Assignment 2

-190010008

1.

Since the routing prefix is 20, the ISP has $2^{(32-20)}$ or 2^{12} addresses. Out of these 2^{12} addresses, half (or 2^{11}) addresses have to be given to organization A and quarter (2^{10}) addresses have to be given to organization B. So the routing prefix for organization A will be 21 and for organization B, it will be 22. If we see all options given in the question, only options (A) and (B) are left as only these options have the same number of routing prefixes. Now we need to choose from options (A) and (B).

To assign addresses to organization A, ISP needs to take the first 20 bits from $245.248.128.0$ and fix the 21^{st} bit as 0 or 1. Similarly, ISP needs to fix the 21^{st} and 22^{nd} bits for organization B. If we take a closer look at the options (A) and (B), we can see the 21^{st} and 22^{nd} bits for organization B are considered as 0 in both options. So 21^{st} bit of organization A must be 1. Now take the first 20 bits from $245.248.128.0$ and 21^{st} bit as 1, we get addresses for organization A as $245.248.136.0/21$. Also, we get the addresses for organization B as $245.248.128.0/22$. Thus option (A) is correct.

2.

Ans : (D) 255.255.255.224

The last octets of IP addresses of A and B are 113 (**011**10001) and 91 (**010**11011). The netmask in option (D) has the first three bits set in the last octet. If netmask has the first 3 bits set, then these bits must be the same in A and B, but that is not the case. In simple words, we can say option (D) is not a valid netmask because doing binary ‘&’ of it with addresses of A and B doesn’t give the same network address. It must be the same address as A and B are on the same network.

3.

The binary representation of the subnet mask is $11111111.11111111.11111000.00000000$. There are 21 bits set in the subnet. So 11 (32-21) bits are left for host IDs. The total possible values of host IDs are $2^{11} = 2048$. Out of these 2048 values, 2 addresses are reserved. The address with all bits as 1 is reserved as the broadcast address and the address with all host ID bits as 0 is used as the network address of the subnet. In general, the number of addresses usable for addressing specific hosts in each network is always $2^N - 2$ where N is the number of bits for the host ID. So finally there can be a maximum number of **2046** hosts per subnet in this network.

4.

The maximum number of subnets $= 2^6 - 2 = 62$.

Note that 2 is subtracted from 2^6. The RFC 950 specification reserves the subnet values consisting of all zeros (used as the network address) and all ones (used as the broadcast address), reducing the number of available subnets by two.

The maximum number of hosts is $= 2^{10} - 2 = 1022$.

2 is subtracted for the number of hosts also. The address with all bits as 1 is reserved as the broadcast address and the address with all host ID bits as 0 is used as the network address of the subnet.

In general, the number of addresses usable for addressing specific hosts in each network is always $2^N - 2$ where N is the number of bits for the host ID.

5.

Correct match:

A. 128.96.171.92	1. Interface 0
B. 128.96.167.151	3. R2
C. 128.96.163.121	5. R4
D. 128.96.165.121	4. R3

Taking the 1st IP Address: 128.96.171.92
Bitwise AND between 128.96.171.92 and 255.255.254.0 we get the subnet ID as follows:
25512812825596961111111010101011101010100920
Subnet ID = 128.96.170.0
Thus, 128.96.171.92 will be forwarded to interface 0

Taking the 2nd IP Address: 128.96.167.151
Bitwise AND between 128.96.167.151 and 255.255.254.0 we get,
25512812825596961111111010100111010011001510
∴ Subnet ID = 128.96.166.0
∴ 128.96.167.151 will forward to interface R2

Taking the 3rd IP Address: 128.96.163.151
Now, Bitwise AND between 128.96.167.151 and 255.255.252.0 we get,
255128128255969611111100101000111010000001510
Subnet ID = 128.96.160.0 (Doesn't match with any given interface)
Thus, 128.96.163.151 will be forward to default interface R4

Taking the last IP Address: 128.96.164.121
Bitwise AND between 128.96.164.121 and 255.255.254.0 we get,
255128128255969611111110101001001010010001210
∴ Subnet ID = 128.96.164.0
∴ 128.96.167.151 will forward to interface R3

6.

The number of networks that can be joined is 2^n where n is the number of bits borrowed from network bits.

Default Subnet mask $255.255.0.0$ i.e. $11111111.11111111.00000000.0000000$

Given Subnet mask $255.192.0.0$ is $11111111.11000000.00000000.0000000$

Number of bits taken from network bits $= 6$

Number of subnets $= 2^6 = 64$

7.

Packet 128.48.64.0 will be forwarded to that destination that matches the maximum number of bits in the destination IP Address represented by its subnet mask.

128.48.64.0 is 10000000.00110000.01000000.0000000

Destination	Subnet	Interface	Number of bits to be matched to the given IP Address/ No. of ones in Subnet	Does it match with the previous number of bits of ones of the given IP Address?
192.18.1.0	255.255.255.0	A	24	No
128.48.0.0	255.255.128.0	B	17	Yes (17 bits)
128.48.0.0	255.255.0.0	C	16	Yes (16 bits)
Default		D	None	-

A: 192.18.1.0 is **11000000.00010010.00000001**.0000000

B: 128.48.0.0 is **10000000.00110000.0**0000000.0000000

C: 128.48.0.0 is **10000000.00110000**.00000000.0000000

Logical AND operation between subnet mask and IP address gives the subnet ID.

a) 128.48.64.0 & 255.255.255.0 = 128.48.64.0 which is not equal to the destination, so the packet will not be forwarded to interface A.

b) 128.48.64.0 & 255.255.128.0 = 128.48.0.0 so packet can be forwarded to B.

c) 128.48.64.0 & 255.255.0.0 = 128.48.0.0 so packet can be forwarded to C.

If two IP addresses match then the packet should be forwarded to the subnet with more number of 1’s in the subnet mask.

Hence, the router will forward the packet to **Interface B**.

8.

The default subnet mask for Class C is 255.255.255.192

$(192)_{10} = (11000000)_2$

Since 192 is written as 11000000, it has 2 subnets and the remaining all hosts. So, for the first three octets, 24 bits are fixed and for the last octet 2 bits are fixed, i.e. 24 + 2 = **26 bits**. Option (B) is correct.

9.
In classful addressing, The range of the first octet should be between one of the following:

CLASS A ⇒ 0 to 127

CLASS B ⇒ 128 to 191

CLASS C ⇒ 192 to 223

CLASS D ⇒ 224 to 239

CLASS E ⇒ 240 to 255

Given IP address = **198**.78.41.0. So, it is a **class C** address. Option (C) is correct.

10.

The full range of **multicast** addresses is from 224.0.0.0 to 239.255.255.255. Multicast addresses represent a group of IP devices that can only be used as the destination of a datagram and not as the source. Option (C) is correct.

11.

Class B networks use a default subnet mask of **255.255.0.0** and have 128-191 as their first octet. Option (D) is correct.

12.
IP address: 125.134.112.66
Subnet Mask: 255.255.224.0
IP address: 01111101 10000110 01110000 01000010
Subnet Mask: 11111111 11111111 11100000 00000000
Network ID: 01111101 10000110 01100000 00000000

So, Network Address = **125.134.96.0**

13.

In classful addressing, the IP addresses with 0 (zero) as network number **refers to the current network**. Option (A) is correct.

14.

In classless IP addressing:

- The number of addresses needs to be a power of 2.
- The mask needs to be included in the address to define the block.
- The starting address must be divisible by the number of addresses in the block.

All are correct restrictions in the classless address. So, **option (D) All of the above** is correct.

15.

The broadcast address for IP network 172.16.0.0 with subnet mask 255.255.0.0 is **172.16.255.255**. Here the subnet has the 1^{st} 16 bits as ones, so the broadcast address will have the 1^{st} 16 bits the same as that of the IP network and the remaining 16 bits all as ones.

16.

(A) and (C) are not the answers as the second byte of IP differs and the subnet mast has 255 for the second byte.

Consider (B), (& for bitwise AND)

10.35.28.2 & 255.255.31.0=10.35.28.0(28=111002)

10.35.29.4 & 255.255.31.0=10.35.29.0(29=111012)

So, we get different subnet numbers

Consider (D).

128.8.129.43 & 255.255.31.0=128.8.1.0(129=100000012)

128.8.161.55 & 255.255.31.0=128.8.1.0(161=101000012)

The subnet number matches. So, **option (D) 128.8.129.43 and 128.8.161.55** is the answer.