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Experiment No. 7

Aim : WAP to implement of IPv4 addressing concept along with the subnet masking.

Theory :

- **IPv4 Addressing**

⇒

- Every host and router on the Internet has an IP address that can be used in the source address and destination address fidds of IP packet.
- IP address is assigned to each and every host and router on the Internet which is referred in the source as well as destination address fields of IP packets.
- One significant aspect is that an IP address does not refer to host in reality.
- It actually refers to a network interface, hence if presence of a host is on two networks, then there must be two IP addresses assigned to it.
- However, in general, the presence of most of the hosts is on single network and accordingly has one IP address.
- Whereas, there are multiple interfaces of router and accordingly have multiple IP addresses.
- The address space of IPv4 is 2^{32}.

For e.g.,
binary notation to decimal dotted notation
⇒ 11000011 10000011 00011010 11111111

We replace each group of 8 bits with its equivalent decimal number and add dots for separation.
∴ 193.131.26.255

- **Subnet**

⇒ A subnet is simply a subdivision of a network address that can be used to represent one LAN on the internetwork.

- **Subnet Mask**

⇒
- An IP address has two components,
  - The network address and
  - The host address.
- Subnet mask is a mask used to determine what subnet an IP address belongs to.
- The subnet mask is the network address plus the bits reserved for identifying the subnetwork -- by convention, bits for the network address are all set to 1, though it would also work if the bits were set exactly as in the network address.

• Characterstics of IPv4.

⇒
- IPV4 could be a 32-bit IP address.
- IPv4 could be a numeric address, and its bits are separated by a dot.
- The number of header fields is twelve and the length of the header field is twenty.
- IPv4 supports VLSM (Virtual Length Subnet Mask).
- IPv4 uses the Port Address Resolution Protocol to map to the MAC address.

• Advantages of IPv4

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- IPv4 security permits encryption to keep up privacy and security.
- IPv4 network allocation is significant and presently has quite 85000 practical routers.
- It becomes easy to attach multiple devices accross an outsized network while not NAT.
- IPv4 addresses are redefined and permit flawless encoding.

- In IPV4, we have 5 classes A, B, C, D, E.
- It is clear that first byte / Octet tells us to which class address belongs and values for class A, B, C, D and E. HOB decides the class.
- Addresses are denoted by 4 decimal numbers from 0 to 255, separated by dot
- for e.g., 192.168.3.39

	1st octet range	1st octet value/HOB
class A	1 - 126*	0
class B	128 - 191	10
class C	192 - 233	110
class D	224 - 239	1110
class E	240 - 255	1111

*127 is reserved for loopback.

26/09/23

```
import ipaddress

# Input the IP address
ip_address = input("Enter the IP address (e.g., 192.168.1.0): ")
print(f"Net ID: {ip_address}")
print(f"Class C")
subnet_mask = "255.255.255.0"
print(f"Network Mask: {subnet_mask}")

# Create an IPv4 network object
network = ipaddress.IPv4Network(f"{ip_address}/{subnet_mask}", strict=False)

# Set the number of subnets to 4
num_subnets = int(input("Enter the no. of subnets: "))

# Calculate the custom prefix length with 2 bits for subnet ID
custom_prefix_length = network.prefixlen + 2

# Calculate the subnet size
subnet_size = 2 ** (32 - custom_prefix_length)

print(f"Total number of IP addresses possible in each subnet: {subnet_size} addresses")

# Iterate and print each of the 4 subnets with a custom prefix length of 30 bits
for i, subnet in enumerate(network.subnets(new_prefix=custom_prefix_length)):
    if i >= num_subnets:
        break
    print(f"For Subnet {i + 1}:")
    print(f"Subnet Address: {subnet.network_address}")
    print(f"Broadcast Address: {subnet.broadcast_address}")
    print(f"Valid Range: {subnet.network_address + 1} to {subnet.broadcast_address - 1}")
    print()
```

```
Enter the IP address (e.g., 192.168.1.0): 193.121.100.0
Net ID: 193.121.100.0
Class C
Network Mask: 255.255.255.0
Enter the no. of subnets: 4
Total number of IP addresses possible in each subnet: 64 addresses
For Subnet 1:
Subnet Address: 193.121.100.0
Broadcast Address: 193.121.100.63
Valid Range: 193.121.100.1 to 193.121.100.62

For Subnet 2:
Subnet Address: 193.121.100.64
Broadcast Address: 193.121.100.127
Valid Range: 193.121.100.65 to 193.121.100.126

For Subnet 3:
Subnet Address: 193.121.100.128
Broadcast Address: 193.121.100.191
Valid Range: 193.121.100.129 to 193.121.100.190

For Subnet 4:
Subnet Address: 193.121.100.192
Broadcast Address: 193.121.100.255
Valid Range: 193.121.100.193 to 193.121.100.254
```