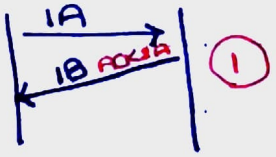
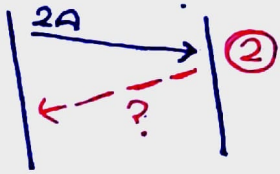
# CN Sheet 4

1. In One-bit Sliding window (Full duplex stop & wait)
   - → Node A sends Packet 1A to node B
   - → Node B sends Packet 1B to node A along with ACK 2A




. Now suppose
   - → Node A sends Packet 2A to node B
   - → Node B receives Packet 2A but has no Packet to send to node A.




Will Protocol Fail? Explain.

⇒ ① is the normal case (other party has a Packet to Piggyback the ack.)

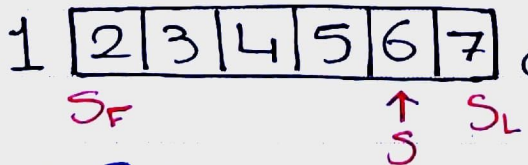
⇒ For ②, what we assumed in the lecture

| Sliding Window | Go Back N | Selective Repeat |
|---|---|---|
| • Network layer has ∞ supply of Packets © Sense | • Will block until it's ready (has a Packet) | • will stop blocking after ack. timeout |

- here we need to drop the assumption for sliding 1-bit window
  → In this case if when we try to fetch network layer Packet when there's none
    → it gives us a dummy to send (or returns false and we do it ourselves)
      - No Problem, Protocol won't fail (other side does get ack.)

    → it blocks until there's a Packet to send
      - Can cause Protocol to fail:
        → Network layer has no more Packets so Sender waits for ack forever.
        → It will keep timing out forever (resending the frame)

2. In Go-Back N
   → $W_S = 6$ ($\leq$ MAX-SEQ)
   → Frames 1, 2, 3, 4, 5 have been sent
   → Frames 6, 7, 8, 9, 10 waiting to be sent
   → Sender received on ack for 1




a) what Frames can Sender send before waiting for next ack from receiver?
   - Assuming it sent nothing yet ($S = S_F$) then
     2, 3, 4, 5, 6, 7
     (Otherwise just 6, 7)

b. Sometime later

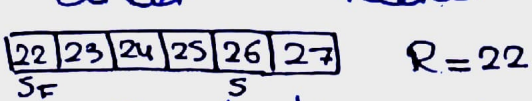
→ Sender transmit frames 20, 21, 22, 23, 24, 25

→ Frame 22 got loss

- Which frames will Sender have to retransmit

⇒ Receiver will expect & accept 20, 21

→ then will expect 22; frames 23, 24, 25 will get discarded.




- Receiver will keep silent, Sender time out & resends all outstanding frames 22, 23, 24, 25

C. Repeat B. but for Selective repeat

- This time when

→ Receiver gets 20, 21

- In order, so it passes to L3
- $R_f = 22$
- Send Cumulative ack 22 (Sender update $S_f$)

→ gets 23, 24, 25

- Not in-order; so it sends a nack on 22
- It still accepts them into buffer & marks them as arrived.
- Hence, Sender only needs to send 22 (response to nack)

3. Does Selective Repeat use Cumulative ackn. and why?

→ Yes
→ To let Sender Know that a Sequence of in order frames has arrived Successfully (so it Can Send more)
→ This is much more efficient than Sending individual acks
- In this case we Send more ack. frames (overhead)
- If the reverse Channel is noisy then many of them may need to be resent (overhead++)

Ex

4. Trade off between Go-back-N & Selective Rep.

Go Back N
→ Less buffer Size at receiver (1)
→ More efficient BW occupation
$W_S = 2^m - 1 > \frac{2^m}{2}$ (recall n ∝ no of frames)
assuming Channel isn't noisy.
→ If the Channel is noisy & receiver discards many outstanding frames (have to resend) then we lose this advantage.
→ Receiver is less Complex

- Meanwhile Selective Repeat is the opposite (much more efficient the noisier is the Channel)

5. Does Go-back-N fail for no reverse traffic?

// Page 1

→ yes
→ It must wait for a network_layer_ready event to send a frame with piggybacked ackn. (blocks)
- If that never happens, the other end will keep timing out & resending the frame.

6. How about selective repeat?

→ NO
→ It waits for network layer only for a limited time by setting an ack. timer
- If it timesout it will just send a lone ackn.
- Such time should be less than what it takes sender to time out (else ack loses its purpose as sender resends).

7. Why must window size for Go-back be MAX_SEQ $(2^m - 1)$ and not MAX_SEQ $(2^m)$

← let $m = 2$, $W_S = 4$


all acks get lost

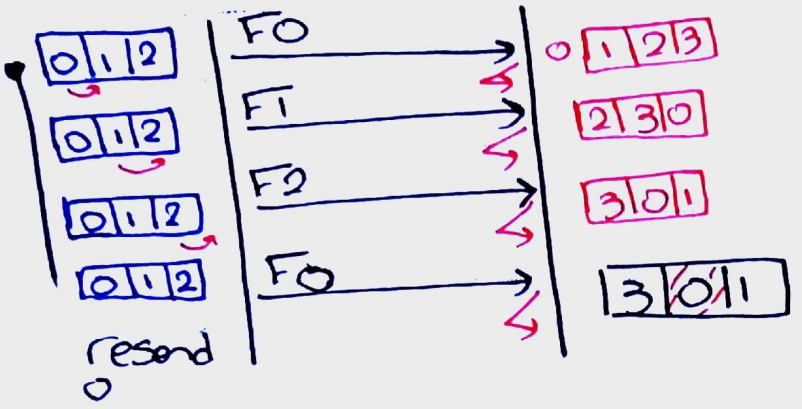
→ Sender assumes frames got lost & resends

- Receiver erroneously accepts the same seq. as if it's new.

8. For Selective rePeat why $W_S = W_R = \frac{MAX\_SEQ+1}{2}$ and not $MAX\_SEQ$ $(2^m - 1)$

$2^m/2$

- let $W_S = MAX\_SEQ = 3$




} erroneously accepted the 0 as Part of the same seq.

9. Which is better for a channel with high rate of Packet drop?

→ Selective rePeat as illustrated in 5

10. In SR, Should ACK Timer ≪ Retrans. timer or the OPPOSite?

- The opposite of course to avoid wasted Packets (as illustraked in 6)

#Rules

→ $W_S = \frac{2T_P + T_t}{T_t}$ For 100% efficiency

→ Minium no of bits m that makes all frames under the window different

$m = \lceil \log_2 W_S \rceil$ $W_S \leq 2^m - 1$ $W_S = 2^{m-1}$

- It's always more for Go-back / SR

11.

→ Sliding Window Protocol

→ 1000 Km long Cable (both ways) ⇄

→ Operates at 1 MBIS

→ $2T_p = 10$ MS/Km (round trip delay)

• Per Km of the Cable

→ Frame Size = 1KB

• What is m (bits for Seq nrs)

→ Known

$$m = \lceil \log_2 W_S \rceil \quad (1)$$

is the no. of bits we at least need.

• To get $W_S$, we can assume that efficiency is 100%.

$$W_S = \frac{2T_p + T_t}{T_t}$$

$$2T_p = 10\text{MS} \times 1000 = 10 \times 10^{-3} \text{ S}$$

$$T_t = \frac{L}{B} = \frac{1000B}{10^6 \text{ BIS}} = 10^{-3} \text{ S}$$

$W_S = 11$ by Plugging

$m = 4$ bits ($\lceil \log_2 11 \rceil$)

• We would've used the exact formula rather than (1) if SR/Go Back was specified.

12.

- $L = 1000$ bit
- $B = 10^6$ b/s
- $2T_p = 25$ ms
- half-duplex link (nothing special)

→ Find min no of bits to distinguish seq nrs (frames under window)

- Assume no time gap is needed between transmission of two frames (we already do by using $W_S = \frac{T_t + 2T_p}{T_t}$) 6

$$T_t = L/B = 10^{-3}\,s = 10^{-3}\,ms$$

$$W_S = \frac{T_t + 2T_p}{T_t} = 26$$

$$n = \lceil \log_2 W_S \rceil = 5 \text{ bits}$$