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Lab Practical #09:

Study of IP Addressing and sub-netting.

Practical Assignment #09:

1. Find default subnet marks, network bits, host bits, hosts per subnet, no of subnets, subnet number, 1st valid IP address, last valid IP address, and broadcast address.
   i. 8.1.4.5/16
   ii. 130.4.102.1/24
   iii. 199.1.1.1/24
   iv. 130.4.102.1/22
   v. 199.1.1.100/27

   Answers :

i. 8.1.4.5/16

- **Default Subnet Mask –** 255.255.0.0
- **Network bits –** 16
- **Host bits –** 32 - 16=16
- **Hosts per Subnet –** 2^{16} - 2 = 65,534
- **No of subnets –** 256
- **Subnet number –** 8.1.4.0
- **1st valid IP address –** 8.1.4.1
- **Last valid IP address –** 8.1.4.254
- **Broadcast address –** 8.1.4.255

ii. 130.4.102.1/24

- **Default Subnet Mask –** 255.255.255.0
- **Network bits –** 24
- **Host bits –** 32 – 24 = 8
- **Hosts per Subnet –** 2^{8} - 2 = 254
- **No of subnets –** 256
- **Subnet number –** 130.4.102.0
- **1st valid IP address –** 130.4.102.1
- **Last valid IP address –** 130.4.102.254
- **Broadcast address –** 130.4.102.255

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iii. 199.1.1.1/24

- **Default Subnet Mask –** 255.255.255.0
- **Network bits –** 24
- **Host bits –** 32 - 24=8
- **Hosts per Subnet –** 2^8 - 2 = 254
- **No of subnets –** 1
- **Subnet number –** 199.1.1.0
- **1st valid IP address –** 199.1.1.1
- **Last valid IP address –** 199.1.1.254
- **Broadcast address –** 199.1.1.255

iv. 130.4.102.1/22

- **Default Subnet Mask –** 255.255.252.0
- **Network bits –** 22
- **Host bits –** 32 – 22 =10
- **Hosts per Subnet –** 2^{10} - 2 = 1,022
- **No of subnets –** 64
  Here CIDR notation is /22 by default CIDR notation of class-B is /16 so borrowed bits are 22 - 16 = 6
  No of subnets = 2^6 = 64
- **Subnet number –** 130.4.100.0
- **1st valid IP address –** 130.4.100.1
- **Last valid IP address –** 130.4.103.254
- **Broadcast address –** 130.4.103.255

v. 199.1.1.100/27

- **Default Subnet Mask –** 255.255.224.0
- **Network bits –** 27
- **Host bits –** 32 – 27 =5
- **Hosts per Subnet –** 2^5 - 2 = 30
- **No of subnets –** 8
  Here CIDR notation is /27 by default CIDR notation of class-C is /24 so borrowed bits are 27 - 24 = 3
  No of subnets = 2^3 = 8
- **Subnet number –** 199.1.1.96
- **1st valid IP address –** 199.1.1.97
- **Last valid IP address –** 199.1.1.126
- **Broadcast address –** 199.1.1.127

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How to calculate Network Address(Subnet Number)

For ex- 199.1.1.100/27
IP address – 199.1.1.100
Subnet Mask – 255.255.255.224

first convert IP address and Subnet mask into binary like this

199.1.1.100 = 1 1 0 0 0 1 1 1 . 0 0 0 0 0 0 0 1 . 0 0 0 0 0 0 0 1 . 0 1 1 0 0 1 0 0

255.255.255.224 = 1 1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 1 . 1 1 1 0 0 0 0 0

Now perform AND operation between them

1 1 0 0 0 1 1 1 . 0 0 0 0 0 0 0 1 . 0 0 0 0 0 0 0 1 . 0 1 1 0 0 1 0 0

Now covert answer to Decimal

1 1 0 0 0 1 1 1 . 0 0 0 0 0 0 0 1 . 0 0 0 0 0 0 0 1 . 0 1 1 0 0 1 0 0 = 199.1.1.96

So Network Address(Subnet Number) = **199.1.1.96**

By using this method we can calculate Network Address(Subnet Number) of any given IP Address

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2. A host in a class C network has been assigned an IP address 192.168.17.9. Find the number of addresses in the block, the first address, and the last address.

   - Given IP is of Class-C so CIDR is /24
   - So Host bits = 32-24=8
   - **Number of addresses in block –** $2^{(\text{host bits})} = 2^8 - 2 = 254$
   - **First IP Address –** 192.168.17.1
   - **Last IP Address –** 192.168.17.254

3. An address in a block is given as 185.28.17.9. Find the number of addresses in the block, the first address, and the last address.

   - Given IP is of Class-B so CIDR is /16
   - So Host bits = 32-16=16
   - **Number of addresses in block –** $2^{(\text{host bits})} = 2^{16} - 2 = 65,534$
   - **First IP Address –** 185.28.17.1
   - **Last IP Address –** 185.28.17.254

4. A block of addresses is granted to a small organization. We know that one of the addresses is 205.16.37.39/28. What is the first address, last address, number of addresses in a block.

   - Given IP is of Class-C but CIDR is /28
   - So Host bits = 32-28=4
   - **Number of addresses in block –** $2^{(\text{host bits})} = 2^4 - 2 = 14$
   - **First IP Address –** 205.16.37.32
   - **Last IP Address –** 205.16.37.47

5. Subnet the IP address 216.21.5.0 into 30 hosts in each subnet. Find Class, Default Mask, Bit Borrowed, New subnet mask, No. of Hosts & Subnet, Network Ranges (Subnets).

   - **Class -** C
   - **Default Mask -** 255.255.255.0
   - Calculate the no of usable host by using below formula
     - $2^{host} - 2 >=$ No of we need in per subnet
   - We need 30 Hosts each Subnet
   - We can use above formula to calculate the Required Host bits
     - $2^{host} >= 30$
     - $2^5 >= 30 \rightarrow 32 >= 30$
   - So, Required Host Bits is 5

- **Bit Borrowed –** 3 (for host we required 5 bits so 8 – 5 =3)
- **New Subnet Mask** -255.255.255.224
- **No of Hosts** -2^5 = 32
- **No of Subnet –** $2^{(\text{bit borrowed})} = 2^3 = 8$
- **Network Ranges –**
  - Subnet 1: - 216.21.5.0 – 216.21.5.31
  - Subnet 2: - 216.21.5.32 – 216.21.5.63
  - Subnet 3: - 216.21.5.64 – 216.21.5.95
  - Subnet 4: - 216.21.5.96 – 216.21.5.127
  - Subnet 5: - 216.21.5.128 – 216.21.5.159
  - Subnet 6: - 216.21.5.160 – 216.21.5.191
  - Subnet 7: - 216.21.5.192 – 216.21.5.223
  - Subnet 8: - 216.21.5.224 – 216.21.5.255

6. Subnet the IP address 192.10.20.0 into 52 hosts in each subnet. Find Class, Default Mask, Bit Borrowed, New subnet mask, No. of Hosts & Subnet, Network Ranges (Subnets).

- **Class -** C
- **Default Mask -** 255.255.255.0
- Calculate the no of usable host by using below formula
  - 2^{host} >= No of we need in per subnet
- We need 30 Hosts each Subnet
- We can use above formula to calculate the Required Host bits
  - 2^{host} >= 52
  - 2^6 >= 52 ⟶ 64 >= 52
- So, Required Host Bits is 6
- **Bit Borrowed –** 2 (for host we required 6 bits so 8 – 6 = 2)
- **New Subnet Mask -**255.255.255.192
- **No of Hosts** -2^5 = 64
- **No of Subnet –** $2^{(\text{bit borrowed})} = 2^2 = 4$
- **Network Ranges –**
  - Subnet 1: - 192.10.20.0 – 192.10.20.63
  - Subnet 2: - 192.10.20.64 – 192.10.20.127
  - Subnet 3: - 192.10.20.128 – 192.10.20.191
  - Subnet 4: - 192.10.20.192 – 192.10.20.255