IP Addressing and Subnetting (Part 1)

Example Questions

Question 1

A router outside the organization receives a packet with destination address 190.1.1.5 /16. What is the network and broadcast address for the destination address?

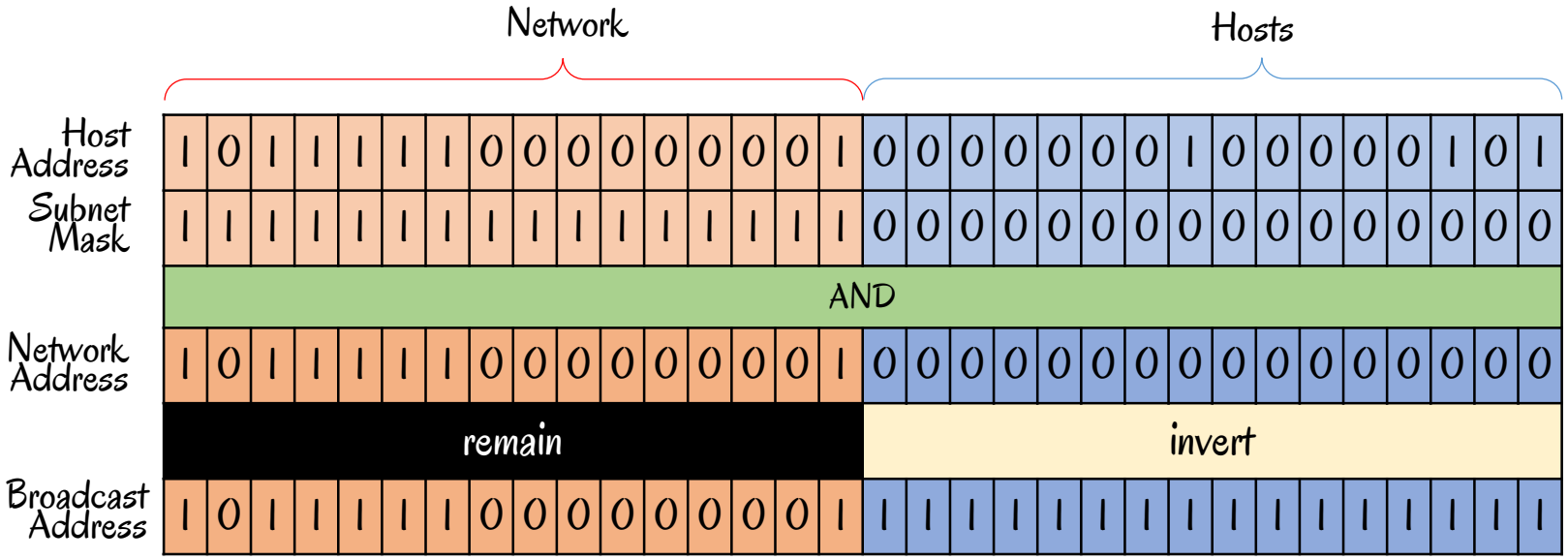
Solution 1

Address = 190.1.1.5 = 10111110.00000001.00000001.00000101

Mask = /16 = 11111111.11111111.00000000.00000000

= 255.255.0.0

ANDing → Address & Mask (Binary form)



Network Address = 190.1.0.0

Broadcast Address = 190.1.255.255

Solution 2

- Step 1: Calculate the network address.
  - Network address = the lowest address in the address block.
  - The address block given has a prefix length of /16. This means the network portion has 16 bits and the host portion has 16 bits.
  - All the bits in the host portion must be 0.

190								1								0								0							
1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Network																Host															

  - Therefore, the network address is 190.1.0.0

- Step 2: Calculate the broadcast address.
  - Broadcast address = the highest address in the address block.
  - All the bits in the host portion must be 1.

190								1								255								255							
1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Network																Host															

  - Therefore, the broadcast address is 190.1.255.255

Question 2

A packet with source address 202.1.1.21 /30. What is the network and broadcast address for the source address?

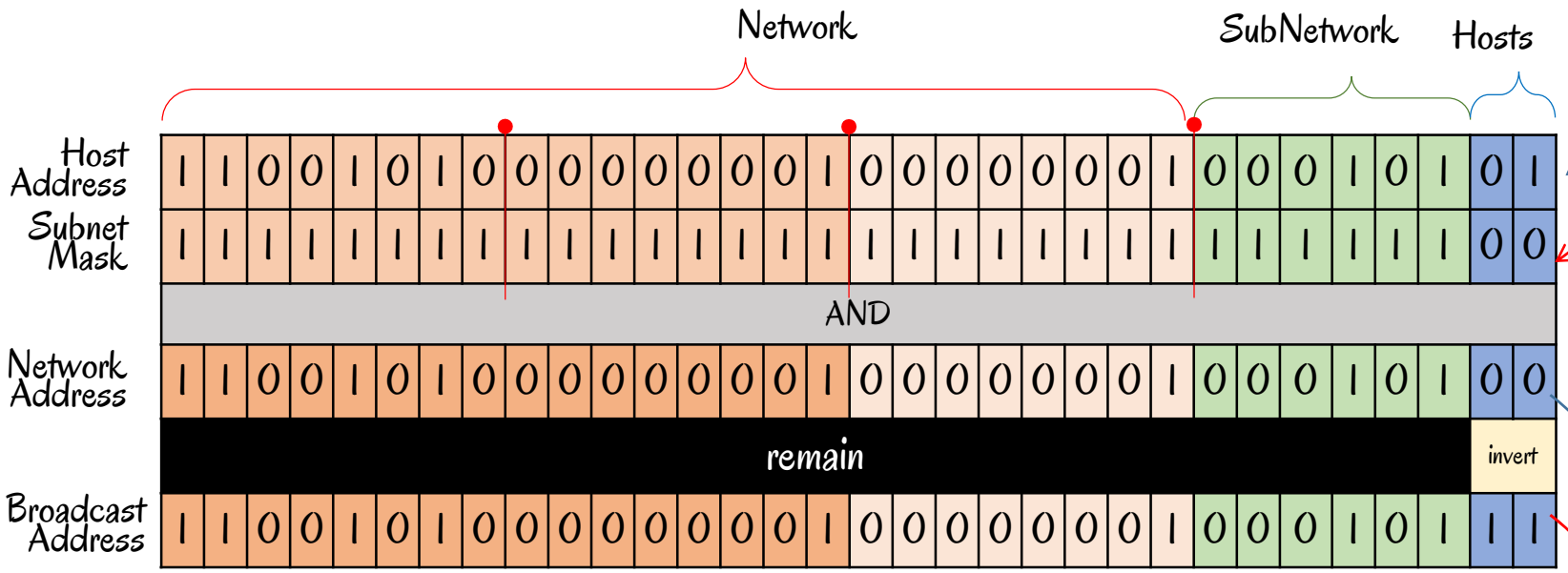
Solution 1

Address = 202.1.1.21 = 11001010.00000001.00000001. 00010101

Mask = /30 = 11111111.11111111.11111111.11111100

= 255.255.255.252

ANDing → Address & Mask (Binary form)



Network Address = 202.1.1.20

Broadcast Address = 202.1.1.23

Solution 2

- Step 1: Calculate the network address.
  - Network address = the lowest address in the address block.
  - The address block given has a prefix length of /30. This means the network portion has 30 bits and the host portion has 2 bits.
  - All the bits in the host portion must be 0.

202								1								1								20									
1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0
Network																														Host	

  - Therefore, the network address is 202.1.1.20

- Step 2: Calculate the broadcast address.
  - Broadcast address = the highest address in the address block.
  - All the bits in the host portion must be 1.

202								1								1								23									
1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	1	1	1
Network																														Host	

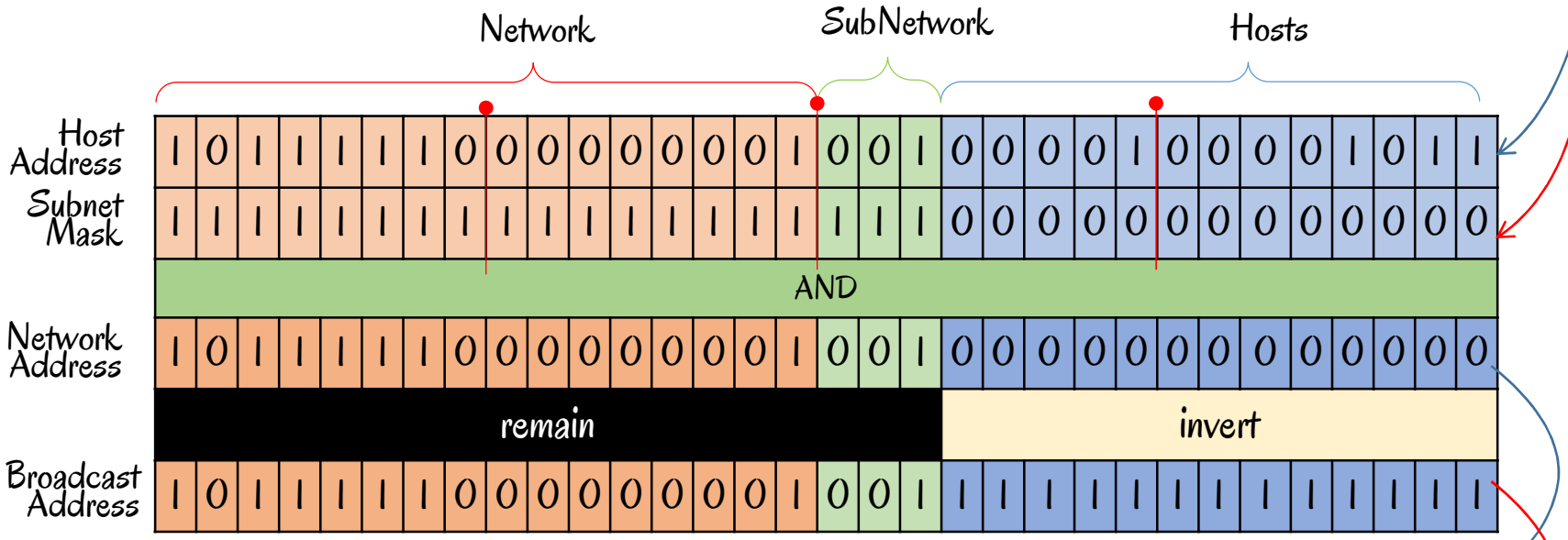
  - Therefore, the broadcast address is 202.1.1.23

Question 3

Given the IP address 190.1.33.91 and Subnet Mask 255.255.224.0. Find the network and broadcast address on which this IP address is located.

Solution 1

Address = 190.1.33.11 = 10111110.00000001. 00100001.00001011
Mask = /19 = 11111111.11111111.11100000.00000000
= 255.255.224.0
ANDing → Address & Mask (Binary form)



Network Address = 190.1.32.0
Broadcast Address = 190.1.63.255

Solution 2

- Step 1: Calculate the network address.
  - Network address = the lowest address in the address block.
  - The address block given has a prefix length of /19. This means the network portion has 19 bits and the host portion has 13 bits.
  - All the bits in the host portion must be 0.

190								1								32				0											
1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Network																				Host											

  - Therefore, the network address is 190.1.32.0

- Step 2: Calculate the broadcast address.
  - Broadcast address = the highest address in the address block.
  - All the bits in the host portion must be 1.

190								1								63				255											
1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Network																				Host											

  - Therefore, the broadcast address is 190.1.63.255