

Assignment: 5

Date: _____

Page: _____

i) Class C network = 192.168.1.0/24 and Required no. of subnets = 25

Given,

IP address = 192.168.1.120 (class C)

Required no. of subnets = 25

a) Network address?

b) Total usable host per subnet = ?

c) Network Range = ?

d) Network address, broadcast address, valid host address for the given IP?

a). The given IP address lies in C class.

The network address = 192.168.1.0

b). Total usable host per subnet,

Step 1:- Required no. of subnets = 25
In Binary = 11001

32	16	8	4	2	1
1	1	0	0	1	

Step 2:- Resolve the required bits in the subnet mask & find the incremental value.

Here, the binary value of 25 subnets that we need

at least r network bits to fulfill the given requirement.

$$\begin{aligned}\text{Default mask} &= 255.255.255.0 \\ &= \text{11111111} \cdot \text{11111111} \cdot \text{11111111} \cdot \text{00000000}\end{aligned}$$

Then, we must convert ' r ' of the default bits (i.e. 0) to network bit (i.e. 1).

$$\begin{aligned}\text{Subnet mask} &= \text{11111111} \cdot \text{11111111} \cdot \text{11111111} \cdot \text{11110000} \\ &= 255.255.255.248\end{aligned}$$

$$\text{Incremental value} = 8$$

Step 3: Use the incremental value to find network range,

$$\begin{aligned}192.168.1.0 &- 192.168.1.7 \\ 192.168.1.8 &- 192.168.1.15 \\ 192.168.1.16 &- 192.168.1.23 \\ 192.168.1.24 &- 192.168.1.31 \\ &\vdots\end{aligned}$$

$$\text{b7. Total usable host per subnet} = 8 - 2 = 6$$

① Network Range = 192.168.1.120 - 192.168.1.127 (15th subnet)

② Network Address of given IP = 192.168.1.120

Broadcast " " " " = 192.168.1.127

Valid host IP " " " " : 192.168.1.121 to 192.168.1.126

③ Total no. of subnets = 2^{no. of extra 1's}
= 2⁵
= 32

ii) Main B network = 172.31.10.101 & Required no.

of hosts per subnet = 100

Step 1:- Determine the no. of bits = 106
Binary = 1100100

Step 2:- Resolve required bits in the subnet mask & find the incremental value.

Default mask for B = 11111111.11111111.00000000.00000000
= 255.255.0.0

Then we reserve '7' host bits & convert rest into network bits (i.e. 1)

Date:

Page:

ie Subnet mask: 11111111.11111111.11111111.10000000
255.255.255.128

Thus, we may determine the incremented value from the last network bit of subnet mask which is 128 in this case.

Step 3:- Use the increment value to find the network range.

192.31.0.0 - 192.16.0.127
192.31.0.128 - 192.31.0.255
192.31.1.0 - 192.31.1.255

(a). Network address = 192.31.0.0.

(b) Total hosts per subnet = $2^{\text{no. of 0's}}$
 $= 2^7$
 $= 128.$

Total usable hosts per subnet = $128 - 2$
 $= 126.$

(c) Network range = 192.31.10.0 - 192.31.10.127.

- (a) Network Address = 192.31.10.0
 Broadcast " = 192.31.10.255
 Valid host " = 192.31.10.1 - 192.31.10.254

- (b) Total no. of subnets = 2^8
 = 256.

- (iii) Class A network = 10.10.10.10 and Required no. of subnets = 100.

10th:-

Step 1:- Determine the no. of required subnets & convert it into binary.

\therefore Req'd no. of subnets = 100
 Binary = 1100.

Step 2:- Resolve req'd bits in the subnet mask & find the incremental value.

Here, the binary value of 100 subnets that we need atleast 7 network bits to fulfill the given requirement.

Default mask for A address = 255.0.0.0
 = 11111111.00000000.00000000.00000000.

Page: _____
Then, we must convert '7' of the client bit (ie. 0) to network bit (ie 1).

Subnet mask = 11111111. 11111111. 00000000. 00000000
 $= 255. 255. 0. 0$

Thus, we determine the incremental value from the last network bit of subnet mask which is 2 in this case.

Step 2:- Use the incremental value to find the network ranges. Here, we start with the network address for the given IP range.

10.0.0.0	10.1.255.255
10.2.0.0	10.3.255.255
10.4.0.0	10.5.255.255

(a) Network Address: 10.0.0.0

(b) Total hosts per subnet: 2^{17}
 $= 131072$

Usable hosts per subnet: $131072 - 2$
 $= 131070$

① Network Address Range: 10.10.0.0 . . .

② Network Range: 10.10.0.0 - 10.11.255.255 .

③ Network address: 10.10.0.0 .

Broadcast address: 10.11.255.255 .

Valid host " = 10.10.1.1 - 10.11.254.254 .

④ Total no. of subnets: 2⁸
= 128 .

2) If 2 devices A and B are assigned with address:

Device A: 172.16.17.30/20

Device B: 172.16.28.15/27 .

i) Determine the subnet each address belongs to .
ii) Calculate the total no. of usable host address for each subnet .

★ -) sol'n:- Device A: 172.16.17.30/20

Device B address: 172.16.17.30

Default mask = /16

$$= 255.255.0.0$$

$$= 1111111.1111111.00000000.00000000$$

Incremental value: ~~16~~

Subnet mask: 120

$$= 1111111.1111111.11110000.00000000$$

$$= 255.255.240.0$$

Incremental value: 16.

Using the incremental value to find network ranges. Here, we start with the network address for the given "n".

$$172.16.0.0 \quad - \quad 172.16.15.255$$

$$172.16.16.0 \quad - \quad 172.16.31.255$$

$$172.16.32.0 \quad - \quad 172.16.47.255$$

i) The address 172.16.17.30 belongs to,
2nd subnet: 172.16.16.0 - 172.16.31.255

ii) Total no. of usable host address for each subnet: 2^{12}
 $= 4096 - 2$
 $= 4094$

* Device B: 172.16.28.15/22
 Class B address: 172.16.28.15
 Default mask of B class: /16
 $= 255.255.0.0$
 $= 11111111.11111111.00000000.00000000$

Subnet mask: /22
 $= 11111111.11111111.11110000.00000000$
 $= 255.255.252.0$

Incremental value: 4

By using incremental value, we start with the network address for the given IP.

172.16.0.0 - 172.16.3.255
 172.16.4.0 - 172.16.7.255
 172.16.8.0 - 172.16.11.255

i) The address 172.16.28.15 belongs to 8th subnet:
 172.16.28.0 - 172.16.31.255

ii) Total no. of usable host ^{for} each subnet: $2^{\text{no. of 0's}} - 2$
 $= 2^{10} - 2$
 $= 1022$

3) Given the IP Address $200.200.1.64/27$ find the network and broadcast address of the subnetwork in which the given IP address belongs. Also, find the total # usable hosts in that subnetwork.

→ Given,

Class C Address: $200.200.1.64/27$

• Default Mask of class C: $11111111.11111111.11111111.00000000$
 $= 255.255.255.0$

Subnet Mask: 27 .

This means we need to convert 3 host bits into network bits.

Subnet mask becomes: $11111111.11111111.11111111.11000000$
 $= 255.255.255.224$

Increment value: 32

Using the incremental value to find network ranges. Here we start with the network address for the given IP.

$200.200.1.0 - 200.200.1.31$
 $200.200.1.32 - 200.200.1.63$
 $200.200.1.64 - 200.200.1.95$

The given IP Address belongs to 3rd subnet,
 $200.200.1.64 - 200.200.1.95$

Network Address = $200.200.1.64$

Broadcast " = $200.200.1.95$

Total host = 25 = 32

Usable host address = 25

$$= 32 - 2$$

$$= 30$$

Ans. D

Page: _____

a) Design even subnets from an IP 192.168.10.0
 calculate the subnet mask, number of
 valid hosts per network and broadcast
 address. Demonstrate the results in the
 table below like this.

→ Soln:-

8/4/11

IP = 192.168.10.0

Reqd no. of subnets = 7

Step 1:- In Binary = 111

Step 2:- The binary value of 7 subnet tells
 us that we need atleast 3 network bits
 to fulfill the given requirement.

Default mask (for class C) = 11111111.11111111.11111111.00000000
 = 255.255.255.0

Borrowing '3' of default bits to network bits.
 Subnet mask: 11111111.11111111.11111111.11000000
 = 255.255.255.224.

We determine the incremental values from the
 last network bit of subnet mask
 which is 32 in this case.

$$\begin{aligned}\text{No. of valid host: } 2^{\text{no. of 0's}} - 2 \\ = 25 - 2 \\ = 30\end{aligned}$$

Step 3: Using the incremental value to find network ranges, we start with the network address for the given IP.

S.N	Subnet ID	Valid Host Range	Broadcast Address.
1.	192.168.10.0	192.168.10.1 - 192.168.10.30	192.168.10.31
2.	192.168.10.32	192.168.10.33 - 192.168.10.62	192.168.10.63
3.	192.168.10.64	192.168.10.65 - 192.168.10.94	192.168.10.95
4.	192.168.10.96	192.168.10.97 - 192.168.10.126	192.168.10.127
5.	192.168.10.128	192.168.10.129 - 192.168.10.158	192.168.10.159
6.	192.168.10.160	192.168.10.161 - 192.168.10.190	192.168.10.191
7.	192.168.10.192	192.168.10.193 - 192.168.10.222	192.168.10.223
8.	192.168.10.224	192.168.10.225 - 192.168.10.254	192.168.10.255

8) Suppose a company has 7 departments. You are given an IP address 192.168.18.0 from your ISP. Each department in your company is requiring 28 computers working with internet. As a network engineer how do you assign a unique network address, broadcast address & range of host IP for each department.

→ Solution:

Required:

7 department each requires 28 computers working with internet.

To support 28 hosts,
we need atleast: $28 + 2$
 $= 30 \text{ IP's}$

$32/16/8/4/2/1$

We need 30 clients,
so converting it in Binary: 11110

The binary value of 30 client tells us that we need at least 5 host-bits to fulfill the given requirement.

Default Mask (r) = 11111111.11111111.11111111.00000000.

Date: _____

Page: _____

Then, we have to reserve atleast 5 '1's' host bits
& convert rest into network bits (i.e. 1)

Subnet Mask = 11111111.11111111.11111111.11100000
= 255.255.255.224

Now, divide the meaningful value 32 to find
network ranges with unique network
address & broadcast address for each dep-
artment. We start with given IP n/w address.

S.N	Network Address	Valid Range (Host IP)	Broadcast Address
1.	192.168.18.0	192.168.18.1 - 192.168.18.30	192.168.18.31
2.	192.168.18.32	192.168.18.33 - 192.168.18.62	192.168.18.63
3.	192.168.18.64	192.168.18.65 - 192.168.18.94	192.168.18.95
4.	192.168.18.96	192.168.18.97 - 192.168.18.126	192.168.18.127

67. Given IP address 156.154.81.56/26, calculate
the total IP address, usable IP address,
the subnet mask, network address & broad-
cast address.
-1 point-

IP address = 156.154.81.56/26 (class B)

Subnet mask: /26

= 11111111.11111111.11111111.11000000

= 255.255.255.192

The increment value = 64

With the help of incremental value '64' we
can find the network ranges. By adding
the incremental value to the network address
of the given IP.

156.154.0.0 - 156.154.0.63

156.154.0.64 - 156.154.0.127

156.154.0.128 - 156.154.0.191

156.154.0.192 - 156.154.0.255

Date: _____

Page: _____

i) Total IP Address = $2^{n_0} \times 2^{n_1} \times 2^{n_2} \times 2^{n_3}$
 $= 2^6 = 64$.

ii) The subnet mask = 255.255.255.192.

iii) 156.154.81.56 lies in . . .

Range,

156.154.81.0 - 156.154.81.63

Broadcast address = 156.154.81.63

Network address = 156.154.81.0.

Date: _____
Page: _____
7). Consider that your institution is planning to design a network with 3 different sub-networks proposed for students, faculty, and staff. Suppose that one of the assigned IP address is 192.16.1.101, determine the network address, subnet mask, total usable hosts in each subnet, and the broadcast address for each of the sub-network.

-) soln:-

Given IP = 192.16.1.101 (class B)

Default Mask of class B: 11111111.11111111.00000000.00000000
= 255.255.0.0

Req^d subnets = 3

Binary = 11

This tells us, we need atleast 2 network bits to fulfill the given requirements.

i.e. subnet mask = 11111111.11111111.11000000.00000000
= 255.255.192.0

Incremental value = 64

To find the range, now we use incremental value on the Network Address of given IP.

Network Address { 172.16.0.0 - 172.16.63.255 } - Broadcast Address.
 172.16.64.0 - 172.16.127.0
 172.16.128.0 - 172.16.191.255

The IP Address 172.16.1.16

(i) Falls on the range 172.16.0.0 - 172.16.63.255

(ii) Network Address = 172.16.0.0

(iii) Total usable host in each subnet = $2^m - 2$
 $= 16382.$

Range of usable host.

172.16.0.1 - 172.16.63.254

172.16.64.1 - 172.16.127.254

172.16.128.1 - 172.16.191.254

2) A company uses the IP address 197.20.64.10.
 a. what does it mean? Explain in brief about all the factors related with it.
 -) soln:-

Here the given IP address is 197.20.64.10/9
 (This is different case as it is class C address and subnet address value is less than 24).

Now, Address in Binary = 197.20.64.10
 = 11000101.01001100.01000000.00001010

Given Network = /9 \Rightarrow 11111111.10000000.00000000.00000000
 \Rightarrow 255.128.0.0

So, the network address can be resolved by LOGICAL AND operation betⁿ the address & the network.

i.e. 11000101.01001100.01000000.00001010
 11111111.10000000.00000000.00000000

Network Address \geq 11000101.00000000.00000000.00000000
 = 197.0.0.0

The subnet block size (or the network size) is determined a value of the left bit position in the subnet mask.

2. 111111. 40000000 - 60000000 - 00000000
118.

Thus,

105,
The Network Address: 197. 0.0.0

The Broadcast " - 197-127-255-255

Host Minimum = 197.0.0.1

Host Maximum = $197 \cdot 197 \cdot 255 \cdot 254$

Total Herb per Subst. 2^{nd} of Oct = 2²³
= 838860 ft.

Total valid host (subnet) = $2^{n-2} = 2^{23-2} = 8388606$

Q7. What is subnetting? calculate total no. of usable IP from given IP 75.35.162.128/27.

- Subnetting is the process of dividing a larger IP network into smaller sub-networks (subnets), each with its own network prefix & host range.

- Allow efficient use of address, less broadcast traffic for better performance, improved security via isolation, simpler management & troubleshooting & optimized routing with smaller routing tables.

IP: 75.35.162.128/27 (class A)

Default mask of class A: 11111111.00000000.00000000.00000000
= 255.0.0.0

Subnet mask: /27

= 11111111.11111111.11111111.11100000
= 255.255.255.224.

Incremental value: 32

Total host: 25 = 32

Usable host: 32 - 2 = 30