

1. Find subnet mask and complement subnet mask from the IP address 175.231.232.116/27

Solution:

Here, $n = \text{CIDR} = 27$

Network bit = 27

Host bit = $32 - n$

= $32 - 27$

= 5

So, Subnet Mask = 11111111.11111111.11111111.11100000

= 255.255.255.224

And, Complement Subnet Mask

= 00000000.00000000.00000000.00011111

= 0.0.0.31

2. Find Network address / IP address / First address of the Network or Network subnet ID from above IP address

Rule 1: ANDing given IP address with subnet mask (as bits are changed in the 4th octet, we only consider 4th octet here)

4th octet of given IP address (in binary) = 01110100

4th octet of subnet mask (in binary) = 11100000 ANDing we get = 01100000 = 96 So, Network Address = 175.231.232.96

Rule 2: Making host bits into zero of the given IP address

Here, host bit exists = $32 - 27 = 5$

and, given IP address's 4th octet = 116 = 01110100

converting host bits into zero we get = 01100000 = 96

So, Network Address = 175.231.232.96

3. Finding Broadcast Address

Rule 1: ORing given IP address with Complement Subnet mask (as bits are changed in the 4th octet, we only consider 4th octet here)

4th octet of given IP address (in binary) = 01110100

4th octet of Complement subnet mask (in binary) = 00011111 ORing we get = 01111111 = 127

So, Broadcast Address = 175.231.232.96

Rule 2: Making host bits into '1' of the Above Network address

Here, 4th octet of Network address = 01100000

So, host bit exists = $32 - 27 = 5$

converting host bits into '1' we get = 01111111 = 127

So, Broadcast Address = 175.231.232.127

4. Find First address and Last address

Here, Network address = 175.231.232.96

So, First Valid host = 175.231.232.97

And, here Broadcast address = 175.231.232.127

Last Valid host = 175.231.232.126

5. An organization has an IP address 192.168.1.0/24, It should divide this address such that
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HQ LAN1 has 50 hosts

HQ LAN2 has 50 hosts

Sales LAN1 has 30 hosts

Sales LAN2 has 30 hosts

IT LAN1 has 12 hosts

IT LAN2 has 8 hosts

Now calculate subnetting and find the network address, subnet mask, valid IP range, Broadcast address using VLSM

Solution:

Host	Network address	Host Range	Broadcast address	Subnet mask
50	192.168.1.0	Bit needed for 50 hosts are = 6 (as $2^6 = 64$ and $0 + 64 = 64$), So Host Range will be 192.168.1.1 to 192.168.1.62	192.168.1.63	Here, host bit = 6, So, making host bits Into zero we get Subnet mask = 255.255.255.192 Another way, here Network bits = $32 - 6 = 26$, So, CIDR = /26 and we say Full form = 192.168.1.0/26
50	192.168.1.64	192.168.1.65 to 192.168.1.126	192.168.1.127	255.255.255.192
30	192.168.1.128	192.168.1.129 to 192.168.1.158	192.168.1.159	255.255.255.224
30	192.168.1.160	192.168.1.161 to 192.168.1.190	192.168.1.191	255.255.255.224
12	192.168.1.192	192.168.1.193 to 192.168.1.206	192.168.1.207	255.255.255.240
8	192.168.1.208	192.168.1.209 to 192.168.1.222	192.168.1.223	255.255.255.240

6. An IP address 192.168.10.0/23, Find –

Subnet Mask

Unique ID (host) number

Broadcast ID

Last usable host address

Solution:

Here, CIDR = 23

11111111.11111111.11111110.00000000

=255.255.254.0

So, Subnet Mask = 255.255.254.0 (**Ans - 1**)

From CIDR we get host bit = $32 - 23 = 9$

So, Total Host = $2^9 = 512$

So, Unique or Usable Host = $512 - 2 = 510$ (**Ans - 2**)

(Because first host address is Network address and last host address is Broadcast address, these 2 host address is not used)

Now, to find Broadcast address we have to find Network address at First. We see that there is a change in 3rd and 4th octet of subnet mask.

So, we have to work with 3rd and 4th octet of the IP address.

3rd and 4th octet of Given IP = 10.0 = 00001010.00000000

3rd and 4th octet of subnet mask = 254.0 = 11111110.00000000

Now, To Find Network address –

ANDing the IP address with subnet mask we get

Network address's 3rd and 4th octet = 00001010.00000000

= 10.0

So, Network address = 192.168.10.0

(By chance, here Given IP address and Network address is same, it happens for CIDR 23, if CIDR changed, it will not remain same)

Now, From CIDR we know, here host bit = $32 - 23 = 9$

So, to get Broadcast address, we will make last 9 bits of Network address into 1 (here in 3rd and 4th octet)

So, 3rd and 4th octet of Broadcast address will be

= 00001011.11111111

= 11.255

So, Broadcast address = 192.168.11.255 **(Ans - 3)**

So, from the above discussion we get-

Network address = 192.168.10.0

So, First usable host address = 192.168.10.1

We also get above, Broadcast address = 192.168.11.255

So, Last usable host address = 192.168.11.254 **(Ans - 4)**

7. From this IP address 192.168.10.2/28, Answer the following questions consider IPV4 address -

Subnet Mask

Network address

Broadcast address

First Network address

Last Network Address

Solution:

Subnet Mask

= 11111111.11111111.11111111.11110000

= 255.255.255.240 **(Ans - 1)**

We get change in 4th octet of subnet mask

4th octet of IP = 0 = 00000010

4th octet of subnet mask = 11110000

ANDing 4th octet of IP with subnet mask

we get 00000000 = 0,

So, Network address = 192.168.10.0 **(Ans - 2)**

Here, CIDR = 28

So, making last $(32 - 28) = 4$ bits into 1 of network address

We get 00001111 = 15

So, broadcast address = 192.168.10.15 **(Ans - 3)**

First address is the next immediate address of Network address

So, First address = 192.168.10.1 **(Ans - 4)**

Last address is the prior immediate address of Broadcast address

So, Last address = 192.168.10.14 **(Ans - 5)**

8. In the following IP address 172.20.0.0/27, find how many subnets and hosts per subnet?

Solution:

Here, given IP address = 172.20.0.0

= 172.20.0.00000000

Subnet Mask = 11111111.11111111.11111111.11100000

=255.255.255.224

(Technique: $11100000 = (2^3 - 1) * 2^5 = 7 * 32 = 224$)

From 4th octet of subnet mask we get Network bit = 3 and host bit = 5

So, Number of subnet = $2^3 = 8$ **(Ans -1)**

And hosts per subnet = $2^5 = 32$

And, valid host per subnet = $32 - 2 = 30$ **(Ans -2)**

Extra: (If ask to find Network, Broadcast address)

ANDing Given IP address with subnet mask we get

Network address = 172.20.0.0

Converting last $(32 - 27) = 5$ bits of Network address into 1 we get

Broadcast address = 172.20.0.00011111

= 172.20.0.31

Extra: if ask how many connections is possible in this network?

Ans: The valid number of hosts is the answer; here in this math we can say it is 30

9. Find subnet of 172.16.2.1/22 which will be applicable for your office room having 50 and 23 PCs. Also find the first and last usable IP addresses along with broadcast address

Solution:

Subnet mask

= 11111111.11111111.11111100.00000000

Given IP address

= 172.16.00000010.00000001

So, Network address (By ANDing)

= 172.16.00000000.00000000

= 172.16.0.0

For 50 PCs

We need minimum 6 bits for hosts (as $2^5 = 32$ but $2^6 = 64$)

So, Network address

= 172.16.0.0

First valid host address

= 172.16.0.1

Last valid host address

= 172.16.0.62

Broadcast address

= 172.16.0.63

For 23 PCs

We need minimum 5 bits for hosts (as $2^4 = 16$ but $2^5 = 32$)

So, Network address

= 172.16.0.64

(the next address of previous 50 PCs broadcast address)

First valid host address

= 172.16.0.65

Last valid host address

= 172.16.0.94

Broadcast address

= 172.16.0.95

10. A network address is given 172.18.10.0/23, divide this network address into 4 subnets and find every subnet address, start address, subnet mask, broadcast address etc.

Solution:

As we should divide the given network address into 4 subnets, we have to find a fixed CIDR for this operation.

Here, total hosts = $2^{(32-23)} = 2^9 = 512$

Now, $512/4 = 128$

We can write $2^7 = 128$

We see, every subnet block will have 128 hosts.

So, our network bit will be $(32-7) = 25$

So, our new CIDR or subnet prefix = /25

1st Subnet:

Subnet address = 172.18.10.0/25

Start address = 172.18.10.1

Subnet mask = 255.255.255.128 (as new CIDR = \25, and $2^7 = 128$)

Broadcast address = 172.18.10.127

2nd Subnet:

Subnet address = 172.18.10.128/25

Start address = 172.18.10.129

Subnet mask = 255.255.255.128 (as new CIDR = \25, and $2^7 = 128$)

Broadcast address = 172.18.10.255

3rd Subnet:

Subnet address = 172.18.11.0/25 (as 4th octet is filled up in previous subnet block, so 3rd octet is changed)

Start address = 172.18.11.1

Subnet mask = 255.255.255.128 (as new CIDR = \25, and $2^7 = 128$)

Broadcast address = 172.18.11.127

4th Subnet:

Subnet address = 172.18.11.128/25

Start address = 172.18.11.129

Subnet mask = 255.255.255.128 (as new CIDR = \25, and $2^7 = 128$)

Broadcast address = 172.18.11.255

11. Given IP address 211.17.180.0/24, Administrator wants to divide it into 32 subnets, so what will be the subnet mask and how many hosts belongs to every subnet, what is the first and last address of 1st and last subnet address?

Solution:

As we should divide the given network address into 32 subnets, we have to find a fixed CIDR for this operation.

Here, total hosts = $2^{(32-24)} = 2^8 = 256$

Now, $256/32 = 8$

We can write $2^3 = 8$

We see, every subnet block will have 8 hosts.

So, our network bit will be $(32-3) = 29$

So, our new CIDR or subnet prefix = /29

So, subnet mask

255.255.255.11111000

=255.255.255.248 (**Ans -1**)

1st subnet:

Host number per subnet = $2^3 - 2 = 6$ (**Ans -2**)

First address = 211.17.180.1 (**Ans -3**)

Last address = 211.17.180.6 (**Ans -4**)

Last subnet:

Host number per subnet = $2^3 - 2 = 6$ (**Ans -5**)