For example: For the network address: 192.168.10.0/25

Here,

- Network address (class-C): 192.168.10.0
- Subnet mask (Dotted decimal): 255.255.255.128
- Subnet mask (Binary): 11111111 11111111 11111111 10000000

Now,

- Number of subnet (networks) = $2^1 = 2$
- Starting IP of valid subnets = 256-128 = 128 (Thus, next subnet start from 128 i.e. two networks are: 192.168.10.0 and 192.168.10.128)
- Number of hosts per subnet = $2^7 = 128$ (Here, 7 represent the number of zeros on last block of binary subnet mask)
- Number of valid host IP per subnet = $2^7 - 2 = 128 - 2 = 126$ (Since, the first IP address is reserved as network address and last is for broadcast)

For example: For the network address: 192.168.0.0/30

Here,

- Network address (class-C): 192.168.0.0
- Subnet mask (Dotted decimal): 255.255.255.252
- Subnet mask (Binary): 11111111 11111111 11111111 11111100

Now,

- Number of subnet (networks) = $2^6 = 64$
- Starting IP of valid subnet = 256-252 = 4 (now take the multiple of 4 in increasing way and thus we can find 64 addresses)
- Number of hosts per subnet = $2^2 = 4$ (Here, 2 represent the number of zeros on last block of binary subnet mask)
- Number of valid host IP per subnet = $2^2 - 2 = 4 - 2 = 2$ (Since, the first IP address is reserved as network address and last is for broadcast)

Thus,

Network	IP assignment
First Network	• Network address: 192.168.0.0/30 • Valid IP for host -1: 192.168.0.1/30 • Valid IP for host -2: 192.168.0.2/30 • Broadcast address: 192.168.0.3/30
Second network	• Network address: 192.168.0.4/30 • Valid IP for host -1: 192.168.0.5/30 • Valid IP for host -2: 192.168.0.6/30 • Broadcast address: 192.168.0.7/30

For example: A given class-C IP address is 192.168.0.0. Now make 6-subnets for that network.

Method-1: If we do not specify exactly 6-subnets

The given IP address is: 192.168.0.0 of class-C

Thus, the given mask: 11111111 11111111 11111111 00000000

Now, using sub-netting as: 192.168.0.0/27

Hence, the new mask: 11111111 11111111 11111111 11100000

Thus, the total number of subnets = $2^3 = 8$ and total number of hosts = $2^5 = 32$ (only 30 are valid for each subnets). Now, the possible 8-subnets can be listed as followed which any 6-subnets can be used.

Subnet no.	Starting IP address	Valid IP addresses (first and last are not used)	Total valid hosts per subnets
1.	192.168.0.0/27	192.168.0.1/27 to 192.168.0.30/27	30
2.	192.168.0.32/27	192.168.0.33/27 to 192.168.0.62/27	30
3.	192.168.0.64/27	192.168.0.65/27 to 192.168.0.94/27	30
4.	192.168.0.96/27	192.168.0.97/27 to 192.168.0.126/27	30
5.	192.168.0.128/27	192.168.0.129/27 to 192.168.0.158/27	30
6.	192.168.0.160/27	192.168.0.161/27 to 192.168.0.190/27	30
7.	192.168.0.192/27	192.168.0.193/27 to 192.168.0.222/27	30
8.	192.168.0.224/27	192.168.0.225/27 to 192.168.0.254/27	30

Method-2: If we have to make exactly 6-subnets then we must use the VLSM

Using Variable Length Subnet Mask (VLSM) we can use variable masking proced
Thus, first of all we can divide the given IP address 192.168.0.0/24 into two subnets
192.168.0.0/25 and then we can divide the first network into two subnets as 192.168.0.0
and second into four subnets as 192.168.0.128/27. This can be listed as:

Given IP: 192.168.0.0/24	S1: 192.168.0.0/25	S1.1: 192.168.0.0/26	62-valid hosts from 1 to 62
		S1.2: 192.168.0.64/26	62-valid hosts from 65 to 126
	S2: 192.168.0.0/25	S2.1: 192.168.0.128/27	30-valid hosts from 129 to 158
		S2.2: 192.168.0.160/27	30-valid hosts from 161 to 190
		S2.3: 192.168.0.192/27	30-valid hosts from 193 to 222
		S2.4: 192.168.0.224/27	30-valid hosts from 225 to 254

For example: Design IPV4 sub network for an organization having 16, 48, 61, 32 and 24 computers in each departments. Use 192.168.5.0/24 to distribute the network.

Solution:

Step 1: Arrange the given requirements in descending order.

61, 48, 32, 24, 16

Step 2: Calculate no. of host bits (x) for the highest requirement i.e. $2^x > 61$

Here, x= 6

Step 3: Write the given network address in binary format and mark host bits and subnet bits i.e

192.168.5.00000000

Here, last 6 bits (underlined) are host bits and remaining two bits are subnet bits.

So, Total no. of hosts = $2^6 = 64$

Total no. of sub networks = $2^2 = 4$

New subnet mask = /26 [old subnet mask (24) + no. of sub network bits used (2)]

First Sub network is: 192.168.5.0/26

Second Sub network is: 192.168.5.64/26 [Add total no. of hosts in last block]

Third Sub network is: 192.168.5.128/26

Fourth Sub network is: 192.168.5.192/26

Step 4: Assign these sub networks to the given departments.

Now, **For Department with 61 hosts,**

Network ID= 192.168.5.0/26

Valid host range = 192.168.5.1/26 to 192.168.5.62/26

Broadcast Address = 192.168.5.63/26

Now, For Department with 48 hosts,
Network ID= 192.168.5.64/26
Valid host range = 192.168.5.65/26 to 192.168.5.126/26
Broadcast Address = 192.168.5.127/26

Now, For Department with 32 hosts,
Network ID= 192.168.5.128/26
Valid host range = 192.168.5.129/26 to 192.168.5.190/26
Broadcast Address = 192.168.5.191/26
If we assign fourth sub network for the department with 24 hosts, there will be maximum loss of IP addresses. So, divide it into two sub networks. (Repeat steps 2 to 4)
Given Network is = 192.168.5.192/26
192.168.5.11000000
No. of host bits = 5
No. of Sub network bits = 1
New Subnet mask = /27
First Sub network is: 192.168.5.192/27
Second Sub network is: 192.168.5.224/27

Now, For Department with 24 hosts,
Network ID= 192.168.5.192/27
Valid host range = 192.168.5.193/27 to 192.168.5.222/27
Broadcast Address = 192.168.5.223/27

Now, For Department with 16 hosts,
Network ID= 192.168.5.224/27
Valid host range = 192.168.5.225/27 to 192.168.5.254/27
Broadcast Address = 192.168.5.255/27

For example: Design IPV4 network for an organization having 800, 1000, 600, 300 and 500 computers in each departments. Use 192.168.0.0/24 to distribute the network.
Solution:
Step 1: Arrange the given requirements in descending order.
1000, 800, 600, 500, 300

Step 2: Calculate no. of host bits (x) for the highest requirement i.e. $2^x > 1000$
Here, x= 10

Step 3: Write the given network address in binary format and mark host bits and network bits.

i.e. 192.168.000000 00.00000000

Here, last ten bits (underlined) are host bits and remaining six bits are network bits.

So, Total no. of hosts = 2^{10} = 1024

Total no. of networks = 2^6 = 6 4

New subnet mask = /22 [old subnet mask (24) - no. of network bits borrowed for hosts (2)]

First network is: 192.168.0.0/22

Second network is: 192.168.4.0/22

Third network is: 192.168.8.0/22

Fourth network is: 192.168.12.0/22

... ...

Sixty Fourth network is: 192.168.252.0/22

Step 4: Assign these networks to the given departments.

Now, For Department with 1000 hosts,

Network ID= 192.168.0.0/22

Valid host range = 192.168.0.1/22 to 192.168.3.254/22

Broadcast Address = 192.168.3.255/22

Now, For Department with 800 hosts,

Network ID= 192.168.4.0/22

Valid host range = 192.168.4.1/22 to 192.168.7.254/22

Broadcast Address = 192.168.7.255/22

Now, For Department with 600 hosts,

Network ID= 192.168.8.0/22

Valid host range = 192.168.8.1/22 to 192.168.11.254/22

Broadcast Address = 192.168.11.255/22

If we assign fourth network for the department with 500 hosts, there will be maximum loss of IP addresses. So, divide it into two sub networks. (Repeat steps 2 to 4)

Given Network is = 192.168.12.0/22

192.168.00001100.00000000

No. of host bits = 9

No. of Sub network bits = 1 $2^1 = 2$

New Subnet mask = /23

First Sub network is: 192.168.12.0/23

Second Sub network is: 192.168.14.0/23

Now, For Department with 500 hosts,

Network ID= 192.168.12.0/23

Valid host range = 192.168.12.1/23 to 192.168.13.254/23
Broadcast Address = 192.168.13.255/23

Now, For Department with 300 hosts,
Network ID= 192.168.14.0/23
Valid host range = 192.168.14.1/23 to 192.168.15.254/23
Broadcast Address = 192.168.15.255/23