, the switch would the transmit the multicast frame to all of its respective ports which are Fa0/2 and Fa0/3 excluding the incoming port value Fa0/1.

**Question 1(b) (8 marks)**

|  |  |
| --- | --- |
| **Switch** | |
| **MAC Address** | **Port** |
| AA-BB-CC-22-22-22 | Fa0/2 |
| AA-BB-CC-44-44-44 | Fa0/3 |
| AA-BB-CC-33-33-33 | Fa0/2 |
| AA-BB-CC-11-11-11 | Fa0/1 |

**Table Q1(b)**

**Question 2 (27 marks)**

**Question 2(a) (4 marks)**

**Question 2(a)(i)**

Diagram

Description automatically generated

**Figure Q2**

**Question 2(a)(ii)**

Diagram

Description automatically generated

Default Gateways

**Figure Q2**

**Question 2(b) (2 marks)**

**Question 2(b)(i)**

**Dotted decimal notation**

Network Address: 50.0.0.0

Network Address in binary: 1100 1000. 0000 0000. 0000 0000. 0000 0000

Since our network address is a Class A address which has 8 network bits and we will need 5 subnets based on the Figure Q2. Class A has 24 host bits.

How many subnets are needed ? 5

How many bits would you need to borrow from the host portion ? 7

What is the IPv4 class for the network 50.0.0.0 ? Class A

IP Address: 50.7.0.0

Total number of bits is 8 + 7 = 15 bits

15 bits:

1111 1111. 1111 1110. 0000 000. 0000 000

7 bits = 128 + 64 + 32 + 16 + 8 + 4 + 2 + 0

= 254

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Class A** | 0NNN NNNN | N | H | H | H |
| **Binary** | 1111 1111 | 1111 1110 | | 0000 000 | 0000 000 |
| **Subnet Mask** | 255 | 254 | | 0 | 0 |

**Resultant Subnet Mask = 255.254.0.0**

**Question 2(b)(ii)**

**Prefix length**

|  |  |  |
| --- | --- | --- |
| **Subnet Mask** | **Subnet Mask in 32-bit** | **Prefix Length** |
| 255.254.0.0 | 1111 1111. 1111 1110. 0000 0000. 0000 0000 | /15 |

Since we have 15 bits that are set to 1 in the subnet mask, our prefix length is **/15.**

**Question 2(c) (6 marks)**

How many subnets are needed ? 5

How many bits would you need to borrow from the host portion ? 7

What is the IPv4 class for the network 50.0.0.0 ? Class A

What is the resultant subnet mask ? 255.254.0.0

With this number of bits borrowed, how many subnets are there ? 2n

Since n represents the number of bits borrowed from the host portion,

23 = 8

How many bits are left for the hosts ID ? Since our network address is Class A, it will have 24 hosts bits.

24 (Host bits) – 7 = 17

How many valid hosts can be included in one subnet ?

Using the formula, Number of usable host IP address = 2(hosts bits) - 2

217 – 2 = 131 070

**128, 64, 32, 16**, **8, 4, 2, 1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Network Address** | 50 | 0 | 0 | 0 |
| **Subnet 10 Address**  10/2 = 10102  0001 01002 = 2010 | 50  50 | **0001010** 0  20 | 0000 0000  0 | 0000 0000  0 |
| **Subnet 20 Address**  20/2 = 101002  0010 10002 = 4010 | 50  50 | **0010100** 0  40 | 0000 0000  0 | 0000 0000  0 |
| **Subnet 30 Address**  30/2 = 111102  0011 11002 = 6010 | 50  50 | **0011110** 0  60 | 0000 0000  0 | 0000 0000  0 |
| Subnet 40 Address  40/2 = 1010002  0101 00002 = 8010 | 50  50 | **0101000** 0  80 | 0000 0000  0 | 0000 0000  0 |
| **Subnet 50 Address**  50/2 =1100102  0110 01002 = 10010 | 50  50 | **0110010** 0  100 | 0000 0000  0 | 0000 0000  0 |
| **Subnet 60 Address**  60/2 = 1111002  0111 10002 = 10010 | 50  50 | **0111100** 0  120 | 0000 0000  0 | 0000 0000  0 |

**Subnet 10 IP Address: 50.20.0.0**

**Subnet 20 IP Address: 50.40.0.0**

**Subnet 30 IP Address: 50.60.0.0**

**Subnet 40 IP Address: 50.80.0.0**

**Subnet 50 IP Address: 50.100.0.0**

**Subnet 60 IP Address: 50.120.0.0**

**Question 2(d) (4 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Network Address** | 50 | 0 | 0 | 0 |
| **Subnet 10 Address**  10/2 = 10102  0001 01002 = 2010 | 50  50 | **0001010** 0  20 | 0000 0000  0 | 0000 0000  0 |
| **Subnet 20 Address**  20/2 = 101002  0010 10002 = 4010 | 50  50 | **0010100** 0  40 | 0000 0000  0 | 0000 0000  0 |

**128, 64, 32, 16**, **8, 4, 2, 1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Subnet 10** | **Subnet 10 IP Address** | **Network Bits** | **Host Bits** | **IP Address** |
| **First Host Address** | 50. **0001010** 0 | **0000 0000 . 0000 0001** | 50.20.0.1 |
| **Last Host Address** | 50. **0001010** 1 | **1111 1111 . 1111 1110** | 50.21.255.254 |
| **Broadcast Address** | 50. **0001010** 1 | **1111 1111 . 1111 1111** | 50.21.255.255 |

**128, 64, 32, 16**, **8, 4, 2, 1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Subnet 20** | **Subnet 20 IP Address** | **Network Bits** | **Host Bits** | **IP Address** |
| **First Host Address** | 50. **0010100** 0 | **0000 0000 . 0000 0001** | 50.40.0.1 |
| **Last Host Address** | 50. **0010100** 1 | **1111 1111 . 1111 1110** | 50.41.255.254 |
| **Broadcast Address** | 50. **0010100** 1 | **1111 1111 . 1111 1111** | 50.41.255.255 |

**Subnet 10 Usable Host Range: 50.20.0.1 - 50.21.255.254**

**Subnet 20 Usable Host Range: 50.40.0.1 - 50.41.255.254**

**Question 2(e)(i) (2 marks)**

Diagram

Description automatically generated

**Fa0/4**

**Fa0/3**

**Fa0/2**

**Fa0/1**

**Fa0/0**

**Fa0/1**

**Fa0/0**

**S0/0/1**

**S0/0/0**

**S0/0/0**

**S0/0/1**

**Figure Q2**

**Question 2(e)(ii) (9 marks)**

Diagram

Description automatically generated

**Fa0/2**

**50.80.0.2**

**Fa0/3**

**50.120.0.2**

**Fa0/3**

**50.100.0.2**

**Fa0/1**

**50.60.0.2**

**50.60.0.4**

**50.60.0.3**

**Fa0/4**

**50.80.0.2**

**Fa0/3 50.60.0.2**

**Fa0/0**

**50.60.0.1**

**S0/0/1**

**50.100.0.1**

**S0/0/0 50.100.0.2**

**S0/0/1**

**50.80.0.2**

**50.40.0.3**

**50.20.0.3**

**Fa0/2 50.40.0.2**

**Fa0/1**

**50.20.0.2**

**S0/0/0**

**50.80.0.1**

**Fa0/1**

**50.40.0.1**

**Fa0/0**

**50.20.0.1**

**Subnet Mask: 255.254.0.0**

**Figure Q2**

**Subnet 10 IP Address: 50.20.0.0**

**Subnet 20 IP Address: 50.40.0.0**

**Subnet 30 IP Address: 50.60.0.0**

**Subnet 40 IP Address: 50.80.0.0**

**Subnet 50 IP Address: 50.100.0.0**

**Subnet 60 IP Address: 50.120.0.0**

**Router A** Fa0/0 IP Address: 50.20.0.1(Subnet 10 1st Host Address) (Default Gateway)

**Router A** Fa0/1 IP Address: 50.40.0.1 (Subnet 20 1st Host Address) (Default Gateway)

**Router A** S0/0/0 IP Address: 50.80.0.1 (Subnet 40 1st Host Address)

**Switch A** IT-VLAN IP Address: 50.20.0.2 (Subnet 10 2nd Host Address)

Since Switch A is connected to both the IT-VLAN and ENG-VLAN which are both separate networks. We will allocate IT-VLAN Subnet 10 as it is the 1st available subnet. This network will be allocated the Subnet 10 available host range 50.20.0.1 - 50.21.255.254

By convention, the 1st host address of Subnet 10 which is 50.20.0.1 will be assigned as the default gateway of IT-VLAN and be assigned to the **Router A** Fa0/0 interface. This is because LANs would be assigned a default gateway.

Since we have Switch A that acts as an intermediary in the IT-VLAN, we will assign 50.20.0.2 which is the next available host address as its IP Address from the Subnet 10 available host range 50.20.0.1 - 50.21.255.254

**Switch A** ENG-VLAN IP Address: 50.40.0.2 (Subnet 20 2nd Host Address)

Now since Subnet 10 has been allocated to IT-VLAN, we will allocate the next available subnet which is Subnet 20 to ENG-VLAN. Subnet 20 has an available host range of 50.40.0.1 - 50.41.255.254

By convention, the 1st host address of Subnet 20 which is 50.40.0.1 will be assigned as the default gateway of ENG-VLAN and be assigned to the **Router A** Fa0/1 interface. This is because LANs would be assigned a default gateway.

Since we have Switch A that also acts as an intermediary in the ENG-VLAN, we will assign 50.40.0.2 which is the next available host address as its IP Address from the Subnet 20 available host range 50.40.0.1 - 50.41.255.254

**PC1** IP Address: 50.20.0.3 (Subnet 10 3rd Host Address)

It could be assumed that 50.20.0.1 (1st Host Address) in this topology would be use as the default gateway of Subnet 10. The 2nd Host Address be used for the Switch A IT-VLAN IP Address. Therefor for PC1 IP Address we will use the Subnet 10 3rd Host Address.

**PC2** IP Address: 50.40.0.3 (Subnet 20 3rd Host Address)

It could be assumed that 50.40.0.1 (1st Host Address) in this topology would be use as the default gateway of Subnet 20. The 2nd Host Address be used for the Switch A ENG-VLAN IP Address. Therefor for PC2 IP Address we will use the Subnet 20 3rd Host Address.

**Router B** S0/0/1 IP Address: 50.80.0.2 (Subnet 40 2nd Host Address)

**Router B** S0/0/0 IP Address: 50.100.0.2 (Subnet 50 2nd Host Address)

**Router C** S0/0/1 IP Address: 50.100.0.1 (Subnet 50 1st Host Address)

**Router C** Fa0/0 IP Address: 50.60.0.1 (Subnet 30 1st Host Address) (Default Gateway)

**Switch B** IP Address: 50.60.0.2 (Subnet 30 2nd Host Address)

Now since Subnet 10 and Subnet 20 have been allocated to IT-VLAN and ENG-VLAN, for the network that Switch B is in, we will allocate the next available subnet which is Subnet 30. Subnet 30 has an available host range of 50.60.0.1 - 50.61.255.254

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Subnet 30** | **Subnet 30 IP Address** | **Network Bits** | **Host Bits** | **IP Address** |
| **First Host Address** | 50. **0011110** 0 | **0000 0000 . 0000 0001** | 50.60.0.1 |
| **Last Host Address** | 50. **0011110** 1 | **1111 1111 . 1111 1110** | 50.61.255.254 |
| **Broadcast Address** | 50. **0011110** 1 | **1111 1111 . 1111 1111** | 50.61.255.255 |

By convention, the 1st host address of Subnet 30 which is 50.60.0.1 will be assigned as the default gateway of the network that network that Switch B is in and be assigned to the **Router C** Fa0/0 interface. This is because LANs would be assigned a default gateway.

Since we have Switch C that acts as an intermediary in the Subnet 30 network, we will assign 50.60.0.2 which is the next available host address as its IP Address from the Subnet 30 available host range 50.60.0.1 - 50.61.255.254.

**PC3** IP Address: 50.60.0.3 (Subnet 30 3rd Host Address)

It could be assumed that 50.60.0.3 (1st Host Address) in this topology would be use as the default gateway of Subnet 30. The 2nd Host Address be used for the Switch B IP Address. Therefor for PC3 IP Address we will use the Subnet 30 3rd Host Address.

**PC4** IP Address: 50.60.0.4 (Subnet 30 4th Host Address)

It could be assumed that 50.60.0.1 (1st Host Address) in this topology would be use as the default gateway of Subnet 30. The 2nd Host Address be used for the Switch B IP Address. Since the PC3 IP Address is already using the Subnet 30 3rd Host Address. Therefor for PC4 IP Address we will use the Subnet 30 4th Host Address.

**Question 3 (40 marks)**

**Question 3(a) (6 marks)**

|  |  |
| --- | --- |
| **Command** | **Parameter** |
| router rip |  |
| version 2 |  |
| network | <network number> |

**Router RA-B2110802:**

RA-B2110802>en

RA-B2110802#conf t

RA-B2110802 (config)#router rip

RA-B2110802 (config-router)#version 2

RA-B2110802 (config-router)# network 192.168.5.0

**Router RB-B2110802:**

RB-B2110802>en

RB-B2110802#conf t

RB-B2110802(config)#router rip

RB-B2110802 (config-router)#version 2

RB-B2110802 (config-router)# network 192.168.5.0

**Router RC-B2110802:**

RC-B2110802>en

RC-B2110802#conf t

RC-B2110802(config)#router rip

RC-B2110802 (config-router)#version 2

RC-B2110802 (config-router)# network 192.168.5.0

**Question 3(b) (8 marks)**

We will create the static routes using exit interface syntax below:

Router (config)#<command> <dest network> <dest subnet mask> <exit interface>

Since Administrative distance (AD) for RIPv2 is 120, we must set the AD above 120 for backup static routes so we will set the AD at 130.

|  |  |
| --- | --- |
| **Router** | **Static Route Configuration Commands To Be Entered At Each Router** |
| Router A | Router>en  Router#conf t  Router(config)#ip route 192.168.5.64 255.255.255.240 S0/0/0 130  Router(config)#ip route 192.168.5.80 255.255.255.240 S0/0/0 130  Router (config)#do wr |
| Router B | Router>en  Router#conf t  Router(config)#ip route 192.168.5.16 255.255.255.240 S0/0/1 130  Router(config)#ip route 192.168.5.32 255.255.255.240 S0/0/1 130  Router(config)#ip route 192.168.5.64 255.255.255.240 S0/0/0 130  Router (config)#do wr |
| Router C | Router>en  Router#conf t  Router(config)#ip route 192.168.5.16 255.255.255.240 S0/0/1 130  Router(config)#ip route 192.168.5.32 255.255.255.240 S0/0/1 130  Router(config)#ip route 192.168.5.96 255.255.255.240 S0/0/1 130  Router (config)#do wr |

**Question 3(c) (4 marks)**

Chart, radar chart

Description automatically generated

**Question 3(d)**

**Question 3(d)(i) (2 marks)**

**SA-B2110802**

Graphical user interface, application

Description automatically generated

**Question 3(d)(ii) (2 marks)**

**SA-B2110802**

Graphical user interface, application, Word

Description automatically generated

Graphical user interface, text, application, email

Description automatically generated

**Question 3(d)(iii) (1 marks)**

**SA-B2110802**

Graphical user interface, application

Description automatically generated

**Question 3(d)(iv) (2 marks)**

**SB-B2110802**

Graphical user interface

Description automatically generated with medium confidence

Graphical user interface, application, Word

Description automatically generated

Graphical user interface, application

Description automatically generated

**Question 3(e)**

**Question 3(e)(i) (3 marks)**

**Router RA-B2110802:**

RA-B2110802>en

RA-B2110802#conf t

RA-B2110802 (config)#router rip

RA-B2110802 (config-router)#version 2

RA-B2110802 (config-router)# network 192.168.5.0

Graphical user interface, text, application

Description automatically generated

**Router RB-B2110802:**

RB-B2110802>en

RB-B2110802#conf t

RB-B2110802(config)#router rip

RB-B2110802 (config-router)#version 2

RB-B2110802 (config-router)# network 192.168.5.0

Graphical user interface, application

Description automatically generated

**Router RC-B2110802:**

RC-B2110802>en

RC-B2110802#conf t

RC-B2110802(config)#router rip

RC-B2110802 (config-router)#version 2

RC-B2110802 (config-router)# network 192.168.5.0

Graphical user interface, text, application

Description automatically generated

**Question 3(e)(ii) (6 marks)**

**Router RA-B2110802:**

Graphical user interface, application

Description automatically generated

**Router RB-B2110802:**

Graphical user interface, application

Description automatically generated

**Router RC-B2110802:**

Graphical user interface, application

Description automatically generated

**Question 3(f) (4 marks)**

**Router RA-B2110802:**

Graphical user interface, text, application

Description automatically generated

**Router RB-B2110802:**

Graphical user interface, text, application

Description automatically generated

**Router RC-B2110802:**

Graphical user interface, text, application

Description automatically generated

**Question 3(g) (2 marks)**

**PC1 pings PC2**

Graphical user interface, text

Description automatically generated

**PC2 pings PC3**

Graphical user interface, text

Description automatically generated

**Question 4 (8 marks)**

**Root Bridge**

Diagram

Description automatically generated

**ND**

**ND**

**ND**

**ND**

**ND**

**ND**

**D**

**D**

**R**

**D**

**R**

**D**

**D**

**D**

**R**

**R**

**Figure Q4**

|  |  |
| --- | --- |
| **Ethernet Speed** | **IEEE Port Cost** |
| **10 Mbps** | **100** |
| **100 Mbps** | **19** |
| **1 Gbps** | **4** |
| **10 Gbps** | **2** |

Rules to monitor most especially when switches are allowed to choose a root bridge and various ports.

* Only one root bridge can be assigned to each network
* Only one root bridge can be assigned to each non-root bridge
* Only one designated port can be assigned to each segment
* All non-designated ports would be considered as unused ports

**Steps to obtain Spanning Tree**

**Step 1:**

Choose the Root Bridge based on the switch that has the lowest priority value.

In this scenario, Switch A is regarded as the Root Bridge.

**Step 2:**

For the second step, we need to search for the path that contains the lowest cost value based from each non-root switch to the Root Bridge which in this case is Switch A.

**Explanation and Working:**

Lowest cost path from **Switch E** to Root = 4 (Path E 🡪 D 🡪 A, cost = 4 + 19 = 23, is higher)

Lowest cost path from **Switch B** to Root = 4 + 4 + 4 = 12 (Path B 🡪 A, cost = 19, is higher)

Lowest cost path from **Switch D** to Root = 4 + 4 = 8 (Path D 🡪 A, cost = 19, is higher)

Lowest cost path from **Switch C** to Root = 4 + 4 = 8 (Path C 🡪 B 🡪 A, cost = 23, is higher)

Lowest cost paths are Forwarding links. All others Blocking links.

**Step 3:**

For the third step, we need to choose the respective Root Ports based on the rule that one root port only one route port can be assigned to each non-root bridge.

**Step 4:**

For this fourth step, we will choose the respective Designated Ports on the basis that only one designated port can be assigned to each segment

**Step 5:**

For this fifth step, we will choose the respective Non-Designated Ports (NDP) on the basis that all non-designated ports would be considered as unused or as inactived ports.