UIT2403 – Data Communication and Networking

UNIT III: NETWORK LAYER AND INTERNETWORKING

Tutorial – II with Solutions

Network Layer and IP Addressing

Date: 09.05.2024

1. You have a host 192.168.50.2/24. What is its network address?

Given data

- The IP address of the host is 192.168.50.2
  - The binary representation of the given IP address is 11000000 10101000 00110010 00000010
  - **Note:** The first byte of the given IP address i.e., 192 indicates that the given IP address comes under Class C of IPV4 address (Class C first byte in decimal lies between 192 and 223 – Refer to Class Notes).
- The subnet mask is given as /24 (in CIDR).
  - The subset mask can be represented in dotted decimal as 255.255.255.0.
  - The same subset mask can also be represented in binary as 11111111 11111111 11111111 00000000

Calculating the Network Address

The idea is to use the AND function (Refer to Lecture Notes)

- Perform the binary AND operation between the binary representation of the IPV4 address and the binary representation of the subnet mask.

11000000	10101000	00110010	00000010	
11111111	11111111	11111111	00000000	AND
11000000	10101000	00110010	00000000	

The result of binary AND operation is 1100000.10101000.00110010.00000000

Translate the result of binary AND operation into decimal 192.168.50.0.

Answer: Given the host's IP address, its network address is **192.168.50.0**

Points to Remember:

- A class C network would have a subnet mask of 255.255. 255.0 which means that 24 bits are used for the network. In CIDR notation this is designated by a /24 following the IP address.
- A subnet mask is a 32-bit binary mask used to divide an IP address into subnets and specify the number of hosts available on the network.

2. If you are using 255.255.255.192 subnet mask in your network, how many hosts will be available in your network?
Solution:

- The fourth octet in decimal is given as 192.
- The binary representation of 192 is **11**000000.
- This implies that 192 takes 2 bits of the 4th octet into account for the Network Address (so 24 bits (all 1's from 255.255.255, the first three octets) plus two bits which are I's from the fourth octet, so total 26 bits). The number of zero bits remaining is 6 which represents the number of hosts.
- These 6 bits can represent 64 addresses (i. e. $2^6 = 64$).
- But the addresses 000000 (lowest address reserved as the network number) and 111111 (highest address reserved as the broadcast address), so the number of **useable/available** hosts = 64 – 2 = 62.

Answer:
The number of **useable/available** hosts available in the network with the subnet mask 255.255.255.192 is **62**.

Points to Remember:

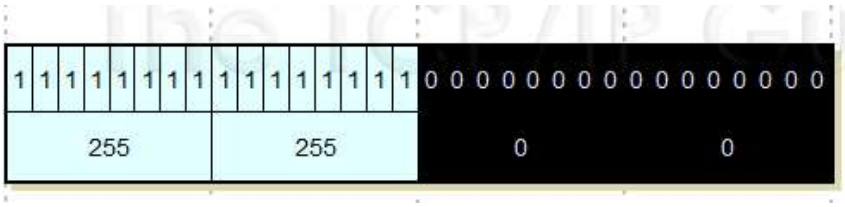
- The given subnet mask 255.255.255.192 is given as /26 in CIDR notation.
- The number after the slash represents the number of consecutive 1's in the subnet mask.

3. You have been allocated a class A network address of 29.0.0.0. You need to create at least 20 networks and each network will support a maximum of 160 hosts. Would the following two subnet masks work?

255.255.0.0 and/or **255.255.255.0**

Considering subnet mask 255.255.0.0

- The given IP address **29.0.0.0** belongs to Class A. But the given subnet masks are belonging to Class B and Class C respectively.
- **255.255.0.0:**,This is the default mask for Class B, but can also be the custom subnet mask for dividing a Class A network using 8 bits for the subnet ID (leaving 16 bits for the host ID).



The subnet mask **255.255.0.0** has **8 bits for the subnet** and **16 bits for the host**

8 bits would accommodate 2^8=256 subnets

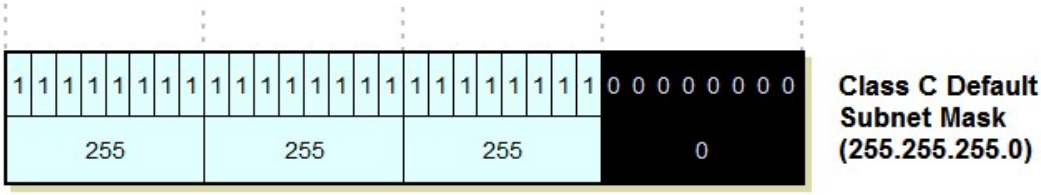
16 bits would accommodate 2^{16}= 65536 – 2 = 655534 usable hosts.

The subnet mask **255.255.0.0** is more than enough to accommodate at least 20 networks and each network will support a maximum of 160 hosts.

The given subnet mask **255.255.0.0** will work.

Considering subnet mask 255.255.255.0

- **255.255.255.0:** This is the default subnet mask for Class C, but can be a custom Class A with 16 bits for the subnet ID *or* a Class B with 8 bits for the subnet ID.



- The subnet mask **255.255.255.0** has **16 bits for the subnet** and **8 bits for the host.**
- 16 bits would accommodate 2^{16}=65536 subnets
- 8 bits would accommodate 2^8= 256 – 2 = 254 usable hosts.
- The subnet mask **255.255.255.0** is more than enough to accommodate at least 20 networks and each network will support a maximum of 160 hosts.
- The given subnet mask **255.255.255.0** will work.

Answer: Both subnet masks 255.255.0.0 and 255.255.255.0 will work.

4. Write the IP address 222.1.1.20 with the subnet mask 255.255.255.192 in CIDR notation.

Solution:

Given subnet mask 255.255.255.192.

Take the fourth octet 192 and convert it into binary 11000000 which means that 2 bits of this octet are used for the subnet. Now add the 24 bits 255.255.255 and we have 26 bits. So, we write: 222.1.1.20/26

Answer: 222.1.1.20/26

5. Write the IP address 135.1.1.25 with the subnet mask 255.255.248.0 in CIDR notation.

Solution:

Given subnet mask 255.255.248.0.

Take the third octet 248 and convert it into binary 11111000 which means that 5 bits of this octet are used for the subnet. Now add the 16 bits 255.255 and we have 21 bits. So, we write: 135.1.1.25/21

Answer: 135.1.1.25/21

6. You have subnetted your 192.168.36.0 network address with a 255.255.255.224 mask. How many subnets are available?

The value of 224 in the subnet mask tells you that three host bits were borrowed from the fourth octet for subnetting. That is the binary representation of 224 is 11100000.

To determine how many subnets are created by borrowing 3 bits, $2^3 = 8$.

To determine how many valid host addresses are available, the remaining 5 zero bits of the last octet, $2^5=32 - 2 =30$.

Answer: 8 usable subnets and 30 hosts per subnet.

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