Answer to the question no.1 :-

(a.)

(i.)

Given,

IPv4 Address = 200.100.50.25

Prefix Mask = /12

Here,

/12 means the first 12 bits are network bits.

Subnet mask in decimal : 255.240.0.0

Converting IP to binary:

200 = 11001000

100 = 01100100

50 = 00110010

25 = 00011001

So, 11001000. 01100100. 00110010. 00011001

Applying mask 255.240.0.0 :

255 = 11111111

240 = 11110000

0 = 00000000

0 = 00000000

Mask binary : 11111111. 11110000. 00000000. 00000000

Bitwise AND:

11001000.01100100. 00110010.00011001

AND 11111111.11110000.00000000.00000000

= 11001000.01100000.00000000.00000000

convert back to decimal:

11001000 = 200

01100000 = 96

00000000 = 0

00000000 = 0

Network Address = 200.96.0.0/12

(Ans)

(ii)

Network: 200.96.0.0/12

First usable host: 200.96.0.1

To find last usable host:

/12 means 12 network bits, 20 host bits

Number of addresses in the network = 2^{20} = 1048576

Network range: 200.96.0.0 to 200.111.255.255

Last usable host = 200.111.255.254

Second last usable host = 200.111.255.253

(Ans)

(b.)

Given,

Network Address = 200.96.0.0/12

Assuming the topology requires 4 subnets of equal size :

Number of subnets needed = 4

Bits to borrow from host part = $\log_2(4) = 2$ bits

New prefix length = 12+2 = /14

Subnet mask for /14 = 255.252.0.0

Now, incrementing value in the 3rd octet where borrowed bits are from the 3rd octet's highest 2 bits. So, the subnets are :-

(1.) 200.96.0.0/14

(2.) 200.100.0.0/14

(3.) 200.104.0.0/14

(4.) 200.108.0.0/14

(Answer)

Answer to the question no. 2:

(a)

(i)

Given,

7th fragment size = 268 bytes (Including header)

Header size = 20 bytes

Data in 7th fragment = (268 − 20) = 248 bytes

Offset of 7th fragment = 186

All fragments have same packet size

For Original Intact Packet size,

Offset is measured in 8 byte units.

Data before 7th fragment = Offset × 8 = (186 × 8) = 1488 bytes

This data belongs to the first 6 fragments.

So, data per fragment = (1488 ÷ 6) = 248 bytes

Total data in original packet

= 7 fragments × 248 bytes = 1736 bytes

Adding original IP header = (1736 + 20)

= 1756 bytes

(ii)

For MTU and 5th fragment offset:

Fragment size = 268 bytes

MTU = 268 bytes

Before 5th fragment, 4 fragments sent.

Data before 5th fragment = 4 × 248 = 992 bytes

5th fragment offset = 992 ÷ 8 = 124

(iii) For MF flag of 7th fragment,

Since 7th is the last fragment, MF flag = 0.

(b)

(i)

The issues identified in the above configuration of the stem are given below :—

(1) Subnet mask mismatch

(2.) Default router address 1.1.0.255 is the broadcast address /24, not a valid router IP. It should be 1.1.0.254.

(ii)

Solving DHCP Server 2 issue, for allowing computers in R4 LAN to get IP from DHCP Server 2 :

(1.) On R4's interface facing the LAN, configure: ip helper-address <IP-of-DHCP-Server>

(2.) Ensure DHCP Server 2 has a scope for network 1.1.0.0/23 with correct gateway (1.1.0.254)

(3.) Verify that Server 2 is reachable from R4 and no ACL is blocking UDP ports 67 and 68.

Answer to the question no. 4:

(a)

(i) Recursive static default route on R4 toward ISP:

ip route 0.0.0.0. 0.0.0.0 <next-hop-IP>

Example: ip route 0.0.0.0 0.0.0.0 203.0.113.1

(ii) Backup route with higher AD:

ip route 0.0.0.0 0.0.0.0 <backup-next-hop-IP> 250

Example: ip route 0.0.0.0 0.0.0.0 198.51.100.1 250

(b)

(i)

Summarization:

Given, 1.1.0.224/29, 1.1.0.232/29, 1.1.0.240/29, 1.1.0.248/29

All contagious, cover 1.1.0.224 to 1.1.0.255 → /27

Command: ip route 1.1.0.224 255.255.255.224 <next-hop>

(ii)

Mainly, the effect of creating the summarized route in R2 router is that it reduces routing table entries in ISP router, but may cause black-holing if specific /29 fails.

(c)

Route name: Floating Static Default Route

AD=50 reason: Higher AD than primary static route (AD 1), used as back up route.

Answer to the question no. 5 :-

(a)

Identifying ~~[illegible]~~ IPv6 multicast address:

IPv6 multicast addresses always start with FF in hexadecimal. So, any address in the range $\boxed{FF00::/8}$ is a multicast address.

Broadcast in IPv6 :

IPv6 doesnot have a broadcast address. Instead, multicast addresses are used for one-to-many communication.

(b)

Extra info added via Extension Headers.

If 20 bytes added, base header stays 40 bytes.

Total = 60 bytes.

(c)

Why no DAD: DHCPv6 server ensures unique assignment centrally.

Steps: Solicit → Advertise → Request → Reply.

Answer to the question no. 6 :—

(b)

Switch will unicast ARP request to Host D's port (MAC known)

MAC table updated with A's MAC, but no change for D.

(a)

Check second hex digit of first byte:

LSB = 0 → globally unique
LSB = 1 → locally administered

MAC portable because tied to hardware, not location.

(c)

Functions of Preamable and CRC are given below:—

(1.) Preamable:

Synchronizes the receiver's clock and indicates the start of a frame.

(2.) CRC:

Provides error detection for the entire Ethernet frame; the reciever checks CRC to ensure data integrity.