Unit-1

1) **What are transmission impairments? Explain the various impairments affecting the wired medium?**
   Note: - Answer in Edu-clash notes
2) **What is Data Communication & What are the components of data communication?**
   Note: - Answer in Edu-clash notes
3) **Explain the IP addressing System along its classes. What do you mean by Subnet Masking?**
   Answer: -
   1) In order to provide computer to computer communication via Internet, we need a global addressing scheme. Such an addressing is provided by Internet Protocol (IP) at the network layer.
   2) It is a 32-bit address This is called an **IP address or logical address.** Which is made up of the network ID, plus a unique host ID.? This address is typically represented with the decimal value of each octet separated by a period (for example, 192.168.7.27). Every Host and router on the internet has an IP Address. This IP address is unique and no two devices on the Internet can have the same address at the same time.
   3) These numbers are assigned by ISP (Internet Service Provider), and IP address can be used to identify the country or region from which a computer is connecting to the WEB. The IP address can either be Static or dynamic.
   4) In static address is to be given manually. But in dynamic a DHCP server is to be configured to give ip address to the connected hosts automatically. This address is used to uniquely identify each Network host over the network. p address is divided into 5 category usually called classes. This allocation has come to be called class full addressing.
      Following are the classes of ip:-

CLASSES	Range
Class A	1.0.0.0 to 127.255.255.255
Class B	128.0.0.0 to 191.255.255.255
Class C	192.0.0.0 to 223.255.255.255
Class D	224.0.0.0 to 239.255.255.255
Class E	240.0.0.0 to 255.255.255.255

5) IP addressing supports five different address classes: A, B, C, D and E. Only classes A, Band C are available for commercial use.We can find the class of an address when given the address in binary notation or dotted decimal notation. If the address is given in binary notation, the first few bits can tell us the class of the address. If the address is given in dotted decimal notation, the first byte defines the class.
6) **Class A addresses**

   A) Class A addresses are designed for large organizations with a large number of hosts or routers.
   B) In this the first octet of the address identifies the network and the next three octets are used to identify the host.
   C) The first bit of first octet is always 0 and the remaining 7 bits are used to identify the network address.
   D) The next three octets *i.e.* 24 bits are used to identify the host.
   E) The class support addresses from 0.0.0.0 to 0.255.255.255
   F) The first block of network address starts with 1.0.0.0 and the last block of network address starts with 127.0.0.0.
   G) As there are 7 bits in network address, 2^7 = 128 blocks of network address are possible. Out of these two network blocks are reserved. Hence total 126 address blocks are used.
   H) Each network blocks can have 2^{24}--- 2 hosts *i.e.* 16,777,214 host address. Two addresses are less as one address is reserved for the broadcast address and one address is reserved for the network.
   I) A block in class A is too large for almost any organization. This means most of the addresses in class A are wasted and are not used.

7) **Class B address**

   A) The class B addresses are designed for medium sized organizations with tens of thousands of attached hosts or routers.
   B) In this, the first two octets of the address identify the network and the next two octets identify the host within the network.
   C) The first two bits (high order bits) of first octet are always 1,0. Thus the remaining 14 bits identify the network
   D) The third and fourth octet *i.e.* 6 bits are used to identify the host.
   E) The first network block of this class covers the addresses from 128.0.0.0 to 128.0.255.255 (net id 128.0). The last network block of this class covers addresses from 191.255.255.255 (net id 191.255)
   F) The maximum number of network blocks in class B is 2^{14} = 16384.
   G) Each network block in class B can have 2^{16}--- 2 = 65,534 hosts.
   H) A block in class B is also very large and most of the address in class B is also wasted.

8) **Class C address**

A) The class C addresses is designed for small organizations with a small number of attached hosts or routers.
B) In class C, the first three octets of address are used for network and the last octet is used to identify the host.
C) The first three bits of first octet are always set to 1, 1, 0.
D) The remaining 24 - 3 = 21 bits are used for network identification and only 8 bits are used for host.
E) In class C, 2^{21} = 2,097,152 network blocks are possible.
F) Thus, each block in class C address can have 2^8 - 2 = 254 hosts.
G) The first block of network covers addresses from 192.0.0.0 to 192.0.0.255.
H) The last block of network covers the addresses form 223.255.255.0 to 223.255.255.255
I) The class C addresses are too less for many organizations as it supports only 254 hosts in a network.

9) **Class D address**

A) Class D addresses are used for multicast groups (multicasting)
B) The concept of division of octets into network id and host id does not apply to class D.
C) The first four bits of first octet in class D are always set to 1,1,1,0.
D) The address range is 224.0.0.0 to 239.255.255.255

10) **Class E address**

A) The Class E address are reserved for future use and are experimental.
B) The concept of network id and hostid does not apply on class E also.
C) The first four bits of first octet are always set to 1,1,1,1.
D) The address range for class E is 240.0.0.0 to 255.255.255.255.

IP address or class A,B,C,D,E

summary of the varous featuers of IPP addres classes

Class	Format	Purpose	High order bits (s)	Address range of first octet	No of Network/host bits	Max hosts
A	N.H.H.H	Large Organization	0	1-127	7/24	16,777,214 ($2^{24}-2$)
B	N.N.H.H	Medium size organization	1,0	128-191	14/16	65,543 ($2^{16}-2$)
C	N.N.N.H	Small organization	1,1,0	192-223	21/8	245 ($2^{8}-2$)
D	NA	Multicast organization	1,1,1,0	224-239	NA	NA
E	NA	Experimental	1,1,1,1	240-255	NA	NA

E) A Router has more than one IP address because router connects two or more different networks. But A computer or host can only have one and a unique ip address. A routers function is to inspect incoming packet and determine whether it belongs to local network or to a Remote Network, if a local packet is determined then there is no need of routing and if a Remote packet is determined then it will route that packet according to the routing table other wise the packet will be discarded.

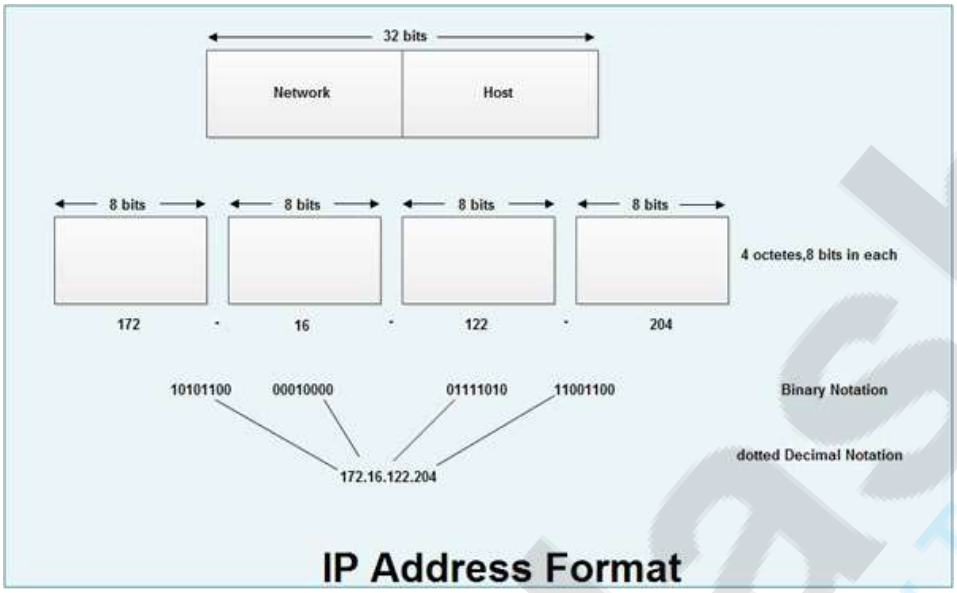
F) In the virtual hosting environment, a single machine can act like multiple machines (with multiple domain names and IP addresses.

G) **IP address format**

A) The 32-bit IP address is grouped eight bits at a time, separated by dots and represented in decimal format. This is known as dotted decimal notation as shown in fig.

B) Each bit in the octet has a binary weight (128,64,32, 16,8,4,2, 1).

C) The minimum value for an octet is 0, and the maximum value for an octet is 255.



H) **Subnetting: -**

A) The process of subnetting involves dividing a network up into smaller networks called subnets or sub networks. Each of these subnets has its own specific address. To create these additional networks we use a subnet mask. The subnet mask simply determines which portion of the IP address belongs to the host. The subnet address is created by dividing the host address into network address and host address.

B) The network address specifies the type of subnetwork in the network and the host address specifies the host of that subnet. Subnets are under local administration. As such, the outside world sees an organization as a single network and has no detailed knowledge of the organization's intema1 structure. Subnetting provides the network administrator with several benefits, including extra flexibility, more efficient use of network address and the capability to contain broadcast traffic. A given .network address can be broken up into may subnetworks. For example, 172.16.1.0, 172.16.2.0, 172.16.3.0 and 172.16.4.0 are all subnets within network 171.16.0.0.

C) A subnet address is created by. borrowing bits from the host field and designating them as subnet field. The number of bits borrowed varies and is specified by the subnet mask. Fig. shows how bits are borrowed from the host address field to create the subnet address field.

Subnet Mask For Class B Address

	Network	Network	Subnet	Host
Binary representation	11111111	11111111	11111111	00000000
Dotted Decimal Representation	255 .	255 .	255 .	0

Bits are borrowed form the host address field to create the subnet address field

D) The subnet mask does not alter the class of the IP address; it simply "borrows" bits from the host portion and uses these to create subnets. This naturally reduces the maximum number of hosts your network can have, because you are using some of your host bits for your subnet bits.

I) Subnet-Mask: -

A) Subnet mask uses the same format and representation technique as IP addresses.Subnet mask has binary is in all bits specifying the network and subnetwork fields, and binary Os in all bits specifying the host field. A subnet address is created by borrowing the bits from host field. Subnet mask bits should come from the high-order (left most) bits of the host field.

B) Various types of subnet mask exist for class Band C subnets.

C) The default subnet mask for a class B address that has no subnetting is 255.255.0.0, while the subnet mask for a class B address 171.16.0.0 that specifies eight bits of subnetting is 255.255.255.0. The reason for this is that eight bits of subnetting or 2^8 - 2 (1 for the network address and 1 for the broadcast address) = 254 subnets possible, with 2^8 - 2 = 254 hosts per subnet.

Subnet Mask for class B Address

	Network	Network	Subnet	Host
Binary representation	11111111	11111111	11111111	00000000
Dotted Decimal Representation	255 .	255 .	255 .	0

A Sample subnet mask

D) • The subnet mask for a class C address 192.168.2.0 that specifies five bits of subnetting is 255.255.255.248 with five bits available for subnetting, 2^5 - 2 = 30 subnets possible, with 2^3 - 2 = 6 hosts per subnet.

E)

128	64	32	16	8	4	2	1		
1	0	0	0	0	0	0	0	=	128
1	1	0	0	0	0	0	0	=	192
1	1	1	0	0	0	0	0	=	224
1	1	1	1	0	0	0	0	=	240
1	1	1	1	1	0	0	0	=	248
1	1	1	1	1	1	0	0	=	252
1	1	1	1	1	1	1	0	=	255
1	1	1	1	1	1	1	1	=	254

Subnet mask bits come form the high - order bits of host field.

How subnet masks are used to determine the network number

F) The router performs a set process to determine the network (or more specifically, the subnetwork) address.
G) First, the router extracts the IP destination address from the incoming packet and retrieves the internal subnet mask.
H) It then performs a *logical* AND operation to obtain the network number. In logical AND operation, 1 "ANDed" with 1 yields 1 and 1 "ANDed" with 0 yields 0.
I) This causes the host portion of the IP destination address to be removed, while the destination network number remains.

J) The router then looks up the destination network number and matches it with an outgoing interface.
K) Finally, it forwards the frame to the destination IP address.
L) Figure shows that when a logical AND of the destination IP address and the subnet mask is performed, the sub-network number remains, which the router uses to forward the packet.

		Network	Subnet	Host
Destination IP address	171.16.12		00000001 11111111	00000010 00000000
Subnet mask	255.255.255.O		00000001 1	00000000 0

Applying logical AND between the destination IP address & the subnet mask Produces subnetwork number