HomeWork -1 Spring 2019 Transport Layer

1.

a. False

b. False

c. True

d. False

e. False

2.

a. True ---- Let's assume that the sender has the window of size 3 and sent 0,1,2 packets at t0. Then the receiver receives the packets and send the ACK's 0,1,2 at t1. After this let's assume the sender timesout as the ACKs are not received and resends all the packets 0,1,2 at t2. Receiver already received in the first time and given ACKs again 0,1,2 at t3. Sender receives the ACKs that were sent by the receiver at t1 and moves the window to 3,4,5. And after some time t5 sender receives the ACKs 0,1,2 second time which are outside the window of (3,4,5).

b. True --- If the window size is 1, then SR , GBN are same as alternating bit protocol. Even though we get the cumulative ACK it refers to only single packet in the window.

3. A n bit sequence number can generate 0 – 2^n-1 numbers. Sequence number of nth packet is n mod 32 in this case. So for 110^{th} packet it's 110 mod 32 = 14

4.

a. Stop and Wait :

Send window =1

Receive Window= 1

b. Go back N :

Send window = 2^m -1 = 32 -1 = 31

Receive Window= 1

c. Selective Repeat :

Send window = 2^(m-1) = 16

Receive Window= 2^(m-1) = 16

5.

a. Let w be the maximum window size in segments

Mentioned that 10 Mbps link which will not buffer any data which is

$$(w * MSS)/ RTT = 10Mbps$$

$$\Rightarrow w* 1500 * 8 / (150 * 10^{-3}) = 10 * 10^6$$

$$w = 125$$

b. Average window size in TCP Reno is (3*w/4) = 0.75 * 125 = 93.75

Avg Throughput = avgwindowsize * MSS/RTT

$$(93.75 * (1500 * 8)) / (150 * 10^{-3}) = 7.5 \text{ Mbps}$$

c. When ever packet is lost , window size becomes w/2 and Increases the window size by 1 in each RTT to recover from packetloss.

No. of RTT needed to increase the window size from w/2 to w = w/r RTT

= 125/2 * (150 * 10^-3) = 9.375 s

6.

Date: / / /

$$\frac{W}{2} + \left(\frac{W}{2}+1\right) + \dots + W$$

$$= \sum_{n=0}^{W/2} \left(\frac{W}{2}+n\right)$$

$$= \left(\frac{W}{2}+1\right)\frac{W}{2} + \sum_{n=0}^{W/2} n$$

$$= \left(\frac{W}{2}+W\right)\frac{W}{2} + \frac{\left(\frac{W}{2}\right)\left(\frac{W}{2}+1\right)}{2}$$

$$= \frac{W^2}{4} + \frac{W}{2} + \frac{W^2}{8} + \frac{W^2}{4} = \frac{3W^2}{8} + \frac{3W}{4}$$

So the lossRate $L = \dfrac{1}{\frac{3W^2}{8}+\frac{3W}{4}}$

7.

a. Intervals of TCP congestion avoidance = [6-16] and [17-22]

b. Threshold becomes half the congestion window when packet loss occurred. Here we can see it occurred during 16^{th} Transmission round. At the stage congestion window is 42. So the threshold is 42/2 = 21 during 18^{th} Transmission round

c. Threshold becomes half the congestion window when packet loss occurred. Loss detected in 22^{nd} round and the window size is 29. So the threshold is 29/2 = 14 during 24^{th} Transmission round

d.

Round	Packets sent
1	1
2	2-3
3	4-7
4	8-15
5	16-31
6	32-63
7	64-96

Packet 70 is sent in 7^{th} Transmission round

e. Threshold will become half to the current congestion window of 8 when the loss occurred and the congestion window is set to new threshold value + 3 MSS. So the new values of congestion window and threshold will be 7 and 4 respectively.

f.

Round	Packet
17	1
18	2
19	4
20	8
21	16
22	21

The total packets would be 52

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