Name:- Pranav Mishra Registration No:- 12114762
Assignment: 2 Course Code:- CAP275 Teacher Name:- Dr. Mithlesh S
Course Title: Data Communication & Networking
Roll No:- RD0C09A55

Ques:-1- What is difference between bit stuffing and byte stuffing? Explain with suitable example.

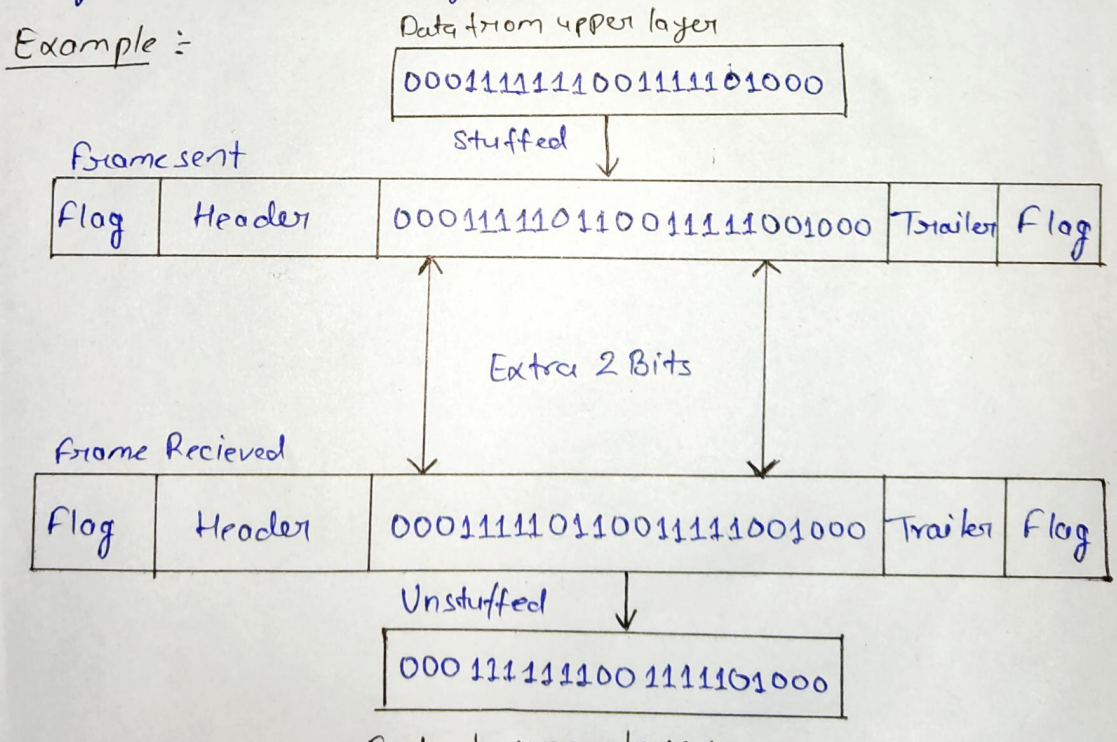
Ans:- The difference between bit stuffing and byte stuffing can be done under the following-

Bit Stuffing:- Mostly flag is a special 8-bit pattern "01111110" used to define the beginning and the end of the frame.

Problem with the flag is the same as that was in case of byte stuffing. So, in this protocol what we do is, if we encounter 0 and five consecutive 1 bits, an extra 0 is added after these bits. This extra stuffed bit is removed from the data by the receiver.

The extra bit is added after one 0 followed by five 1 bits regardless of the values of the next bit. Also, as the sender side always known which sequence is data and which is flag it will only add this extra bit in the data sequence, not in the flag sequence.

Example :-

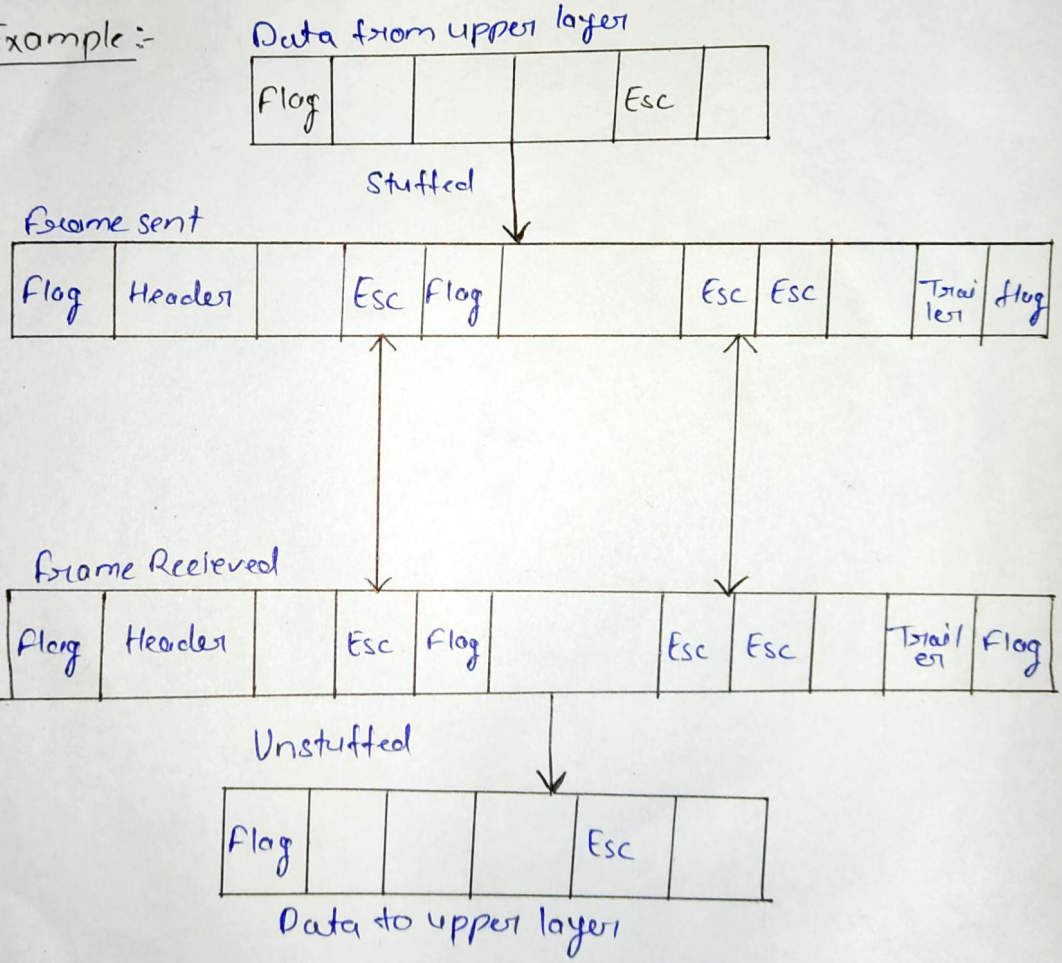


Byte stuffing:- A byte, which has a predefined bit pattern is added to the data section of the frame when there is a character with the same pattern as the flag. Whenever the receiver encounter the ESC (Escape character) character, it removes from the data section and treats the next character as data, not a flag.

But the problem arises when the text contains one or more escape character followed by a flag. To solve this problem, the escape characters that are part of the text are marked by another escape character.

i.e. If the escape character is part of the text, an extra one is added to show that the second one is part of the text.

Example:-



Ques:2:- What is checksum? Explain it with suitable example.

Ans:- Checksum:- Checksum is the error detection method used by upper layer protocols and is considered to be more reliable the LRC, VRC, and CRC. This method makes the use of Checksum Generator on Sender side and checksum Checker on Receiver side.

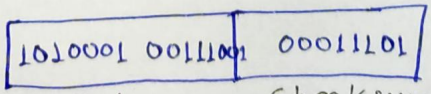
At the sender side, the data is divided into equal subunits of n bit length by the checksum generator. This bit is generally of 16-bit length. These sub units are then added together using one's complement method. This sum is of n bits. The resultant bit is then complemented. This complemented sum which is called checksum is appended to the end of original data unit and is then transmitted to Receiver.

The Receiver after receiving data + checksum passes it to checksum checker. Checksum checker divides this data units into various subunits of equal length and adds all these sub units. These subunits also contain checksum as one of the sub units. The resultant bit is then complemented. If the complemented result is zero, it means the data is error-free, If the result is non zero it means the data contains an error and Receiver rejects it.

Ex:- If the data unit to be transmitted is 10101001001 11001, the following procedure is used at sender site and Reciver site.

```
10101001        subunit 1
00111001        subunit 2
11100010        sum (using 1s complement)
00011101        Checksum (complement of sum)
```

Data transmitted to Receiver is-



Receiver Site:-

10101001	subunit 1
00111001	subunit 2
00011101	Checksum
11111111	sum
00000000	sum's complement

Result is zero, it means no error.

Advantage :- The checksum detects all the errors involving an odd number of bits as well as the error involving an even number of bits.

Disadvantage :- The main problem is that the error goes undetected if one or more bits of a subunits is damaged and corresponding bit or bits of a subunit are damaged and the corresponding bit or bits of opposite value in second subunit are also damaged. This is because the sum of those columns remains unchanged.

Ques :- 3 :- What is HDLC? Explain the frame format of HDLC with neat and clean diagram.

Ans :- HDLC (High-Level Data Link Control) :- High-level Data Link Control is basically bit-oriented protocol for communication that means it uses bit stuffing to achieve data transparency over very point to point and multipoint links in Data Link Layer (DLL). Transparency is basically separation of data from control signals. HDLC was being derived from Synchronous Data Link Control (SDLC).

HDLC is most important and essential protocol in data link layer. Data is also organized and divided into small units also known as data frames and is tranferred across network to destination that verifies and ensure its successful arrival.

There are three types of HDLC frames :-

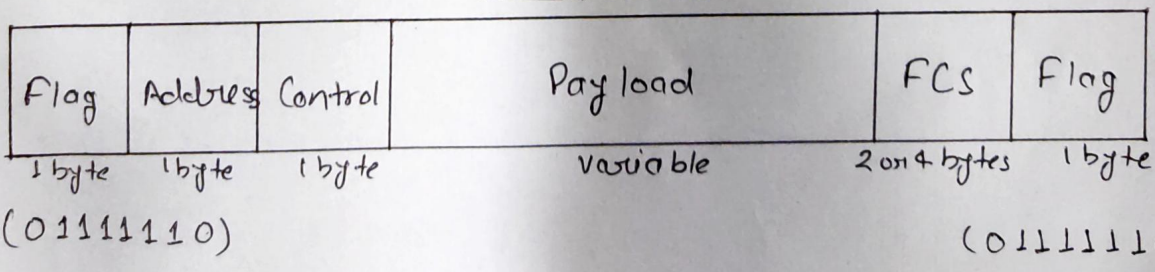
→ Information frames / User data (I-frames)
→ Supervisory frames / Control data (S-frames)
→ Unnumbered frames (U-frames)

HDLC Frame :-

HDLC is a bit-oriented protocol where each frame contains up to six fields. The structure varies according to the type of frame.

The fields of a HDLC frame are-

HDLC Frame



Flag - It is an 8-bit sequence that marks the beginning and the end of the frame. The bit pattern of the flag is 01111110.

Address :- It contains the address of the receiver. If the frame is sent by the primary station, it contains the address(es) of the secondary station(s). If it is sent by the secondary station, it contains the address of the primary station. The address field may be from 1 byte to several bytes.

Control :- It is 1 or 2 bytes containing flow and error control information.

Payload :- This carries the data from the network layer. Its length may vary from one network to another.

FCS :- It is a 2 byte or 4 bytes frame check sequence for error detection. The standard code used is CRC (Cyclic Redundancy code).

Ques: 4:- What is classful addressing scheme? Find the class of following :-

(a) Find the class of each address with their subnet mask.

(a) 00000001 00001011 00001011 11101111

Ans:- Classful Addressing :- IP address is an address having information about how to reach a specific host, especially outside the LAN. An IP address is a 32 bit unique address having an address space of 2^{32}.

Generally, there are two notation in which IP address is written, dotted decimal notation and hexadecimal notation

Dotted Decimal Notation :-

120.11.3.31

Hexadecimal Notation :-

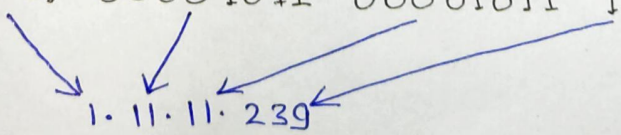
0X75D95EA

~~Classful~~

The 32 bit IP address is divided into five sub-classes. These are following:

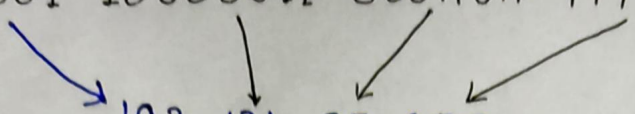
- Class A
- Class B
- Class C
- Class D
- Class E

(a) 00000001 00001011 00001011 11101111



This is from class A address and the subnet mask of this 255.0.0.0

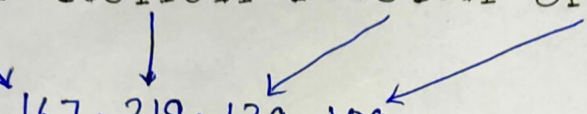
(b) 11000001 10000011 00011011 11111111



193.131.27.255

This is from class C address and the subnet mask of ~~this~~ class C is 255.255.255.0

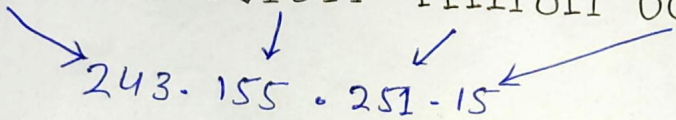
(c) 10100111 11011011 10001011 01101111



167.219.139.109

This is from class B address and the subnet mask of class B is 255.255.0.0

(d) 11110011 10011011 11111011 00001111



243.155.251.15

This is from class D address and the subnet mask of class D is 255.255.255.255.

Ques:-5 An address in a block is given as 73.22.17.25. Find the number of address in the block, the first address and the last address.

Ans:- Given IP: 73.22.17.25

1- This address is belongs to class A as it lies in range 0-127.

2- As we know, in class the subnet mask is 8 n=8

73.22.17.25/8

Number of Address: $N = 2^{32-n}$

Here $n = 8$, therefore

$2^{32-8} = 2^{24} \Rightarrow 16777216$

First address:- To get first address, we add IP address to subnet mask of that class IP address.

Subnet mask for class A is : 255.0.0.0

- Add 73.22.17.25 with 255.0.0.0 perform bitwise and operation

$$\begin{array}{r} 73.22.17.25 \\ 255.0.0.0 \\ \hline 73.0.0.0 \end{array}$$

- First address is 73.00.018 or 73.0.0.0

Last address is - 73.255.255.255

(2) An address in a block is given as 172.16.5.1. Find the number of address in the block, the first address and the last address.

Ans:- Given IP = 172.16.5.1

÷This address belongs to class B because it lies b/w 128-191

Number of Address:- $N = 2^{32-n}$

$n = 16$

$= 2^{32-16} = 2^{16} = 65536$

~~So Number of address in this b~~

First address:- Subnet mask classB is 255.255.0.0

172.16.5.1
255.255.0.0

172.16.0.0

First IP address is 172.16.0.0

Last address:-

So, Last address is → 172.16.255.255

(3) An address in a block is given as 192.168.5.1. Find the number of address in the block, the first address and the last address.

Ans:- Given IP address is 192.168.5.1

+ This address belongs to classC, because it ~~has~~ lies between 192-233.

→ Default subnet value for classC is 24 n=24

So, we can easily find number of address in this block

Number of Address:-

$$N = 2^{32-n}$$

Here $n = 24$

$$2^{32-24} = 2^8 = 256$$

Total no. of address are = 256

First IP address:- Default subnet mask for classC is

255.255.255.0

192.168.5.1
255.255.255.0

First Address is = 192.168.5.0

Last Address:- Last address is = 192.168.5.255

As last address is used as broadcast network, so practically last address is 192.168.5.254