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## Part A: Transportation Layer

(see-my-lisp-for (and (1-1) (1-2)))

1-3 (14 marks) Suppose that a sender using TCP Reno is observed to have the following congestion window sizes, as measured in segments, during each transmission "round" spent in slow start or additive increase mode:

round	cwnd (in segments)	round	cwnd (in segments)
1		1	14
2		2	15
3		4	16
4		8	17
5		16	18
6		32	19
7		33	20
8		34	21
9		35	22
10		36	23
11		37	24
12		38	25
13		39	26

a. Identify the transmission rounds when TCP is in slow start mode.

from round 1-6, 23-26  
as the cwnd is increasing exponentially.

b. After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?

After the 16th transmission round,  
the the cwnd is decreased for 50%, means a non-severe congestion.  
So, it is detected by a triple duplicate ACK.

c. After the 22nd transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?

After the 22nd transmission round,  
the the cwnd is dropped to initial value, means a severe congestion.  
So, it is detected by a timeout.

d. What is the initial value of the slow start threshold ssthresh at the first transmission round?

At the first transmission round, the initial value for the threshold

should be at 32 segments.

As after round 7 (once passed 32 segments),  
the cwnd is increasing linearly.

e. What is the value of ssthresh at the 18th transmission round?

At the 18th round, the threshold should be at most 21 segments.

As after dropping to 21 segments, the cwnd is increasing linearly since then.

Also, it is when it enters the fast-recovery mode.

Therefore the threshold should be 21 segments.

f. What is the value of ssthresh at the 24th transmission round?

At the 24th round, it is in the slow-start mode, hence the threshold  
is set to 50% of before the congestion.

Therefore, the threshold should be 16 (13 but nearest 2's power) segments.

g. Assuming that a segment loss is detected after the 26th transmission round  
by the receipt of a triple duplicate ACK, what will be the new value of ssthresh  
and cwnd?

Since triple duplicate ACK is received, it is a non-severe congestion.

It enters the fast-recovery mode, with the threshold and cwnd set to  
50% of the current value, which is 50% of 8 = 4 segments.