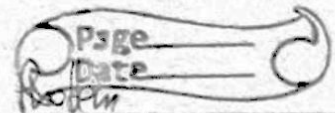


10/11/22

Computer Networks Assignment 2 - Networking



Question 4

(b) We can observe that at every loss event (which occurs at intervals - {5, 13, 23, 38}), the response of the TCP protocol is to set the  $cwnd = 1$ .

→ This means that for ~~any~~ any type of loss event - Timeout or 3D ACKs, the  $cwnd$  value is set to 1.

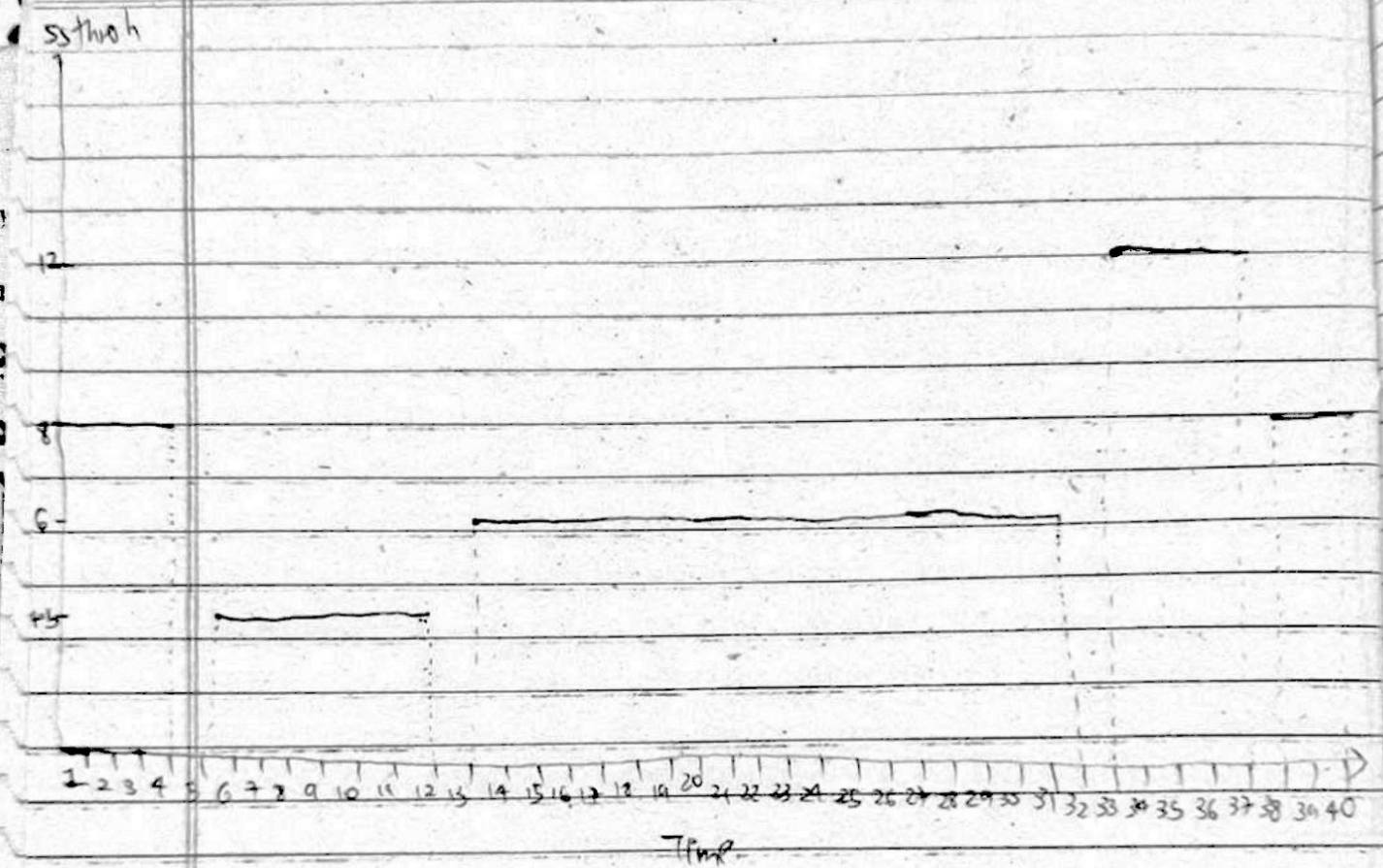
→ We know that TCP Tahoe responds to <sup>both</sup> loss events by setting -  $ssthresh = cwnd / 2$   
 $cwnd = 1$

→ So, we can conclude that the congestion control scheme is, in fact, TCP Tahoe.

→ This also means that we can't definitely say whether a loss event occurred due to - (1) Timeout  
(2) 3D ACKs.

(a) We can observe from the graph that the initial value of  $ssthresh$  was 8.

→ We note that at any loss event -  $ssthresh \leftarrow cwnd / 2$   
 $cwnd \leftarrow ssthresh$



(C) → In the interval 33, a flight of packets of size 24 is sent.

→ We know that there is a loss event here. However, this flight of packets of size 24 was still "in flight" when the sender sent it to the receiver.

→ Hence, the interval = 33  
# packets = 24

(d) → If every loss event corresponds to a timeout, then the maximum number of packets lost at every loss event is the cwnd size of the flight sent just before the loss event occurred.

→ If every loss event is considered to be due to 3D ACKs, then the minimum loss is just the 1 packet that is lost, for which the 3D ACKs were generated - assume that every other packet in the flight made it to the receiver.

→ This minimum/maximum deductions can be made because we are not sure why the loss occurred in the case of TCP Tahoe congestion scheme - it could be due to a Timeout or due to a 3D ACK.

→ Hence,  $\text{Max Loss} = 9 + 12 + 24 + 16 = \boxed{61 \text{ packets}}$

$\text{Min Loss} = 1 + 1 + 1 + 1 = \boxed{4 \text{ packets}}$

→ Max Loss occurs when all losses are ~~due~~ due to Timeout (not care) and Min Loss occurs when all losses are due to 3D ACKs with a minimum of 1 packet loss per loss event.

(e) In this scenario, we know for sure that the loss at interval 33 was due to 3D ACKs.

→ We can conclude that ~~the~~ when a loss event occurs due



to 3D ACKs, the minimum number of packets lost = 2  
maximum number of packets lost = cwnd - 3

(The only packets that reached the receiver were the 3 packets that generated 3dup ACKs. Rest all are lost.)

→ So, the overall maximum # packets lost =  $9 + 12 + (2+3) + 16$   
= 50 packets

This happens when losses at intervals {5, 13, 33} are due to worst-case timeouts and loss at {33} is due to worst-case 3D ACKs loss.

→ The minimum # packets lost =  $1+1+1+1$   
= 4 packets

→ This remains unchanged when all the losses are due to best-case 3D ACKs losses.