Q. B 2:

TCP/IP Addressing Schemes

TCP/IP uses a 32 bit addressing scheme to identify the devices on a network. These 32 bits are divided into four octets, of eight bits each. Each of these four octets is represented in a decimal form, and separated by a dot. For example, 198.172.168.10 is an IP address. This format of representing IP address is called the dotted decimal format.

The octets in an IP address can take a decimal value from 9 to 255 because the largest decimal value that can be represented by eight binary bits is 255(11111111 in binary). For example, the 32-bit binary address 11000110.10101100.1010100.0001010 represents the IP address 198.172.168.10.

Components of IP address:

For continence sake we use IP address dotted-decimal notation, while the computer converts this into binary. However, even though these sets of 32 bits are considered a single "entity", they have an internal structure containing two components:

- Network Identifier **(Network ID):** A certain number of bits, starting from the left-most bit, is used to identify the network where the host or other network interface is located. This is also sometimes called the network prefix or even just the prefix. This is the address of the network itself, and is used by other networks to identify this network.
- Host Identifier **(Host ID):** The remainder of the bits is used to identify the host on the network. This is the address of the device with in the network.

The fundamental division of the bits of an IP address is into a network ID and host ID. Here, the network ID is 8 bits long and the host ID is 24 bits in length.

An IP address contains two parts - a Network ID and a Host ID. This division enables us to have different kinds of address classes under which every IP address is grouped. The purpose behind grouping an IP address under a specific class was to determine which part of the address would be used for the Network ID and which part for the Host ID, along with the number of hosts supported by that particular class.

The different classes to which IP addresses belong are specified below:-

1. Class A Addresses: A class A address has a subnet mask of 255.0.0.0, which basically means that the first octet of the IP address belonging to this class will always specify the network ID, and the remaining three octets will specify the host ID. Class A addresses will be generally used in scenarios

Class A Subnet Mask	Netwok	Host	Host	Host
	255	0	0	0

were the number of networks is less (Because only one octet is being used to specify the network) and the number of hosts is more (Because three octets are being used to specify host ID's). Since each octet can range from 0 to 255, the number of hosts that can be supported by the class A address would be 256x256x256 = 16,777, 216. The first octet of a class A address would generally be between 1 and 126.

2. Class B Addresses: A class B address has a subnet mask of 255.255.0.0, which basically means that the first two octets will be used for the network ID, and the remaining two for the Host ID. A class B address will thus support 256x256 = 65,536 hosts on the network. The first octet of a class B address would generally fall between 128 and 191.

Class B Subnet Mask	Netwok	Network	Host	Host
	255	255	0	0

3. Class C Addresses: A class C address has a subnet mask of 255.255.255.0, which means that three octets identify the network ID and the last octet identifies the host ID. A class C address thus supports 256 hosts, and the first octet would generally be between 192 and 223.

4. Class D Addresses: Class D addresses are used for special types of applications on the network known as Multicast applications. A multicast application usually sends data to a number of systems at the same time by sending data to the multicast address. The first octet of a class D address ranges between 224 to 239 and this address is not usually assigned to a host on the network.

Class C Subnet Mask	Netwok	Network	Network	Host
	255	255	255	0

5. Class E Addresses: Class E addresses were developed only for experimental purposes and are not used on any network. The first octet of this address falls between 240 to 247.

Summary

Class	Subnet Mask decimal	No. of Hosts per Network	No. of Networks	Start -End Address
A	255.0.0.0	16 Million	127	1.0.0.0 - 126.255.255.255
B	255.255.0.0	65000	16000	128.0.0.0 - 191.255.255.255
C	255.255.255.0	254	2 Million	192.0.0.0 - 223.255.255.255
D	Reserved for multicast groups			224.0.0.0 - 239.255.255.255
E	Reserved for future use, or Research and Development Purposes			240.0.0.0 - 254.255.255.254