CS & IT ENGINEERING

COMPUTER NETWORKS

IPv4 Addressing

Lecture No-15

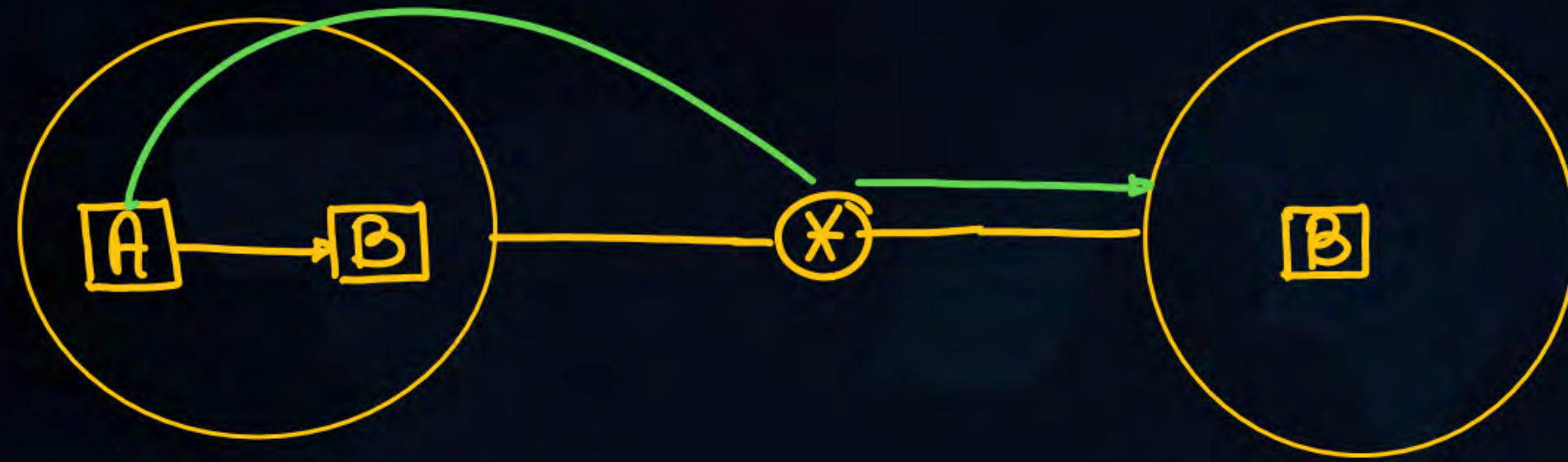By- Ankit Doyla Sir

Subnetting Category 10

$$\frac{A}{IP_A}$$
$$SM_A$$

$$\frac{B}{IP_B}$$

$$\frac{IP_A \text{ AND } SM_A}{NID_{AA}}$$

$$\frac{IP_B \text{ AND } SM_A}{NID_{BA}}$$

1. IF $\boxed{NID_{AA} = NID_{BA}}$ then A assume that B is present in the same Network.

2. IF $\boxed{NID_{AA} \neq NID_{BA}}$ then A assume that B is present in the different Network.

Q.1]

$$\underline{A}$$

$IP_A = 200 \cdot 200 \cdot 200 \cdot 15$

$SM_A = 255 \cdot 255 \cdot 255 \cdot 128$

$$\underline{B}$$

$IP_B : 200 \cdot 200 \cdot 200 \cdot 132$

$IP_A = 200 \cdot 200 \cdot 200 \cdot 00001111$

AND   AND

$\dfrac{SM_A = 255 \cdot 255 \cdot 255 \cdot 10000000}{NID_{AA} = 200 \cdot 200 \cdot 200 \cdot 0}$

$IP_B = 200 \cdot 200 \cdot 200 \cdot 10000100$

AND   AND

$\dfrac{SM_A = 255 \cdot 255 \cdot 255 \cdot 10000000}{NID_{BA} = 200 \cdot 200 \cdot 200 \cdot 128}$

$NID_{AA} \neq NID_{BA}$ so 'A' assume 'B' is Present in the different Network.

Q.2

A

$IP_A : 200.200.200.15$

$SM_A : 255.255.255.128$

B

$IP_B : 200.200.200.66$

$SM_B : 255.255.255.192$

Sol.:

$$IP_A = 200.200.200.15$$
$$AND \qquad AND$$
$$\underline{SM_A = 255.255.255.128}$$
$$NID_{AA} = 200.200.200.0$$

$$IP_B = 200.200.200.66$$
$$AND \qquad AND$$
$$\underline{SM_A = 255.255.255.128}$$
$$NID_{BA} = 200.200.200.0$$

$$IP_B = 200.200.200.01000010$$
$$AND \qquad AND$$
$$\underline{SM_B = 255.255.255.11000000}$$
$$NID_{BB} = 200.200.200.64$$

$$IP_A = 200.200.200.15$$
$$AND \qquad AND$$
$$\underline{SM_B = 255.255.255.192}$$
$$NID_{AB} = 200.200.200.0$$

$NID_{AA} = NID_{BA} = 200.200.200.0$ so 'A' assume that B is Present in the same Network.

$NID_{BB} \neq NID_{AB}$ so 'B' assume that 'A' is Present in the diFerent Network

A

$IP_A : 200.200.200.15$ ✓

$SM_A : 255.255.255.128$

$\underline{255.255.255}.\underline{1}\underline{0000000}$
    NID   SID   HID

$\dfrac{NID}{24}$ $\dfrac{SID}{1}$ $\dfrac{HID}{7}$

No. of subnet $= 2^1 = 2$

No. of Host/subnet
$= 2^7 - 2 = 126$

128
$\underset{SID}{\underline{0}}$ $\boxed{7 bit}$
        HID

128
$\underset{SID}{\underline{1}}$ $\boxed{7 bit}$
          HID

$\boxed{0 - 127}$ $\boxed{128 - 255}$

15-66

B
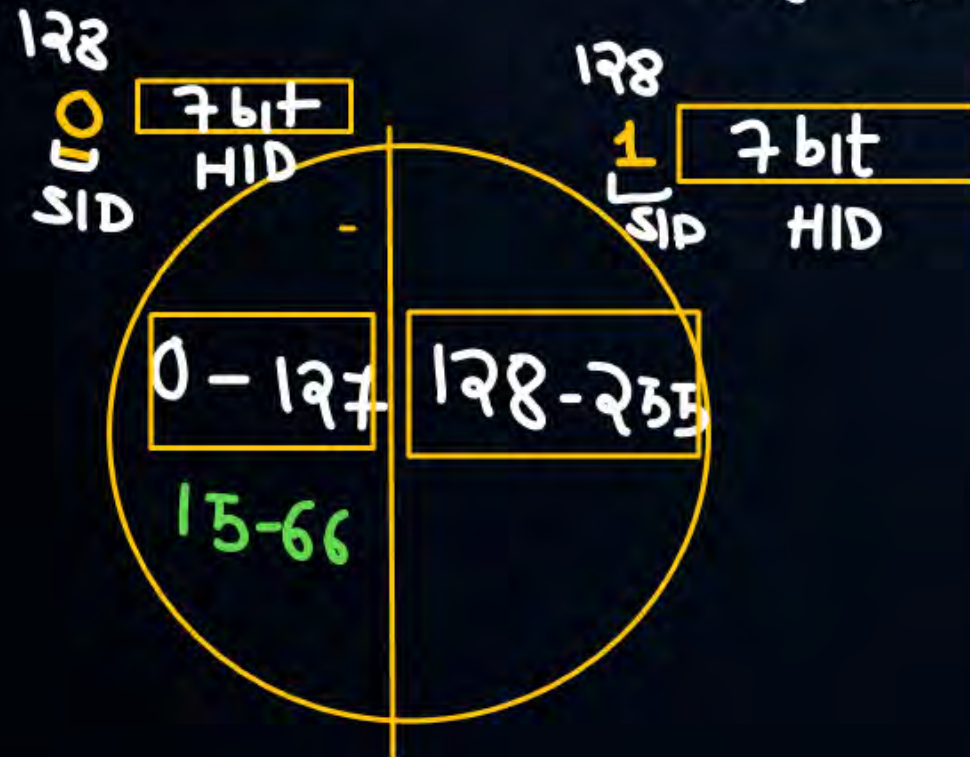
$IP_B : 200.200.200.66$ ✓

$SM_B : 255.255.255.192$

$\underline{255.255.255}.\underline{11}\underline{000000}$
    NID   SID   HID

$\dfrac{NID}{24}$ $\dfrac{SID}{2}$ $\dfrac{HID}{6}$

$2^2 = 4$ subnet

$2^6 - 2 = 62$ Host/subnet

128 64
$\underset{SID}{\underline{00}}$ $\boxed{6 bit}$
        HID

128 64
$\underset{SID}{\underline{01}}$ $\boxed{6 bit}$
        HID

0-63	64-127
15	66
128-191	192-255

128 64
$\underset{SID}{\underline{10}}$ $\boxed{6 bit}$
        HID

128 64
$\underset{SID}{\underline{11}}$ $\boxed{6 bit}$
        HID
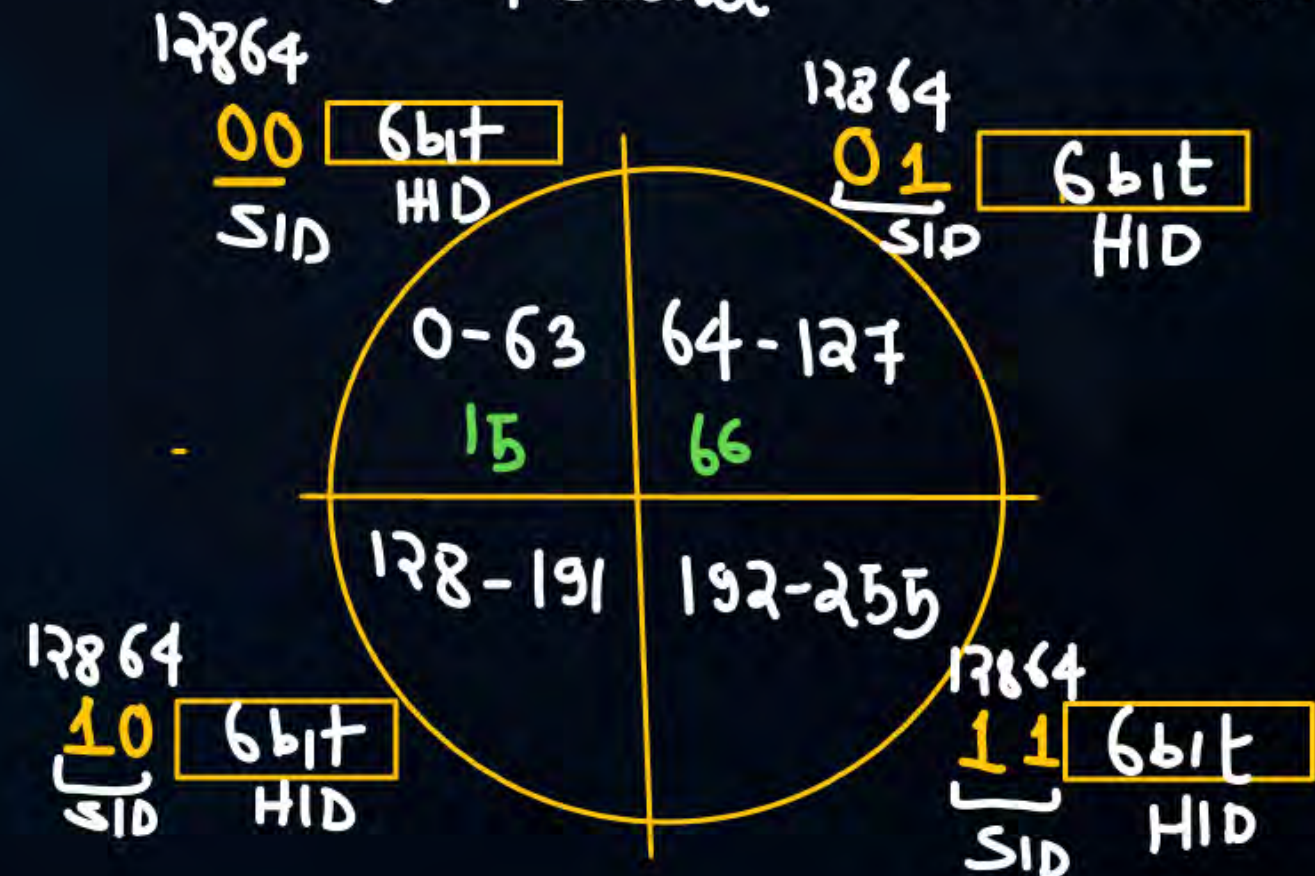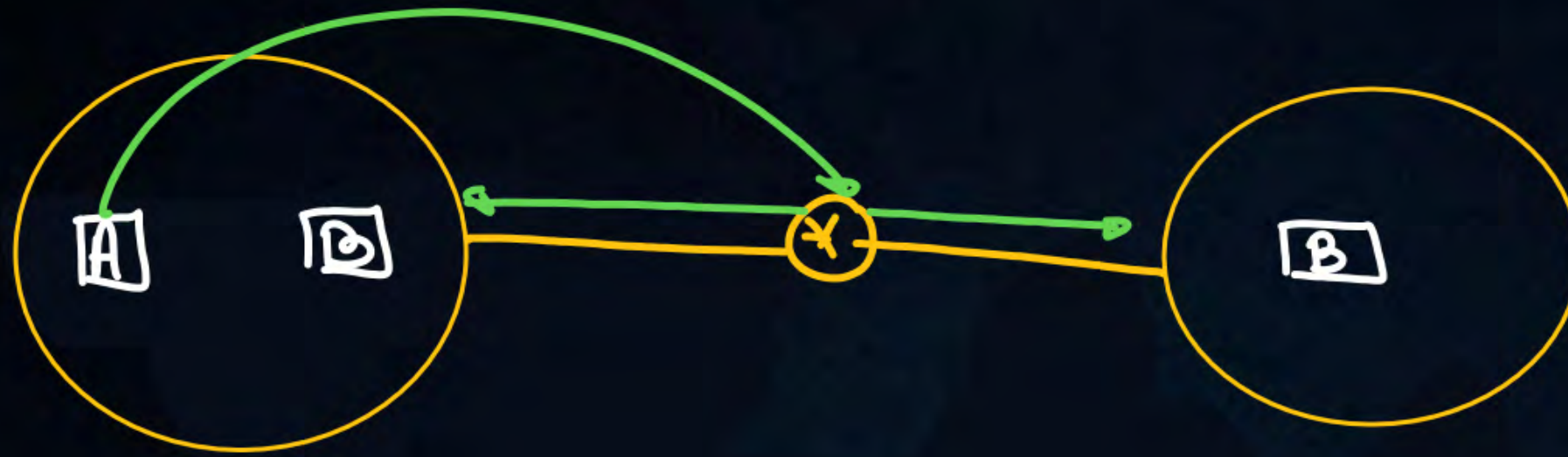
Q. Two computers C1 and C2 are configured as follows. C1 has IP address 203.197.2.53 and netmask 255.255.128.0. C2 has IP address 203.197.75.201 and netmask 255.255.192.0. which one of the following statements is true?   [GATE CS 2006]

A. C1 and C2 both assume they are on the same network

B. C2 assumes C1 is on same network, but C1 assumes C2 is on a different network

C. C1 assumes C2 is on same network, but C2 assumes C1 is on a different network

D. C1 and C2 both assume they are on different networks.

$$\underline{C_1}$$

$$IP_{C_1} : 203.197.2.53$$

$$SM_{C_1} : 255.255.128.0$$

$$\underline{C_2}$$

$$IP_{C_2} : 203.197.75.201$$

$$SM_{C_2} : 255.255.192.0$$

(P)(W)

Soln:

$$IP_{C_1} = 203.197.2.53$$
$$AND \qquad AND$$
$$\underline{SM_{C_1} = 255.255.128.0}$$
$$NID_{C_1C_1} = 203.197.0.0$$

$$IP_{C_2} = 203.197.75.201$$
$$AND \qquad AND$$
$$\underline{SM_{C_1} = 255.255.128.0}$$
$$NID_{C_2C_1} = 203.197.0.0$$

$$NID_{C_1C_1} = NID_{C_2C_1} \text{ so } C_1 \text{ Assume that } C_2 \text{ is Present in the same n/w}$$

$$IP_{C_2} = 203.197.75.201$$
$$AND \qquad AND$$
$$\underline{SM_{C_2} = 255.255.192.0}$$
$$NID_{C_2C_2} = 203.197.64.0$$

$$IP_{C_1} = 203.197.2.53$$
$$AND \qquad AND$$
$$\underline{SM_{C_2} = 255.255.192.0}$$
$$NID_{C_1C_2} = 203.197.0.0$$

$$NID_{C_2C_2} \neq NID_{C_1C_2} \text{ so } C_2 \text{ assume that } C_1 \text{ is Present in the different n/w}$$

Problem Solving on Subnetting Part – 1

Q.1 If subnet mask is 255.255.224.0 then number of subnets are:

MSQ

A. 2^{11} ✓

B. 2^5

C. 2^{15}

D. 2^3 ✓

$$\underbrace{11111111}_{\text{class-A}}.\underbrace{11111111.}_{\text{class-B}}111 00000 . 00 000000$$
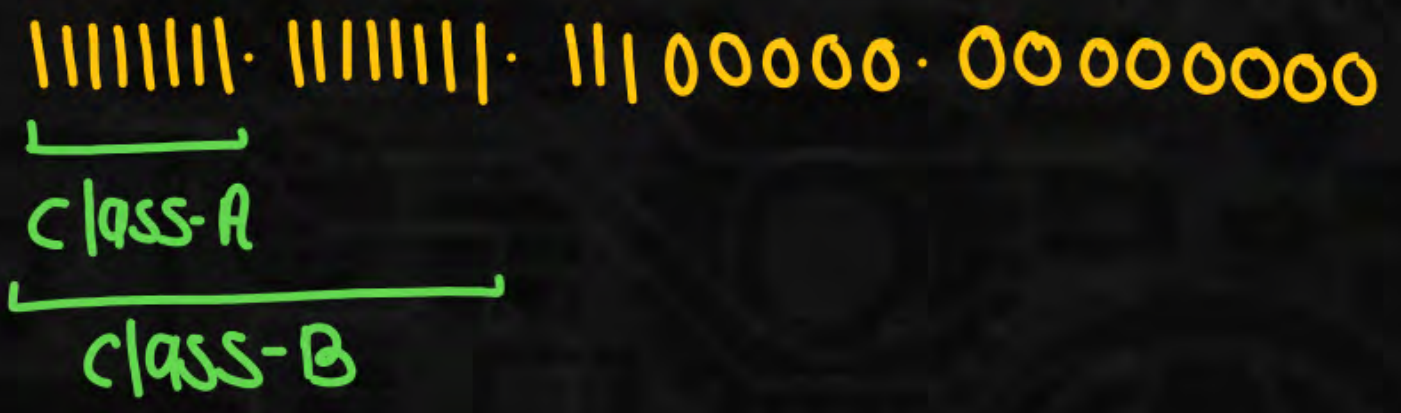
Q.2 If subnet mask is 255.255.255.192 then number of subnets are:

A. 2^{18} ✓

B. 2^5

C. 2^{10} ✓

D. 2^2 ✓

$\underbrace{||||||||}$. $||||||||$. $||||||||$. $11\underline{000000}$

$\underbrace{\qquad\qquad}_{\text{class-A}}$

$\underbrace{\qquad\qquad\qquad\qquad}_{\text{class-B}}$

$\underbrace{\qquad\qquad\qquad\qquad\qquad\qquad}_{\text{class-C}}$

HID = 6 bit
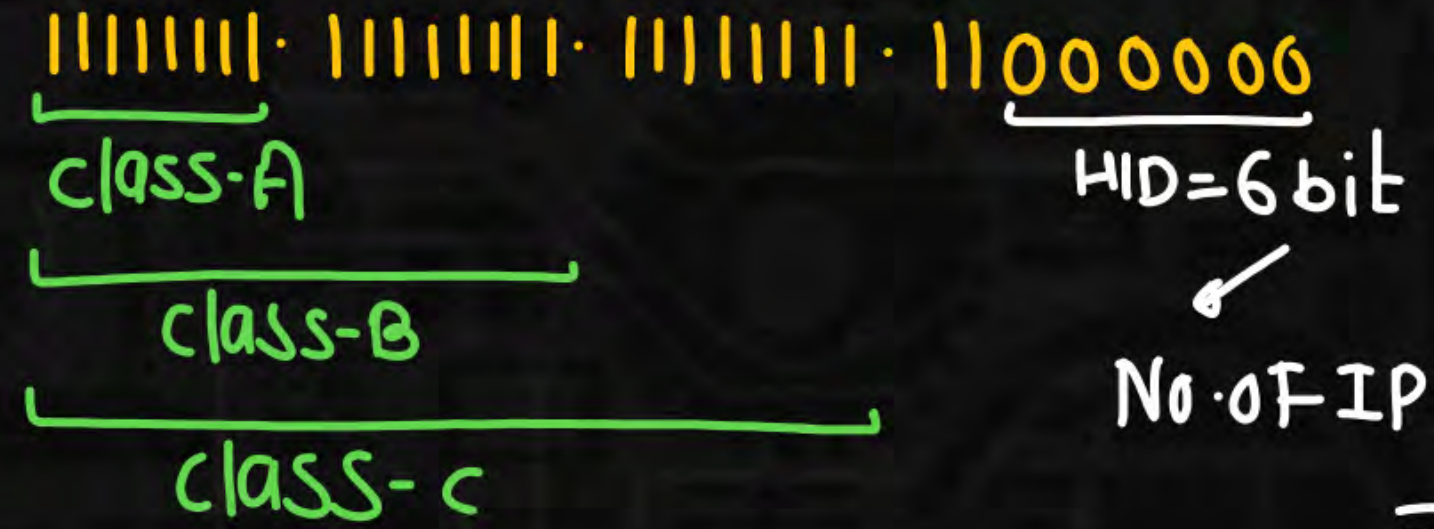
No. oF IP Add/subnet
$= 2^6$

No. oF Host/subnet
$= 2^6 - 2$

(A, C, D)

Q.3 IP address in a block= 200.200.200.60 and the subnet

$\overset{\overset{\displaystyle 32+16+8+4}{\ulcorner}}{}$

Mask = 255.255.255.224 then find

$\overset{\overset{\displaystyle 128+64+32}{\ulcorner}}{}$

(i) Subnet id = 200.200.200.32

(ii) Subnet number 2nd subnet

Sol^n: IPAdd = 200.200.200. 00111100

AND   AND

$\dfrac{SM = 255.255.255.11100000}{SID = 200.200.200.00100000}$

SID = 200.200.200.32

SID=3bit

$- - -$

$0 \overset{d}{\longleftarrow} 000 \longrightarrow 1^{st}$ subnet

$1 \longleftarrow 001 \longrightarrow 2^{nd}$ "

$2 \longleftarrow 010 \longrightarrow 3^{rd}$ "

$3 \longleftarrow 011 \longrightarrow 4^{th}$ "

$4 \longleftarrow 100 \longrightarrow 5^{th}$ "

$5 \longleftarrow 101 \longrightarrow 6^{th}$ "

$6 \longleftarrow 110 \longrightarrow 7^{th}$ "

$7 \longleftarrow 111 \longrightarrow 8^{th}$ "

SM: $\underbrace{255 \cdot 255 \cdot 255}_{\text{NID}} \cdot \underbrace{111}_{\text{SID}} \underbrace{00000}_{\text{HID}}$

$200 \cdot 200 \cdot 200 \cdot \underbrace{001}_{\text{SID}} \underbrace{11100}_{\text{HID}}$

$200 \cdot 200 \cdot 200 \cdot \underbrace{001}_{\text{SID}} \underbrace{-----}_{\text{HIP}}$

$200 \cdot 200 \cdot 200 \cdot \underline{001}\,00000 \to 200 \cdot 200 \cdot 200 \cdot 32 \ (\text{SID})$

$\text{d.val} = 1 \to 2^{nd} \text{ subnet}$

Q.4 IP address in a block= 200.200.200.$\underline{80}$ and the subnet Mask = 255.255.255.224 then find

(i) Subnet id $=\underline{200}\cdot 200\cdot 200\cdot 64$

(ii) Subnet number $=\underline{3^{rd}}$ subnet

$SM: \underbrace{255\cdot 255\cdot 255}_{NID}\cdot \underbrace{111}_{SID}\underbrace{00000}_{HID}$

$200\cdot 200\cdot 200\cdot \underbrace{010}_{SID}\ \underbrace{----}_{HID}$

$200\cdot 200\cdot 200\cdot \underbrace{\boxed{010}}\ 00000 \to 200\cdot 200\cdot 200\cdot 64\ (SID)$

$\boxed{d\cdot val = 2} \to 3^{rd}$ subnet

Q.5 IP address in a block = 200.200.200.122 and the subnet Mask = 255.255.255.240 then find

(i) Subnet id $\underline{\quad}$ = 200.200.200.112

(ii) Subnet number = $\underline{8^{th}}$ subnet

SM: $\underbrace{255 \cdot 255 \cdot 255}_{\text{NID}} \cdot \underbrace{1111}_{\text{SID}} \underbrace{0000}_{\text{HID}}$

$200 \cdot 200 \cdot 200 \cdot \underbrace{0111}_{\text{SID}} \underbrace{----}_{\text{HID}}$

$200 \cdot 200 \cdot 200 \cdot \underbrace{\boxed{0111}}_{\text{SID}} 0000 \rightarrow 200 \cdot 200 \cdot 200 \cdot 112$

d.val = 7 $\rightarrow 8^{th}$ subnet

Q.6 IP address in a block = 157.157.52.80 and the subnet ⮕ class-B

Mask = 255.255.224.0 then find

SM : 255.255.224.0

$$255.255.\underline{111}\underline{00000}.\underline{00000000}$$

NID   SID   HID

(i) Subnet id = 157.157.32.0

(ii) First host = 157.157.32.1

(iii) Last host = 157.157.63.254

(iv) Direct broadcast address = 157.157.63.255

157.157.$\underbrace{001}_{SID}$ $\underbrace{\text{----- . ----------}}_{HID}$

157.157.$\underline{001}$00000.00000000 → 157.157.32.0 (SID)

157.157.$\underline{001}$00000.00000001 → 157.157.32.1 (First Host)

157.157.$\underline{001}$11111.11111110 → 157.157.63.254 (Last Host)

157.157.$\underline{001}$11111.11111111 → 157.157.63.255 (DBA)

Q.7 IP address in a block = 157.157.5̲2.80 and the subnet ⌐class-B

Mask = 255.255.192.0 then find

SM : 255.255 . 11000000 . 00000000
                     NID   SID   HID

(i) Subnet id _____

(ii) First host _____

(iii) Last host _____

(iv) Direct broadcast address _____.

157.157. 0̲0̲ -------------------
                         HID

157.157. 0̲0̲ 000000.00000000 → 157.157.0.0 (SID)

157.157. 0̲0̲ 000000.00000001 → 157.157.0.1 (First Host)

157.157. 0̲0̲ 111111.11111110 → 157.157.63.254 (Last Host)

157.157. 0̲0̲ 111111.11111111 → 157.157.63.255 (DBA)

Q.8 IP address in a block = 100.160.50.60 and the subnet Mask = 255.252.0.0 then find

H.w

(i) Subnet id _____

(ii) First host _____

(iii) Last host _____

(iv) Direct broadcast address _____ .

Q.9 IP address in a block= 200.200.200.90 and the subnet $\leftarrow$ class-c

Mask = 255.255.255.224 then find

(i) 3rd Subnet id = 200.200.200.64

(ii) 7th Subnet id = 200.200.200.192

$$\underline{\text{AD Rule 2.0}}$$

$$\text{SID} = 3\text{ bit}$$

$$\underline{1286432}$$

3rd subnet id : 0 1 0 → 64

7th subnet id : 1 1 0 → 192

SM : 255.255.255.$\underline{111}$ $\underline{00000}$

NID   SID   HID

AD Rule 1286432

000 → 0 → 1st subnet-id

001 → 32 → 2nd "   "

010 → 64 → 3rd "   "

011 → 96 → 4th "   "

100 → 128 → 5th "   "

101 → 160 → 6th "   "

110 → 192 → 7th "   "

111 → 224 → 8th "   "

Q.10 IP address in a block= 200.200.200.90 and the subnet Mask = 255.255.255.240 then find

$$\overline{8}\,\overline{4}\,\overline{2}\,\overline{1} \qquad \overline{8}\,4\,\overline{2}\,1$$
$$0\,0\,1\,1 \qquad 0\,1\,0\,1$$

(i) 4th Subnet id $= \underline{200.200.200}.48$

(ii) 6th Subnet id $= \underline{200.200.200}.80$

SM: $\underline{\underset{NID}{255.255.255}}.\underset{SID}{\underbrace{1111}}\underset{HID}{\underbrace{0000}}$

AD Rule 2.0
$$\underline{128\,64\,32\,16}$$

4th subnet id → 0011 → 48

6th subnet id → 0101 → 80