Chapter - 11

Data Link Control

Framing - data link layer needs to pack bits into frames, so that each frame is distinguish from another.

Character - oriented

Flag | data | Flag

F ABCD F   data b/w the flag.

Byte stuffing and unstuffing -

if flag is also a part of data then befor data's flag we insert esc.

Flag A Flag B Flag → Receiver Confuse

⇓

Flag A ESC Flag B Flag

Now if receiver found flag then it Check flag is there or not. if it is there then flag is part of data.

PAGE NO.:
DATE: / /

→ **Bit-oriented** –

Bit stuffing is the process of adding one extra 0 whenever five consecutive 1's follow a 0 in data, so that receiver does not mistake the pattern 0111110 for a flag.

Data – 0001111111 00 11111 01000

Stuffing

Sent – 00011111 0 1100 11111 0 01000
(↓ marks over the two stuffed 0s)

↓

Unstuffing

Received →

000 1111111 00 11111 001000

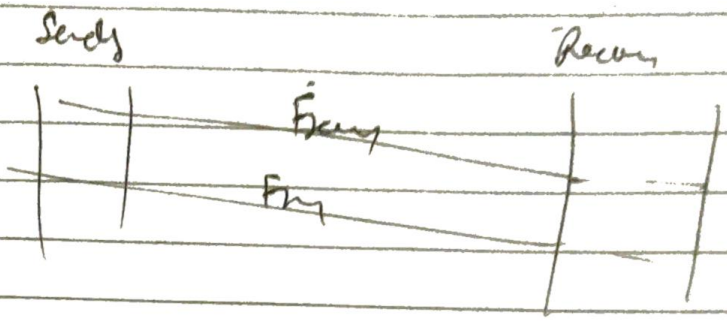
Flow and error control – Previously Discussed

→ **Data Link Layer Protocols** –

- For noiseless channel
  - Simplest
  - Stop and wait
- For noisy channel
  - Stop and wait ARQ
  - Go-Back N ARQ
  - Selective Repeat ARQ

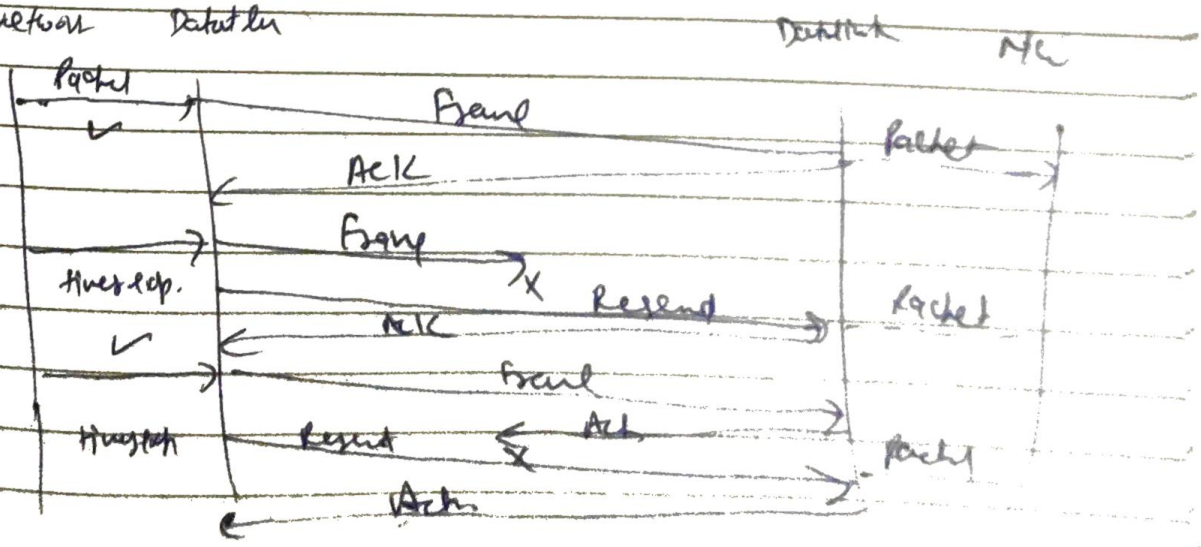
PAGE NO.:
DATE: / /

* Simplest Protocol - neither flow nor error control. We assume that receiver can immediately handle any frame it receives.



* Stop and wait Protocol - This uses both error and flow control.

In this Protocol, the sender sends one frame at a time and wait for an acknowledgement before sending the next one. Every time sender sends a frame, it starts timer. If ack arrives before time expire, timer stoped and sends the next frame. If the time expire, the sender resends the next frame. This means sender needs to keep copy of frame until its ack arrives.



For Noisy Channel

→ Stop and Wait ARQ :

Problem with Previous Stop and wait – if we send frame to receiver, accept this frame and send ACK to the sender. If ack loss, sender again resend the frame but receiver accept this frame previously and thinking this is the next frame. So here frames order not matched data can be corrupted.

→ In Stop and Wait ARQ we use seq. no. to no. of frame. The seq no. are based Modulo 2 arithematic
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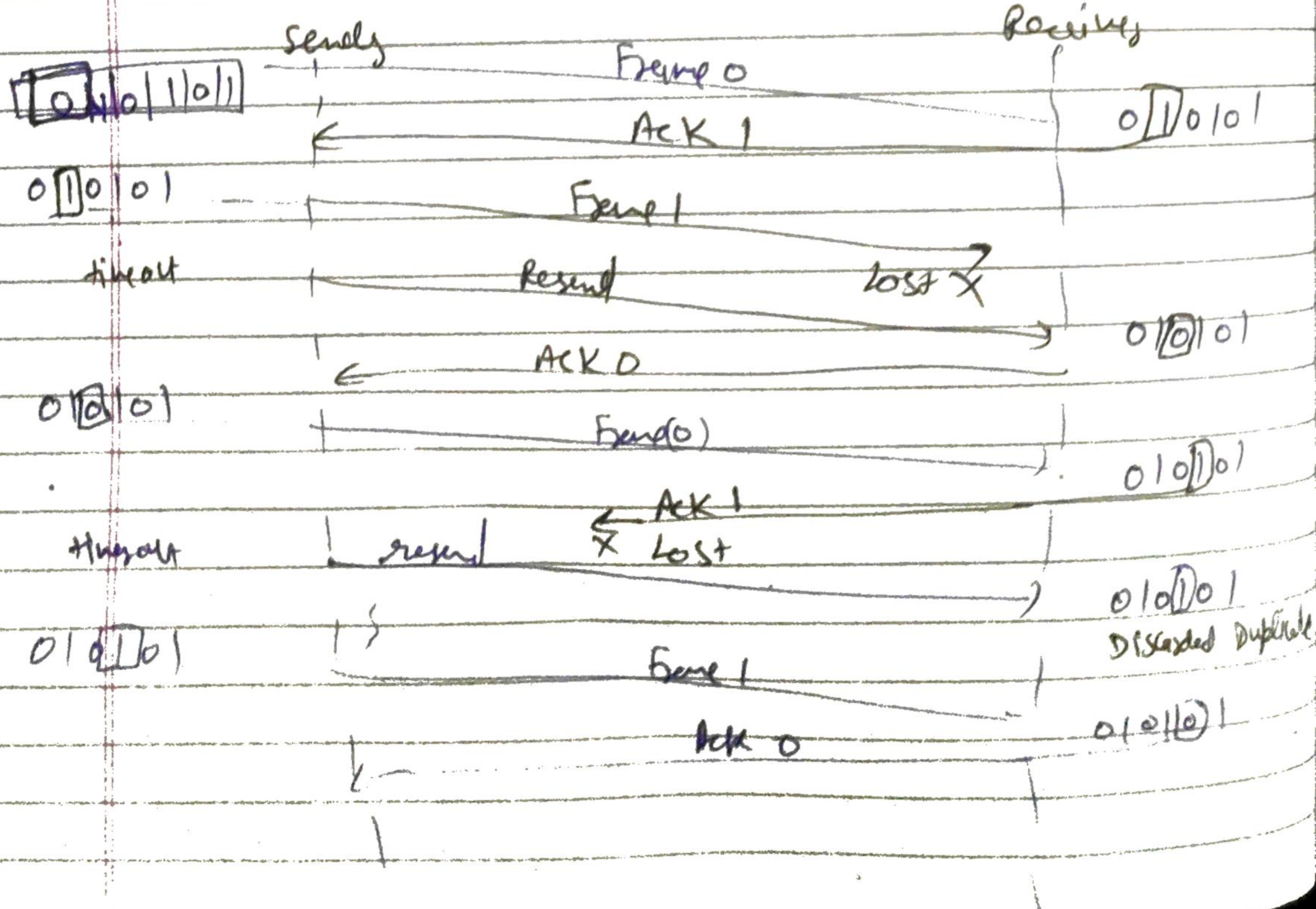
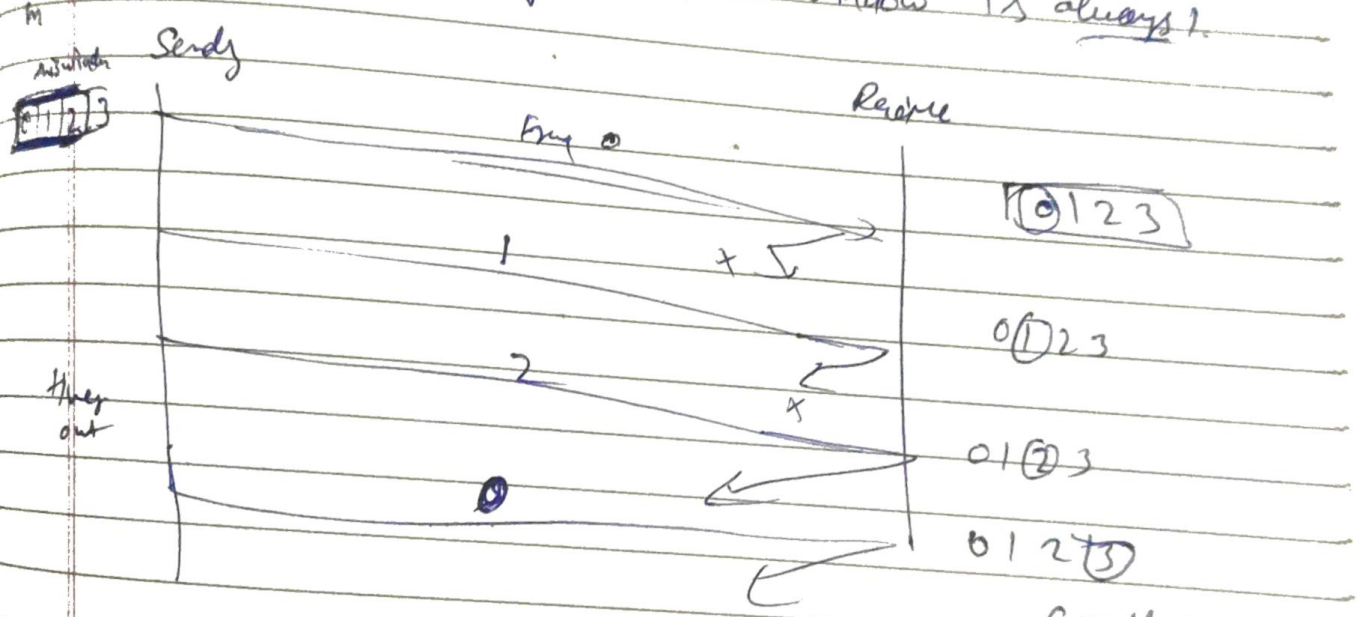


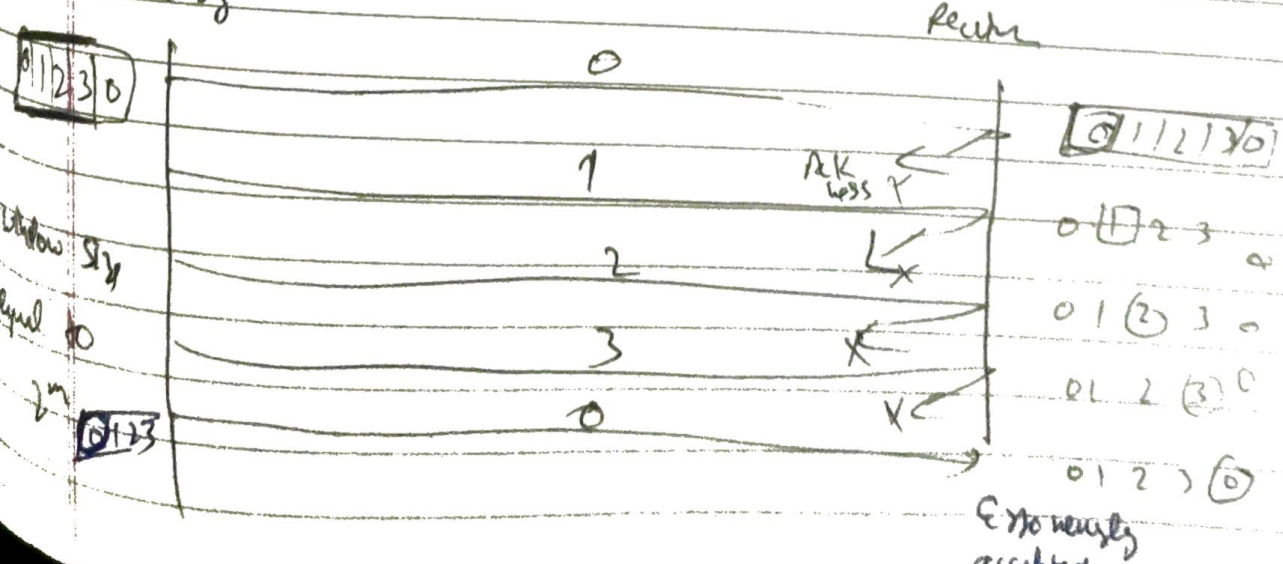
PAGE NO.
DATE

* Go Back N :- In this Protocol we can send several frames before receiving ack, we keep a copy of these frames until the acknowledgement arrive.

In which, the size of send window must be less than $2^m - 1$, the size of receiver window is always 1.



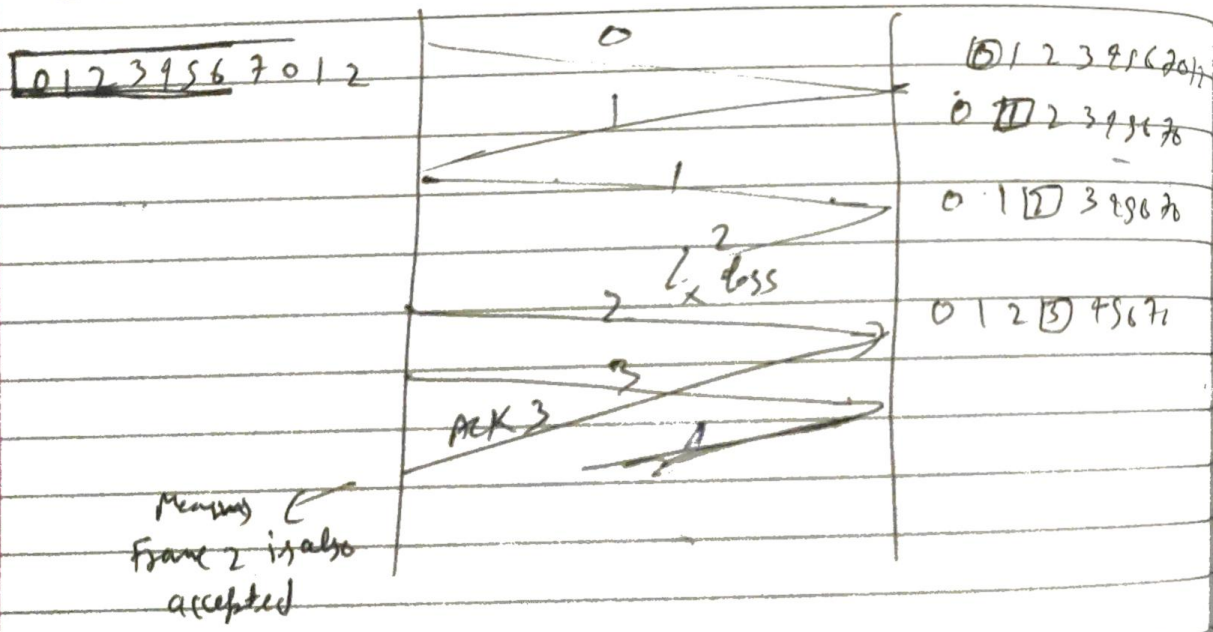
~~Sender~~ ~~Sender~~ window size $< 2^m$



PAGE NO.:
DATE: / /

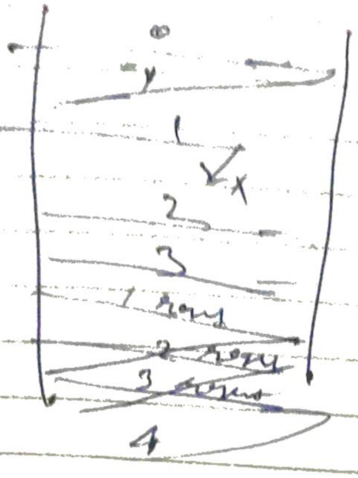
After timeout Sender resend frame 0 but receiver think that frame is next frame but it is first frame so here this error will be occur

diagram



Means if any ack lost, after, if greater value's ack is received then previous all frames are accepted.

a)



no action bcoz receiving waiting for frame 1.

bcoz receiving window size is 1.

* Selective Repeat Request.

In which both sending and receiving window size is same.

$2^{m-1} = 2^{m-1}$ same issue if we take lag than 2^{m-1}

in which out of order frames are also accepted

Means यहाँ window का size है उतने कोई भी आ गया तो accept होंगे सारे।

if any of frame Missing in window then Simply receiver send NACK (Negative Ack)

Means frame 1 lost 2, 3 accept होंगे तो 1 का NACK भेजेंगे।

window size 2^{m-1}