

King Fahd University of Petroleum and Minerals  
 College of Computer Sciences and Engineering  
 Department of Computer Engineering

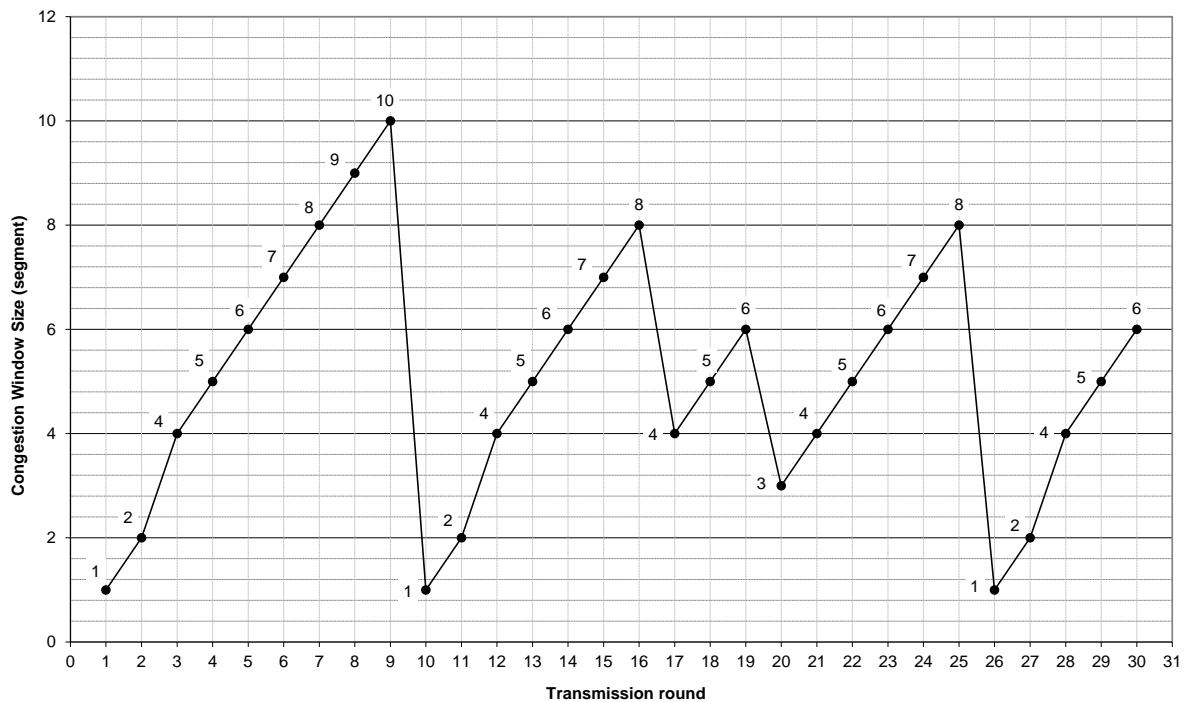
COE 344 – Computer Networks (T172)

Homework # 03 (due date & time: Tuesday 27/03/2018 during class period)

**Late homework submission will NOT be accepted**

\*\*\* Show all your work. No credit will be given if work is not shown! \*\*\*

**Problem # 1 (14 points):** Consider the following plot of TCP window size as a function of time.



Assuming TCP *Reno* is the protocol experiencing the behavior shown above, answer the following questions.

- a) (3 points) Identify the intervals of time when TCP *slow start* is operating.
- b) (3 points) Identify the intervals of time when TCP *congestion avoidance* is operating.
- c) (1 point) After the 16<sup>th</sup> transmission round, is segment loss detected by a **triple duplicate ACK** or by **timeout**?
- d) (1 point) After the 25<sup>th</sup> transmission round, is segment loss detected by a **triple duplicate ACK** or by **timeout**?
- e) (1 point) What is the initial value of **Threshold** at the first transmission round?
- f) (1 point) What is the value of **Threshold** at the 12<sup>th</sup> transmission round?
- g) (1 point) What is the value of **Threshold** at the 23<sup>rd</sup> transmission round?
- h) (2 points) During what transmission round is the 23<sup>rd</sup> segment sent?
- i) (1 point) Assuming a packet loss is detected after the 30<sup>th</sup> round by a **triple duplicate ACK**, what will be the values of the congestion-window size and of **Threshold**?

**Problem # 2 (36 points; 9 points each):** For each of the following TCP **Reno** scenarios, show the remainder of the traffic exchange (e.g. acknowledgements with sequence numbers, retransmissions with sequence numbers and size of data field, ...) assuming that no timeout takes place, time between any two received TCP segments is larger than 500 ms, all previously transmitted segments are received before a retransmission is received.

