http://download.cnet.com/mac/bitcricket/3260-20_4-6302017.html
http://www.dslreports.com/faq/cisco/30.1_Quick_subnet_calculating_techniques
Binary Number System (2-based Number System)
Example #1
IP Address: 192.168.0.4
Subnet Mask: /31 (255.255.255.254)
From the table above, /31 informs that there is a network that consists of two IP addresses; 192.168.0.4 and 192.168.0.5. The 192.168.0.4/31 is then 1st IP address of the network.

Example #2
IP Address: 192.168.0.4
Subnet Mask: /30 (255.255.255.252)
Refer to the table, /30 shows that there is a network that consists of four IP addresses; 192.168.0.4 to 192.168.0.7. The 192.168.0.4/30 is then 1st IP address of the network.

Example #3
IP Address: 192.168.0.4
Subnet Mask: /29 (255.255.255.248)
Using the above table, /29 reflects that there is a network that consists of eight IP addresses; 192.168.0.0 to 192.168.0.7. The 192.168.0.4/29 is then 5th IP address of the network.

Example #4
IP Address: 192.168.0.4
Subnet Mask: /32 (255.255.255.255)
Based on the above table, /32 points that there is a network that consists of a single IP address; 192.168.0.4. The 192.168.0.4/32 is then 1st and the last (the only) IP address of the network.

What IP Address Represents in IP Network
In general, an IP address represents a machine within certain IP network. This machine can be any machine that understand IP address such as PC, printer, server, router, firewall, X-Box, and Playstation. In networking term, such machine is sometimes called a host.
When a host (let's say Host A) in IP network needs to communicate with other host of some IP network (let's say Host B), then Host A uses its IP address to communicate with Host B. This communication is a two-way communication, meaning there should be a reply communication from Host B to A. Host B in this communication back to A also uses its IP address.
What Subnet Mask Represents in IP Network
In general, a Subnet Mask represents how large an IP network is. From subnet mask of specific IP address, you can tell the following
* Number of IP address within the subnet
* Number of IP address available for host
* IP Address range of the subnet
Later on, you can also tell the following from subnet mask of specific IP address

* The first IP address within the subnet (called Network ID IP address)
* The last IP address within the subnet (called Broadcast IP address)
In terms of IP network communication between two hosts say Hosts A and B, A can tell if itself is within the same network as B or not just by checking itself IP address and subnet mask. On later discussion, you will see how this ability plays important part in IP network communication.

http://www.wikihow.com/Calculate-Network-and-Broadcast-Address

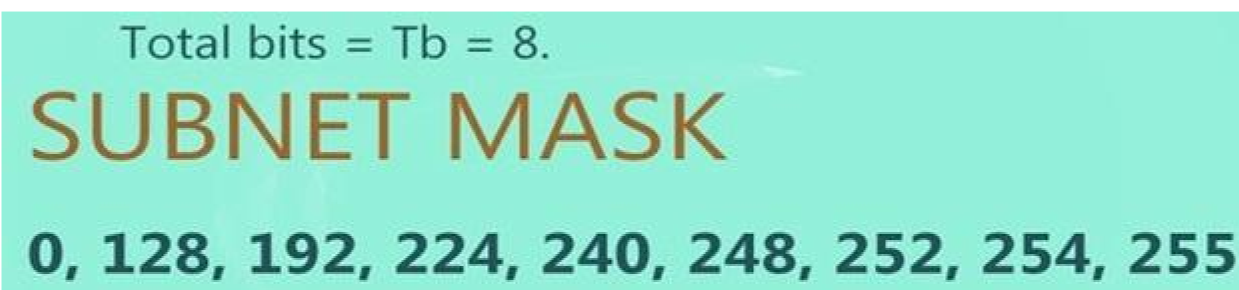
http://jodies.de/ipcalc?host=190.15.20.80&mask1=18&mask2=

http://www.csgnetwork.com/ipinfocalc.html

http://www.dslreports.com/faq/cisco/30.1_Quick_subnet_calculating_techniques

Method 1 of 2: For Classful Network

· Sub-net mask can be 0, 128, 192, 224, 240, 248, 252, 254 and 255.

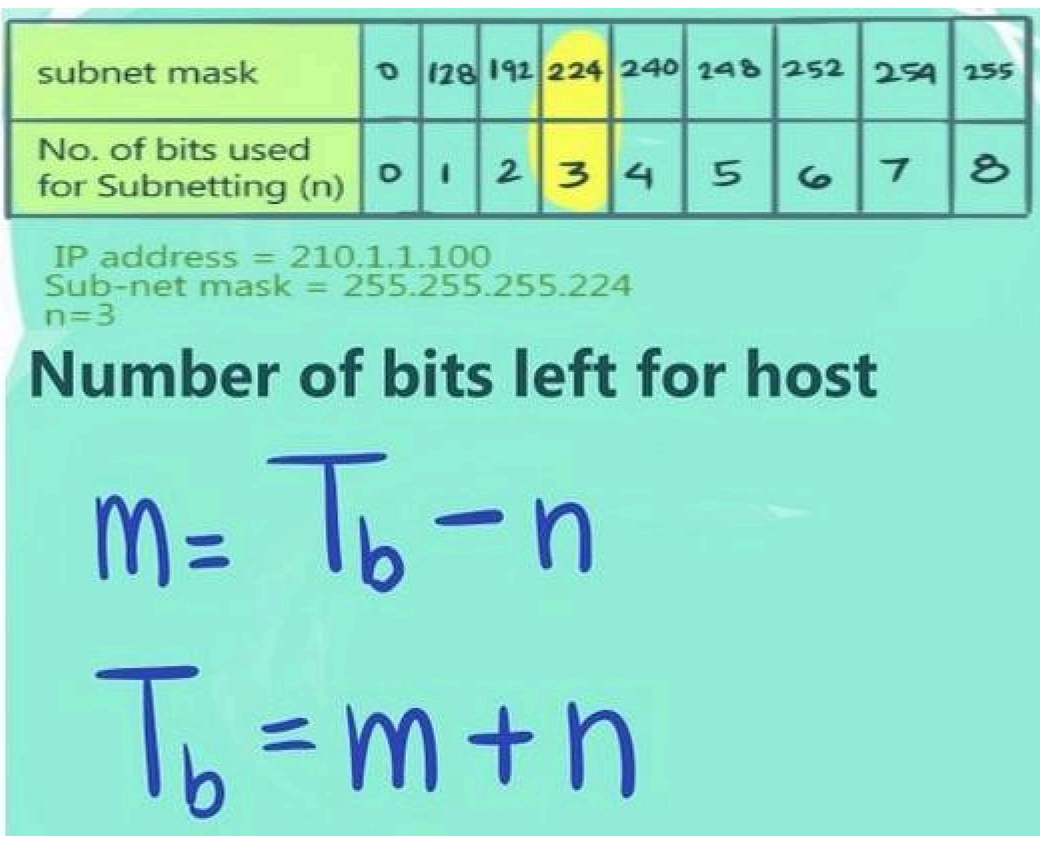


· Below table gives you the "Number of bits used for subnetting"(n) to their corresponding subnet mask.

subnet mask	0	128	192	224	240	248	252	254	255
No. of bits used for Subnetting (n)	0	1	2	3	4	5	6	7	8

- For subnet mask 255 is default, so it'll not consider for subnet masking.
- For example:
- Let, IP address = 210.1.1.100 and Sub-net mask = 255.255.255.224

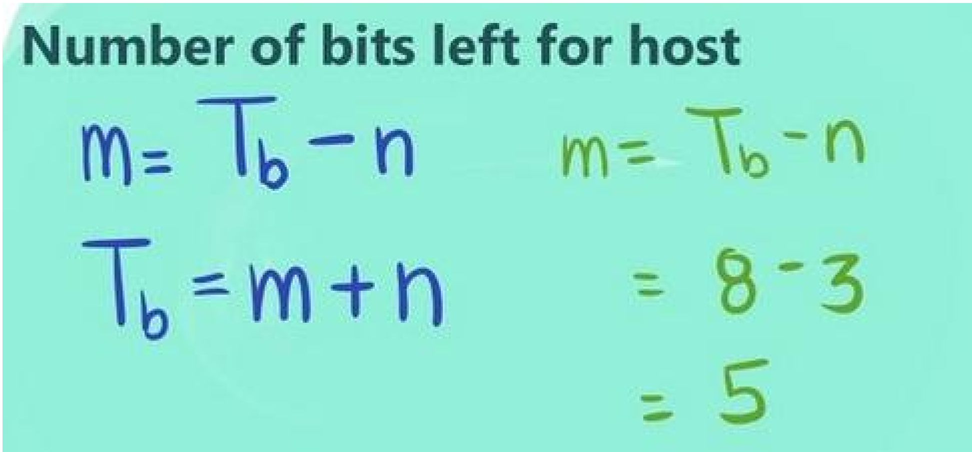
Total bits = T_b = 8 Number of bits used for subnetting = n = 3 (as subnet mask = 224 and its corresponding "No. of bits used for Subnetting" is 3 from above table)

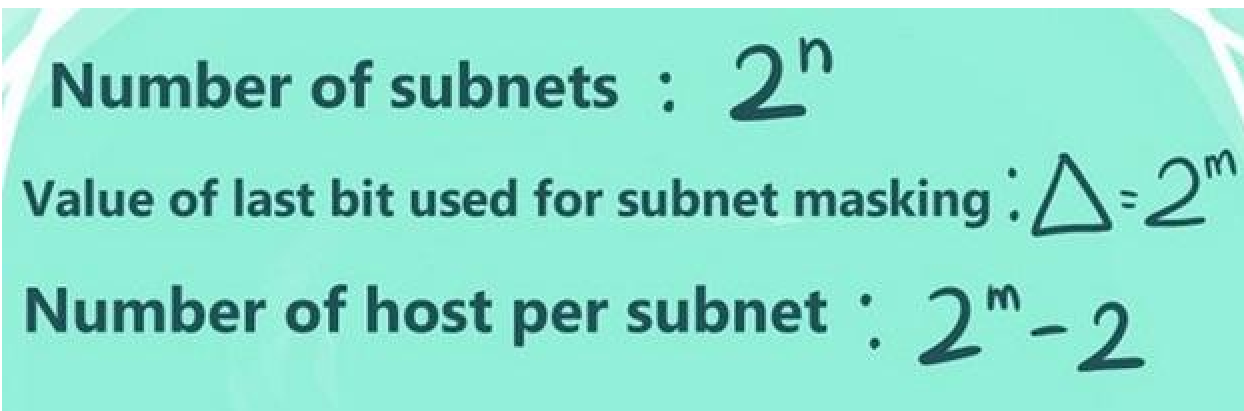


2-From the previous step, you got the "Number of bits used for subnetting"(n) and you know the "T_b", then you can get "Number of bits left for host"(m) = T_b - n

as total bits is the summation of number of bits used for subnetting and number bits left for host i.e. T_b = m+n.

· Number of bits left for host = m = T_b - n = 8 - 3 = 5

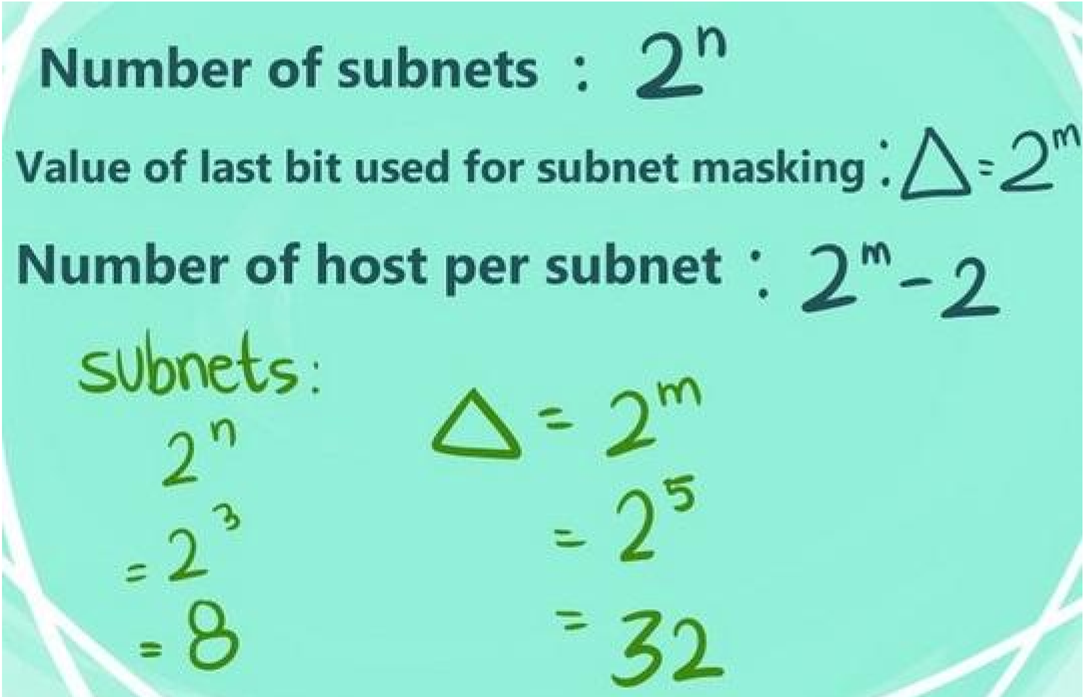




3-Now you have to calculate "Number of subnets" = 2^n and "Value of last bit used for subnet masking"(Δ) = 2^m. Number of host per subnet = 2^m - 2.

· Number of subnets = 2^n = 2^3 = 8

· Value of last bit used for subnet masking = Δ = 2^m = 2^5 = 32



210.1.1.0- 210.1.1.31	210.1.1.32- 210.1.1.63	210.1.1.64- 210.1.1.95	210.1.1.96- 210.1.1.127
210.1.1.128- 210.1.1.159	210.1.1.160- 210.1.1.191	210.1.1.192- 210.1.1.223	210.1.1.224 210.1.1.255

4-Now you can find previously calculated number of subnets by separating subnets each having "Value of last bit used for subnet masking" or Δ addresses.

- The 8 subnets (as calculated in previous step) are shown above.
- Each of them has 32 addresses.

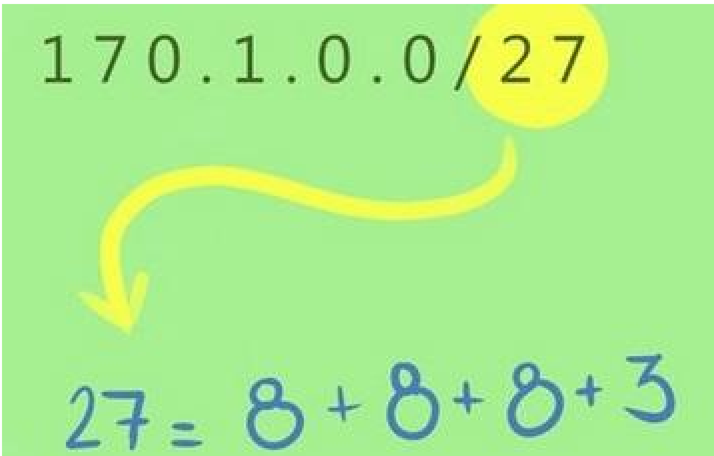
5-Now you have to find that your IP address is in which subnet, that subnet's first address is *network address* and last address is *broadcast address*.

· Here the taken IP address is 210.1.1.100 . 210.1.1.100 comes in 210.1.1.96 - 210.1.1.127 subnet (see the previous step table). So 210.1.1.96 is network address and 210.1.1.127 is broadcast address for the taken IP address i.e. 210.1.1.100 .

Method 2 of 2: For CIDR

1-In CIDR, you have a IP address followed by bit-length prefix separated by slash(/). Now you have to convert bit-length prefix to quad-dotted decimal representation. To do this follow below steps.

· Write the the bit-prefix in below format.



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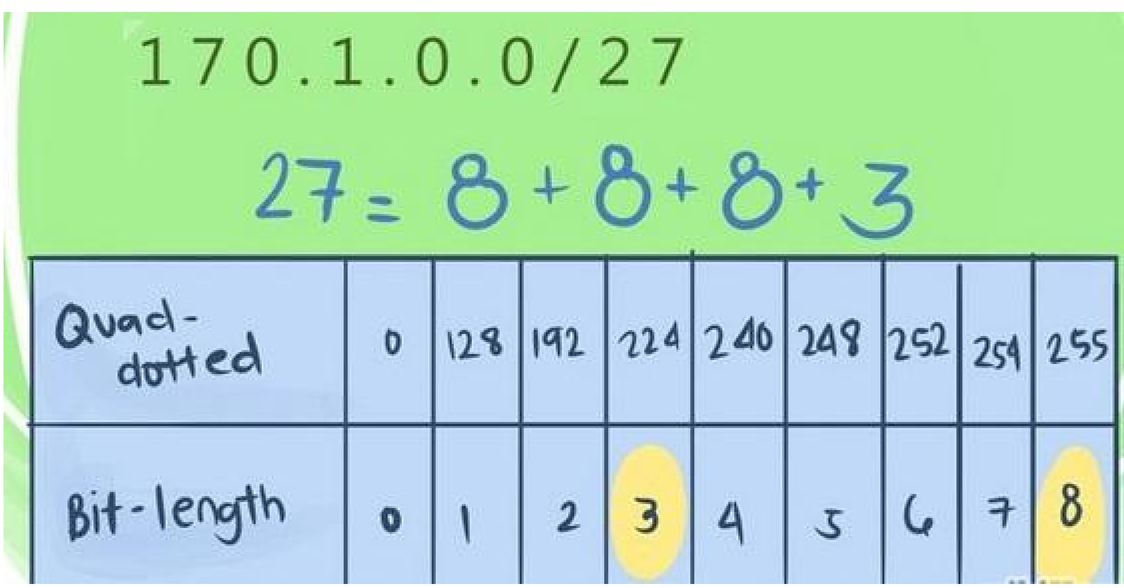
· If it's 27, then write it as 8 + 8 + 8 + 3 .

· If it's 12, then write it as 8 + 4 + 0 + 0 .

· Default is 32, which is 8 + 8 + 8 + 8.

· Convert the corresponding bit according to the below table and represent in quad-dotted decimal format.

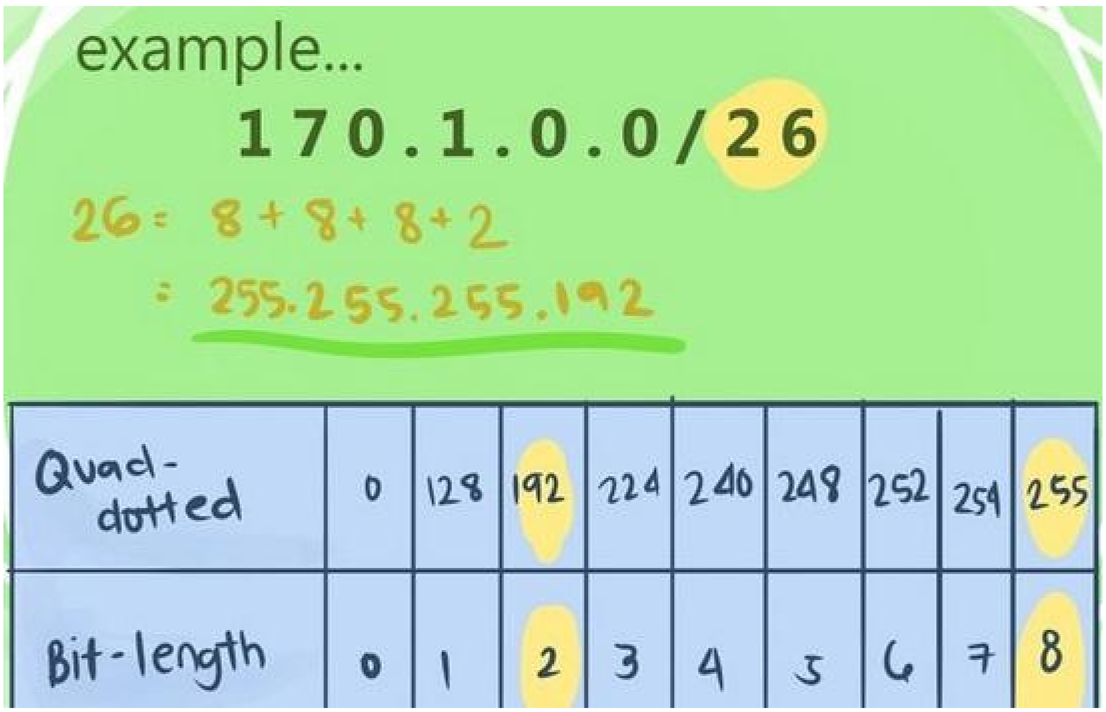


Let IP address is 170.1.0.0/26 . Using above table, you can write:

26 = 8 + 8 + 8 + 2

255 . 255 . 255 . 192

Now the IP address is 170.1.0.0 and subnet mask in quad-dotted decimal format is 255.255.255.192 .



2-Total bits = T_b = 8.

· Sub-net mask can be 0, 128, 192, 224, 240, 248, 252, 254 and 255.

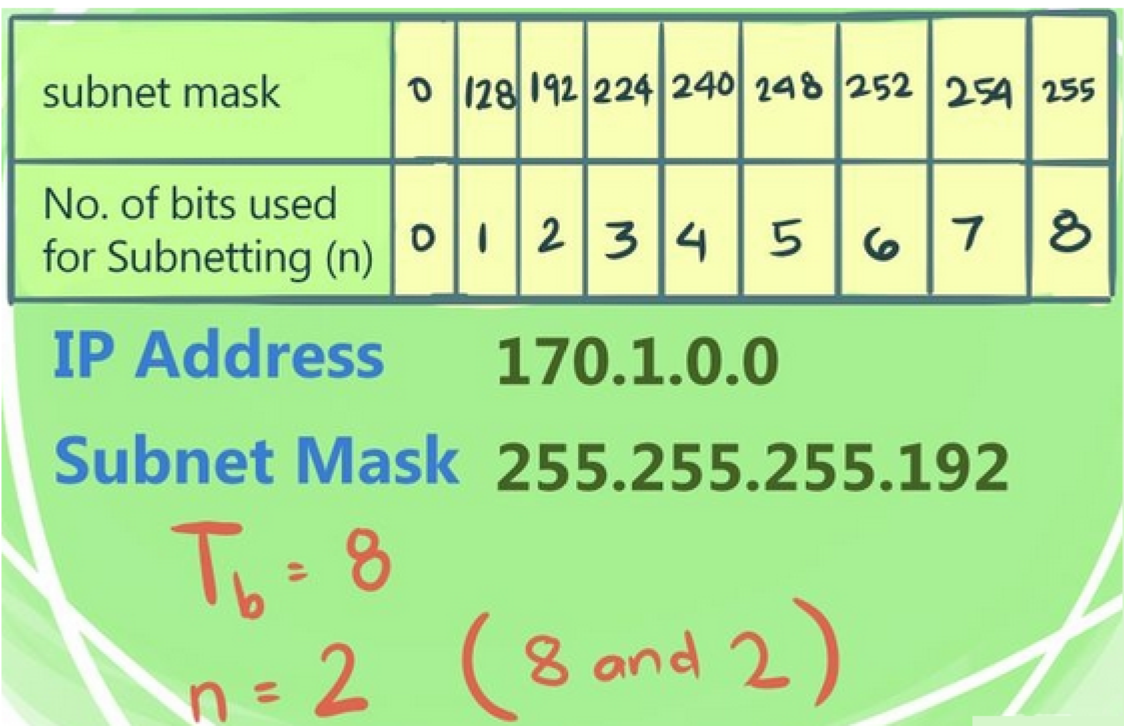
· Below table gives you the "Number of bits used for subnetting"(n) to their corresponding subnet mask.

subnet mask	0	128	192	224	240	248	252	254	255
No. of bits used for Subnetting (n)	0	1	2	3	4	5	6	7	8

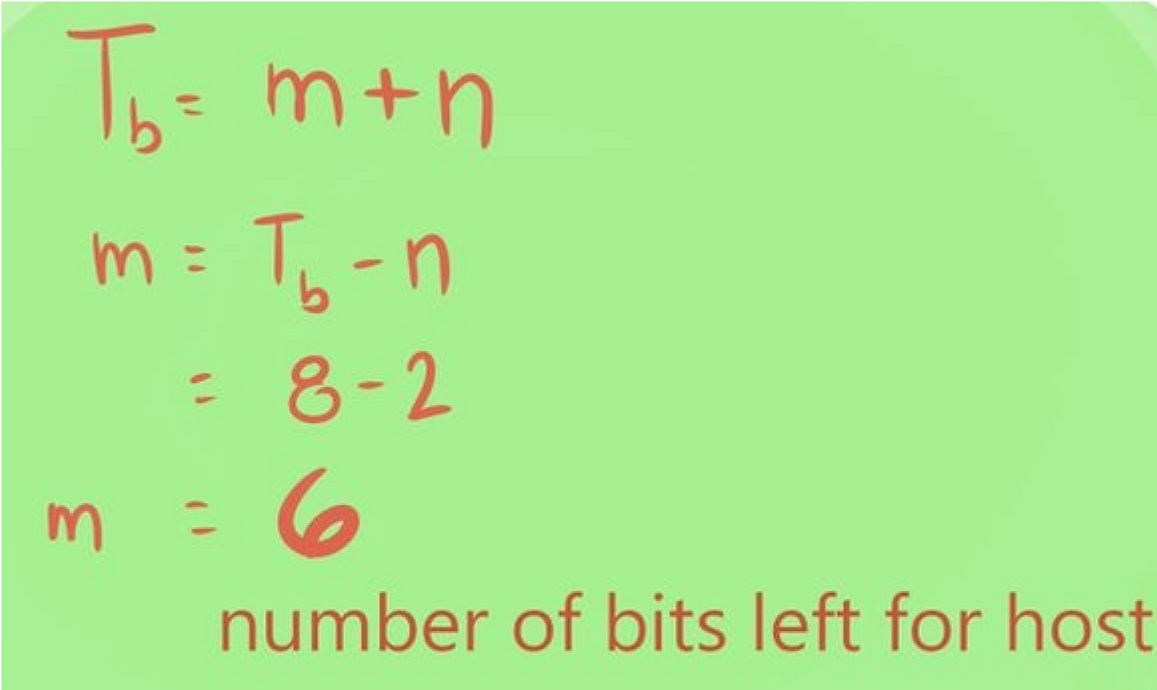
· For subnet mask 255 is default, so it'll not consider for subnet masking.

· From the previous step, you got IP address = 170.1.0.0 and Sub-net mask = 255.255.255.192

Total bits = T_b = 8 Number of bits used for subnetting = n = 2 (as subnet mask = 192 and its corresponding "No. of bits used for Subnetting" is 2 from above table)

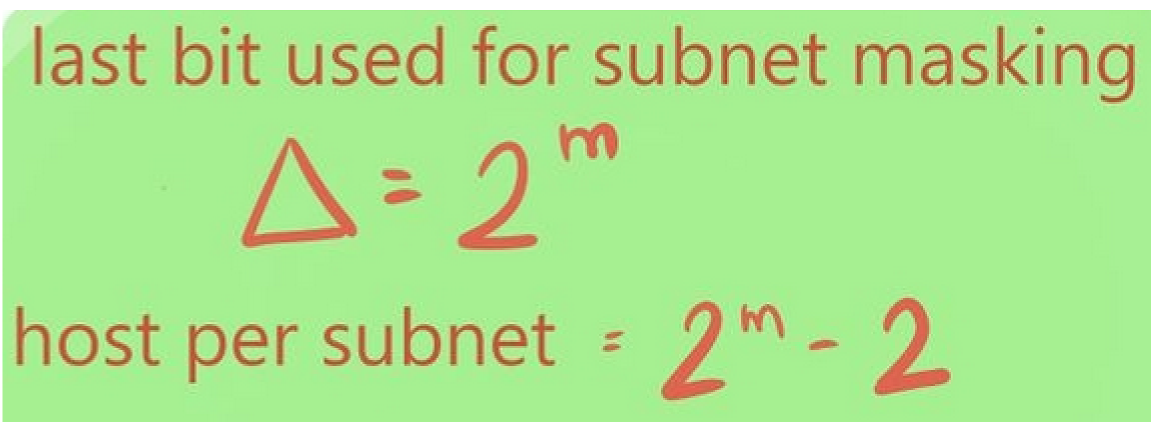


subnet mask	0	128	192	224	240	248	252	254	255
No. of bits used for Subnetting (n)	0	1	2	3	4	5	6	7	8



3-From the previous step, you got the "Number of bits used for subnetting"(n) and you know the "T_b", then you can get "Number of bits left for host"(m) = T_b - n as total bits is the summation of number of bits used for subnetting and number bits left for host i.e. T_b = m+n.

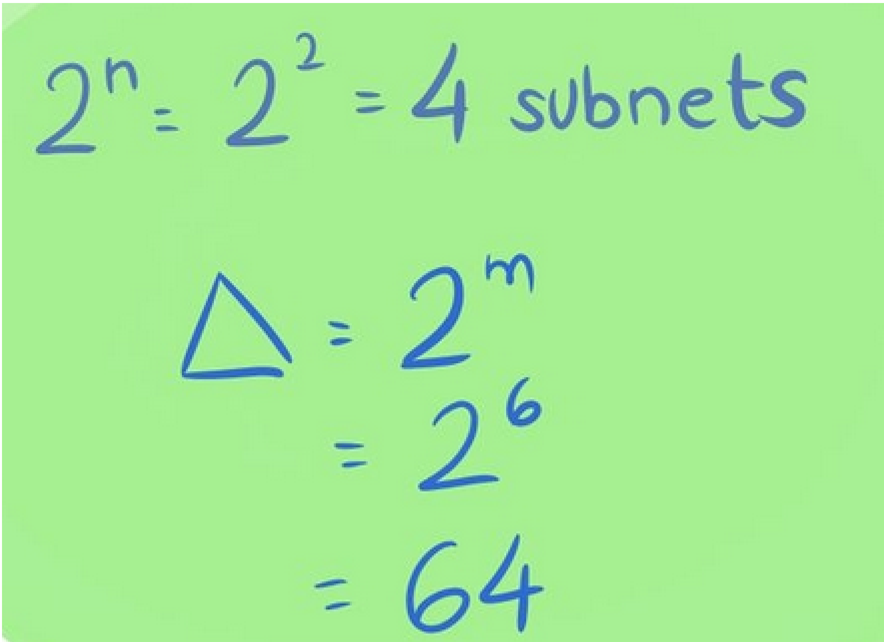
· Number of bits left for host = m = T_b - n = 8 - 2 = 6



4-Now you have to calculate "Number of subnets" = 2^n and "Value of last bit used for subnet masking"(Δ) = 2^m. Number of host per subnet = 2^m - 2.

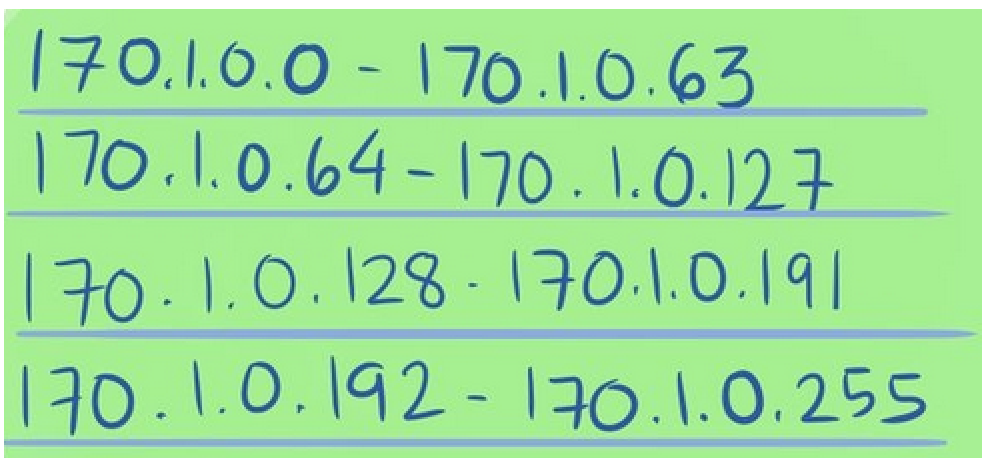
· Number of subnets = 2^n = 2^2 = 4

Value of last bit used for subnet masking = Δ = 2^m = 2^6 = 64

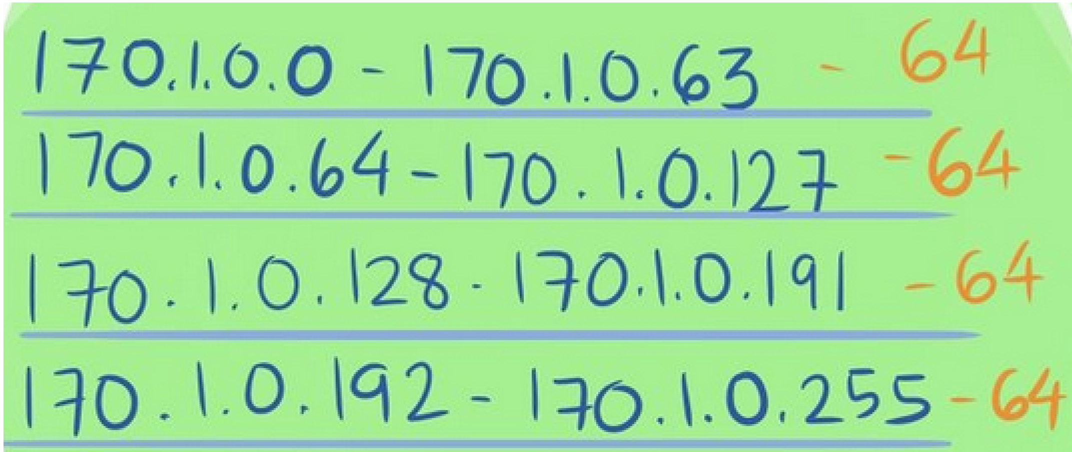


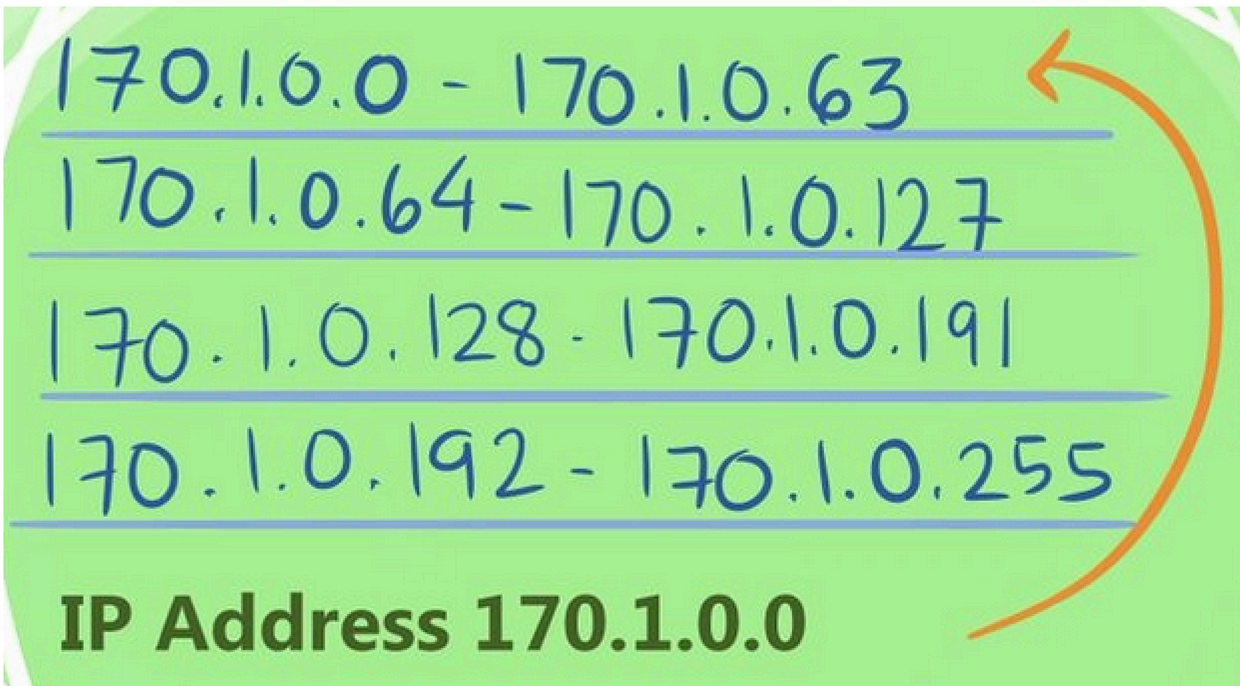
Now you can find previously calculated number of subnets by separating subnets each having "Value of last bit used for subnet masking" or Δ addresses.

· The 4 subnets (as calculated in previous step) are



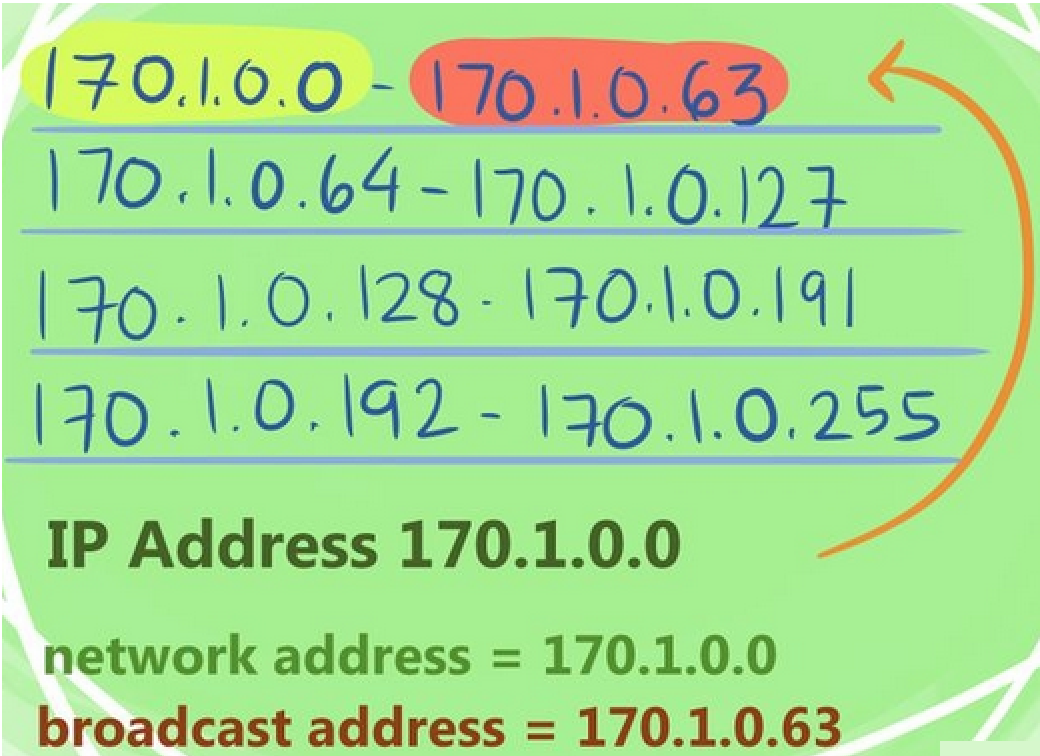
Each of them has 64 addresses.





6-Now you have to find that your IP address is in which subnet, that subnet's first address is *network address* and last address is *broadcast address*.

· Here the taken IP address is 170.1.0.0 . 170.1.0.0 comes in 170.1.0.0 - 170.1.0.63 subnet (see the previous step table). So 170.1.0.0 is network address and 170.1.0.63 is broadcast address for the taken IP address i.e. 170.1.0.0 .



Examples

For Classful Network

· IP address = 100.5.150.34 and subnet mask = 255.255.240.0

Total bits = T_b = 8

Subnet Mask	0	128	192	224	240	248	252	254	255
No. of bits used for Subnetting (n)	0	1	2	3	4	5	6	7	8

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· Number of bits used for subnetting for subnet mask 240 = n_1 = 4

(as subnet mask = 240 and its corresponding "No. of bits used for Subnetting" is 4 from above table)

Number of bits used for subnetting for subnet mask 0 = n_2 = 0

(as subnet mask = 0 and its corresponding "No. of bits used for Subnetting" is 0 from above table)

Number of bits left for host for subnet mask 240 = $m_1 = T_b - n_1 = 8 - 4 = 4$

Number of bits left for host for subnet mask 0 = $m_2 = T_b - n_2 = 8 - 0 = 8$

Number of subnets for subnet mask 240 = $2^{n}{}_{1} = 2^4 = 16$

Number of subnets for subnet mask 0 = $2^{n}{}_{2} = 2^0 = 1$

Value of last bit used for subnet masking for subnet mask 240 = $\Delta_1 = 2^{m}{}_{1} = 2^4 = 16$

Value of last bit used for subnet masking for subnet mask 0 = $\Delta_2 = 2^{m}{}_{2} = 2^8 = 256$

For subnet mask 240, addresses will be separated by 16 and for subnet mask 0, it'll be 256. Using Δ_1 and Δ_2 value, the 16 subnets are given below

100.5.0.0 - 100.5.15.255	100.5.16.0 - 100.5.31.255	100.5.32.0 - 100.5.47.255	100.5.48.0 - 100.5.63.255
100.5.64.0 - 100.5.79.255	100.5.80.0 - 100.5.95.255	100.5.96.0 - 100.5.111.255	100.5.112.0 - 100.5.127.255
100.5.128.0 - 100.5.143.255	100.5.144.0 - 100.5.159.255	100.5.160.0 - 100.5.175.255	100.5.176.0 - 100.5.191.255
100.5.192.0 - 100.5.207.255	100.5.208.0 - 100.5.223.255	100.5.224.0 - 100.5.239.255	100.5.240.0 - 100.5.255.255

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· **IP address 100.5.150.34 comes in 100.5.144.0 - 100.5.159.255 and hence 100.5.144.0 is the network address and 100.5.159.255 is the broadcast address**.

For CIDR

· IP address in CIDR = 200.222.5.100/9

9	=	8	+	1	+	0	+	0
		255	.	128	.	0	.	0

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· IP address = 200.222.5.100 and subnet mask = 255.128.0.0

Total bits = T_b = 8

Subnet Mask	0	128	192	224	240	248	252	254	255
No. of bits used for Subnetting (n)	0	1	2	3	4	5	6	7	8

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· Number of bits used for subnetting for subnet mask 128 = n_1 = 1

(as subnet mask = 128 and its corresponding "No. of bits used for Subnetting" is 1 from above table)

Number of bits used for subnetting for subnet mask 0 = n_2 = n_3 = 0

(as subnet mask = 0 and its corresponding "No. of bits used for Subnetting" is 0 from above table)

Number of bits left for host for subnet mask 128 = m_1 = T_b - n_1 = 8 - 1 = 7

Number of bits left for host for subnet mask 0 = m_2 = m_3 = T_b - n_2 = T_b - n_3 = 8 - 0 = 8

Number of subnets for subnet mask 128 = $2^{n}{}_{1}$ = 2^1 = 2

Number of subnets for subnet mask 0 = $2^{n}{}_{2} = 2^{n}{}_{3} = 2^0 = 1$

Value of last bit used for subnet masking for subnet mask 128 = $\Delta_1 = 2^{m}{}_{1} = 2^7 = 128$

Number of host per subnet = $2^{m}{}_{1} - 2 = 2^7 - 2 = 126$

Value of last bit used for subnet masking for subnet mask 0 = $\Delta_2 = \Delta_3 = 2^{m}{}_{2} = 2^{m}{}_{3} = 2^8 = 256$

Number of host per subnet for subnet mask 0 = $2^{m}{}_{2} - 2 = 2^{m}{}_{3} - 2 = 2^8 - 2 = 254$

For subnet mask 128, addresses will be separated by 128 and for subnet mask 0, it'll be 256.

Using Δ_1, Δ_2 and Δ_3 value, the 2 subnets are given below

200.0.0.0 - 200.127.255.255	200.128.0.0 - 200.255.255.255

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· **IP address 200.222.5.100 comes in 200.128.0.0 - 200.255.255.255 and hence 200.128.0.0 is the network address and 200.255.255.255 is the broadcast address**.

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Example #1
IP Address: 192.168.0.4
Subnet Mask: /31 (255.255.255.254)
From the table above, /31 informs that there is a network that consists of two IP addresses; 192.168.0.4 and 192.168.0.5. The 192.168.0.4/31 is then 1st IP address of the network.

Example #2
IP Address: 192.168.0.4
Subnet Mask: /30 (255.255.255.252)
Refer to the table, /30 shows that there is a network that consists of four IP addresses; 192.168.0.4 to 192.168.0.7. The 192.168.0.4/30 is then 1st IP address of the network.

Example #3
IP Address: 192.168.0.4
Subnet Mask: /29 (255.255.255.248)
Using the above table, /29 reflects that there is a network that consists of eight IP addresses; 192.168.0.0 to 192.168.0.7. The 192.168.0.4/29 is then 5th IP address of the network.

Example #4
IP Address: 192.168.0.4

Subnet Mask: /32 (255.255.255.255)
Based on the above table, /32 points that there is a network that consists of a single IP address; 192.168.0.4. The 192.168.0.4/32 is then 1st and the last (the only) IP address of the network.