

DCN Hw-3

Name: Basil Ichowaja Bk08432

Q1) Starting IP address: 192.10.10.0/24

Subnets = 15

$$A = \log_2(15) = 4$$

$$\text{total Prefix} = 24 + 4 = 28$$

Subnet mask = 255.255.255.240

$$2^{32-28} = 2^4 = 16$$

hence each subnet will have 16 addresses

\Rightarrow first subnet:

① network id:

Starting ip = 192.10.10.0

11000000 . 00001010 . 00001010 . 00000000

11111111 . 11111111 . 11111111 . 11110000

And

11000000 . 00001010 . 00001010 . 00000000

② Broadcast id:

↳ ① complement of the mask

↳ ② then OR operation

Complement:-

Compl → 00000000 . 00000000 . 00000000 . 00001111

netid → 11000000 . 00001010 . 00001010 . 00000000

OR

↳ [11000000 . 00001010 . 00001010 . 00001111]

Broadcast id = [192 . 10 . 10 . 15]

Range :-

first; network id + 1

11000000 . 00001010 . 00001010 . 00000000

+

1

11000000 . 00001010 . 00001010 . 00000001

↓

192 . 10 . 10 . 1

Last:- Broadcast - 1

11000000. 00001010. 00001010. 00001111

- 1

11000000. 00001010. 00001010. 00001110



192. 10. 10. 14

⇒ Second Subnet:-

① net id: Previous broadcast was
192. 10. 10. 15, so this
Subnet will Start from 192. 10. 10. 16

In binary:-

11000000. 00001010. 00001010. 00010000

1111111. 1111111. 1111111. 11110000

Ano

11000000. 00001010. 00001010. 00010000



192. 10. 10. 16

② broadcast id:-

Complement of Subnet mask :-

11111111 · 11111111 · 11111111 · 11110000



complement



00000000 · 00000000 · 00000000 · 00001111

netid 11000000 · 00001010 · 00001010 · 00010000

OR

11000000 · 00001010 · 00001010 · 00011111



192 · 10 · 10 · 31

\Rightarrow Subnet 14 :-

1st ip of Subnet 14



192 · 10 · 10 · 0 + (13 × 16)



192 · 10 · 10 · 208

Network id:-

IP \rightarrow 11000000 · 00001010 · 00001010 · 11010000

Sub \rightarrow 11111111 · 11111111 · 11111111 · 11110000

Ans \rightarrow 11000000 · 00001010 · 00001010 · 11010000

\downarrow
192 · 10 · 10 · 208 Ans //

Broadcast id:

① Complement of Subnet mask :-

00000000 · 00000000 · 00000000 · 00001111

② OR:

net \rightarrow 11000000 · 00001010 · 00001010 · 11010000

comp \rightarrow 00000000 · 00000000 · 00000000 · 00001111

OR

11000000 · 00001010 · 00001010 · 11011111

~~~~~  
192 · 10 · 10 · 223      Ans

$\Rightarrow$  Subnet 15 :-

Start = 192 · 10 · 10 · 0 + (14 × 16)

Start = 192 · 10 · 10 · 224

Net id:

IP  $\rightarrow$  11000000. 00001010. 00001010. 11100000

Sub  $\rightarrow$  11111111. 11111111. 11111111. 11110000

And

11000000. 00001010. 00001010. 11100000

~~~~~

192. 10. 10. 224 Any

Broadcast id:

net \rightarrow 11000000. 00001010. 00001010. 11100000

comp \rightarrow 00000000. 00000000. 00000000. 00001111

or

11000000. 00001010. 00001010. 11101111

~~~~~

192. 10. 10. 239

Random Subnets:

Subnet ~ 8:

Start = 192. 10. 10. 0 + (7  $\times$  16)

Start  $\rightarrow$  192. 10. 10. 112

Network id :

IP → 11000000 · 0000lolo · 0000lolo · 01110000

Sub → 1111111 · 1111111 · 1111111 · 11110000

And

11000000 · 0000lolo · 0000lolo · 01110000

~~~~~ | ~~~~~

192 · 10 · 10 · 112 → Ans//

Broadcast id :

IP → 11000000 · 0000lolo · 0000lolo · 01110000

Comp → 00000000 · 00000000 · 00000000 · 0000llll

OR

11000000 · 0000lolo · 0000lolo · 01111111

~~~~~ | ~~~~~

192 · 10 · 10 · 127 → Ans//

Subnet q :-

Start = 192 · 10 · 10 · 0 + (8 × 16)

Start = 192 · 10 · 10 · 128

Network id :

IP → 11000000 · 0000lolo · 0000lolo · 10000000

Sub → 1111111 · 1111111 · 1111111 · 11110000

And

11000000 . 00001010 . 00001010 . 10000000  
~~~~~ ~~~~~

192. 10. 10. 128

Broadcast id:-

net → 11000000 . 00001010 . 00001010 . 10000000

conf → 00000000 . 00000000 . 00000000 . 00001111

OR

11000000 . 00001010 . 00001010 . 10001111
~~~~~ ~~~~~

192. 10. 10. 143 → Ans //

⇒ no of addresses in each Subnet

$$\downarrow \\ 2^{(32-28)} = 2^4 = 16$$

$$\text{Usable addresses} = 16 - 2 = \textcircled{14}$$

↓  
because of network  
and broadcast

14 × 15 → Per Subnet usable = 210

20 employees will get internet connectivity.

$\Rightarrow$  unused addresses :-

$15 \times 16 \rightarrow$  including the network and broadcast for each Subnet

$15 \times 16 = 240$  addresses used by total 15 Subnets

$$256 - 240 = 16$$

16 address are still available for use and could be divided into a Subnet itself.

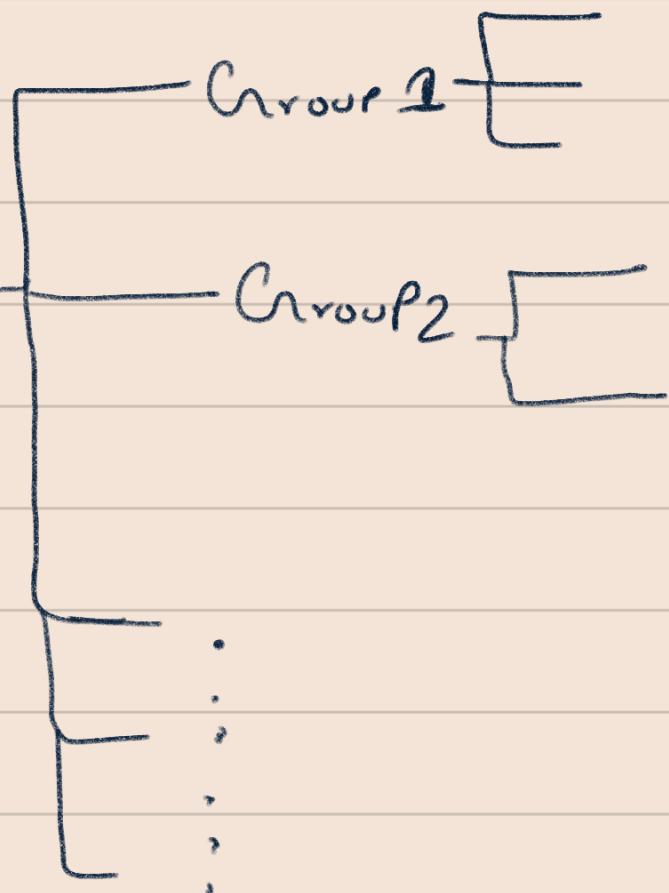
$\Rightarrow$  Subnet mask for each Subnet is same since every Subnet is being divided into equal length which is 255.255.255.240

OR

/28

Question 2:-

192.16.10.0/24



Goes on till 13

Groups.

total Subnets now will be changed  
because we are creating 5  
additional Subnets :-

$$13 + 5 = 18 \text{ Subnets}$$

$$\text{bits} = \log_2(18) = 5$$

$$\text{Updated Subnet mask} = 24 + 5 = /29$$



192.16.10.248

Group 1 design:- (Subnet 1)

⇒ net id: 192.10.10.0

IP: 11000000. 00001010. 00001010. 00000000

Sub: 11111111. 11111111. 11111111. 11111000

And

11000000. 00001010. 00001010. 00000000  
~~~~~  
~~~~~

192.10.10.0

⇒ Broadcast id:-  
~~~~~

if: 11000000. 00001010. 00001010. 00000000

Comp: 00000000. 00000000. 00000000. 00000111

OR

11000000. 00001010. 00001010. 00000111
~~~~~  
~~~~~

192.10.10.7

IP's for users:

192.10.10.1 - 192.10.10.6

\Rightarrow Subnet 2

network id:- 192.10.10.8

IP: 11000000. 00001010. 00001010. 00001000

mask :- 11111111. 11111111. 11111111. 11111000

And

11000000. 00001010. 00001010. 00001000



192.10.10.8

\rightarrow net id

Broadcast id :-

IP: 11000000. 00001010. 00001010. 00001000

compl: 00000000. 00000000. 00000000. 00000111

or

11000000. 00001010. 00001010. 00001111

192.10.10.15

\rightarrow Broadcast id

\Rightarrow Subnet 3 :-

\Rightarrow net id: 192.10.10.16

IP: 11000000. 00001010. 00001010. 00010000

mask: 11111111. 11111111. 11111111. 11111000

And

11000000 . 0000 lolo . 0000 lolo . 0001000

192 . 10 . 10 . 16

⇒ Broadcast id :-

net id : 110 . 0000 . 0000 lolo . 0000 lolo . 0001000

comp : 00000000 . 00000000 . 00000000 . 00000111

OR:

11000000 . 0000 lolo . 0000 lolo . 00010111

192 . 10 . 10 . 23 → Broad id

Group 2 :

⇒ Subnet 1 :-

⇒ network Id = 192 . 10 . 10 . 24

IP : 11000000 . 0000 lolo . 0000 lolo . 00011000

Sub : 11111111 . 11111111 . 11111111 . 11111000

Ans:

11000000 . 0000 lolo . 0000 lolo . 00011000

192 . 10 . 10 . 24

\Rightarrow Broadcast id :-

ip : 11000000 . 00001010 . 00001010 . 00011000

mask : 00000000 . 00000000 . 00000000 . 00000111

OR

11000000 . 00001010 . 00001010 . 00011111

192 . 10 . 10 . 31

ip's for users : 192 . 10 . 10 . 25 - 192 . 10 . 10 . 30

\Rightarrow Subnet 2 :-

\hookrightarrow net id = 192 . 10 . 10 . 32

net : 11000000 . 00001010 . 00001010 . 00100000

mask : 11111111 . 11111111 . 11111111 . 11111000

And :

11000000 . 00001010 . 00001010 . 00100000

\hookrightarrow 192 . 10 . 10 . 32 \rightarrow net id

\hookrightarrow Broadcast id :

net : 11000000 . 00001010 . 00001010 . 00100000

mask : 00000000 . 00000000 . 00000000 . 00000111

OR 11000000 . 00001010 . 00001010 . 00100111

192.10.10.39 → Broad id

usable IP's for users

↳ 192.10.10.33 - 192.10.10.38

⇒ Now after this the remaining 13 Subnets will have similar ranges (in terms of IP's they can accommodate) and will start from 192.10.10.40 and so on.

Question 3)

Given IP : 191.10.10.0/16

no of Subnets to be made = 100

no of IP's from this

$$2^{(32-16)}$$

$$= 65536$$

⇒ no of bits to borrow from the network address bits for making 100 Subnets

$$= \log_2 (100)$$

$$= 7$$

Updated Subnet mask = $16 + 7$

$$= 23$$



255.255.254.0

no of ip's for each Subnet



$$2^{32-23} = 2^9 = 512$$

$$512 - 2 = 500$$



usable

⇒ Subnet 1 :-

Start: 191.10.10.0, mask ≤ 23

network id:

ip: 1011111. 00001010. 00001010. 00000000

mask: 1111111. 1111111. 1111110. 00000000

And

1011111. 00001010. 00001010. 00000000



191.10.10.0 → net id

\Rightarrow Broadcast id:

comp of mask



00000000 . 00000000 . 00000001 . 11111111

net: 10111111 . 00001010 . 00001010 . 00000000

comp : 00000000 . 00000000 . 00000001 . 11111111

or

10111111 . 00001010 . 00001011 . 11111111

~~~~~

191 . 10 . 11 . 255  $\rightarrow$  Broadcast id

$\Rightarrow$  Subnet mask : 255 . 255 . 254 . 0

$\Rightarrow$  Subnet 2 :-

Start : 191 . 10 . 11 . 255 + 1

Start : 191 . 10 . 12 . 0

ip: 10111111 . 00001010 . 00001100 . 00000000

mask: 11111111 . 11111111 . 11111110 . 00000000

Ans:

10111111 . 00001010 . 00001100 . 00000000

~~~~~

192 . 10 . 12 . 0 \Rightarrow network id

\Rightarrow Broadcast id:

IP: 10111111. 00001010. 00001100. 000 000 00

MAC: 60000000. 00000000. 00000001. 111 111 11

OR

10111111. 00001010. 00001101. 11111111

191. 10. 13. 255 \rightarrow Broadcast id

\Rightarrow Subnet mask :- 255. 255. 254. 0

\Rightarrow Subnet 99:

$$512 \times (99-1) = 512 \times 98$$

= 50176 \Rightarrow offset

Base: 10111111. 00001010. 00001010. 000 000 00

50176: 00000000. 00000000. 11000100. 000 000 00

+

10111111. 00001010. 1100110. 000 000 00

