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- AIM:- Study of Network IP:
  - Classification of IP address
  - Subnetting
  - Supernetting
- Apparatus (Software):- NA
- Theory:- An IP Address (Internet Protocol Address) is a unique numerical label assigned to each device connected to a network. It identifies both the host and the network to which the device belongs. IP Addresses are categorized into classes based on their range and usage.
  There are two versions of IP:
  - IPv4 → 32-bit address (e.g., 192.168.1.1)
  - IPv6 → 128-bit address (e.g., 2001:0db8:85a3::8a2e:0370:7334)

In this experiment, we focus on IPv4 addressing.

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- Procedure:- Following is required to be study under this Practical.
  - Classification of IP Address.

As shown in below figure we teach how the IP addresses are classified and when they are used.

Class	Address Range	Supports
Class A	1.0.0.1 to 126.255.255.254	Supports 16 million hosts on each of 127 networks.
Class B	128.1.0.1 to 191.255.255.254	Supports 65,000 hosts on each of 16,000 networks.
Class C	192.0.1.1 to 223.255.254.254	Supports 254 hosts on each 2 million networks.
Class D	224.0.0.0 to 239.255.255.255	Reserved for multicast groups
Class E	240.0.0.0 to 254.255.255.254	Reserved.

* Note:

(i) IPs starting with 127.X.X.X are reserved for loopback (local host) testing.

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(ii) Private IP ranges:

(a) Class A: 10.0.0.0 – 10.255.255.255

(b) Class B: 172.16.0.0 – 172.31.255.255

(c) Class C: 192.168.0.0 – 192.168.255.255

- Subnetting: Subnetting is the Process of dividing a large network into smaller Subnetworks (Subnets) to improve performance and security and reduce broadcast traffic.
  Now let's see why we develop Sub netting and How to calculate Subnet mask and how to identify Subnet address.

(i) Why we use Subnetting

- Efficient Utilization of IP address
- Enhanced network security and Organization
- Reduces network Congestion
- Simplifies management.

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(ii) How to calcuate Subnet mask

(a) Identify the class of IP address

(b) Determine how many bits you need to borrow from the host Portion for Subnetting.

(c) Calcuate:

- Number of Subnets = 2^n (where n = borrowed bits)
- Number of Hosts Per Subnet = $2^h - 2$ (where h = remaining host bits)

- Supernetting: Supernetting is the opposite of Subnetting - it combines multiple smaller networks into a single larger network. It is commonly used by ISPs to simplify routing and increase efficiency. Now let's see why we develop Supernetting and How to calcuate Supernet mask and how to identify Supernet address.

(i) Why we use Supernetting

- Reduces routing table size
- Efficient IP management for ISPs
- Allows aggregation of several networks into one.

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(ii) How to calculate Supernet mask

(a) Identify adjacent networks that can be combined.

(b) Check that the networks are contiguous (in sequence)

(c) Move the network mask boundry leftward to reduce network bits.

- Result:

(i) Studied the Classification of IP addresses (A-E)

(ii) Learned how to perform subnetting and calculate subnet masks and subnet addresses.

(iii) Understood the concept of supernetting and how to calculate supernet masks.

- Conclusion:

By performing this experiment, we understood the structure of IP addresses, how networks are divided using subnetting, and how multiple networks are combined using supernetting. These concepts are essential for efficient network design and management.