National University of Computer and Emerging Sciences

FAST School of Computing **Fall-2020** **Islamabad Campus**

CS-307 Computer Networks

Wednesday, 25th November, 2020

Course Instructors

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Serial No:

Sessional Exam 2

Total Time: 1 Hours

Total Marks: 35

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Signature of Invigilator

_____ _____

Student Name Roll No Section Signature

DO NOT OPEN THE QUESTION BOOK OR START UNTIL INSTRUCTED.

Instructions:

1. Attempt on question paper. Attempt all of them. Read the question carefully, understand the question, and then attempt it.
2. No additional sheet will be provided for rough work. Use the back of the last page for rough work.
3. If you need more space write on the back side of the paper and clearly mark question and part number etc.
4. After asked to commence the exam, please verify that you have eight (8) different printed pages including this title page. There are a total of three questions.
5. Calculator sharing is strictly prohibited.
6. Use permanent ink pens only. Any part done using soft pencil will not be marked and cannot be claimed for rechecking.

	Q-1	Q-2	Q-3	Q-4	Q-5	Total
Marks Obtained						
Total Marks	**5**	**6**	**10**	**6**	**8**	**35**

Note: You need to be as specific as possible and provide the answers in the space provided. Anything written outside the allocated space (box) would not be considered for evaluation. Marks for each sub-part are mentioned with the question.

Cutting, over writing and irrelevant information would be considered as incorrect.

Question 1 [5 Points]

Suppose Host-A sends three segments back-to-back to Host-B using Go-Back-N protocol with Sequence-Numbers 1, 2, and 3 respectively. Answer, the following questions:

(i) If segment with Sequence-Number 2 is lost and the other two are correctly received, how Host-B will react in this situation?

[1 point]

It will send ACK(1) twice

(ii) If Host-B is not running a buffer, and there is successful in-order delivery of the three segments, what will be the acknowledgment-number(s) in response?

[1 point]

ACK(1), ACK(2), (ACK3)

(iii) For the mentioned scenario of three segments sent by Host-A, how many timers will be maintained by it?

[1 point]

Just a single timer

(iv) If Host-A receives acknowledgment for segment 2 only and timeout event is triggered, which segment(s) would be resent?

[1 point]

Segment with Sequence-Number 3 only would be resent as ack(2) is a cumulative ack for both segments 1 and 2.

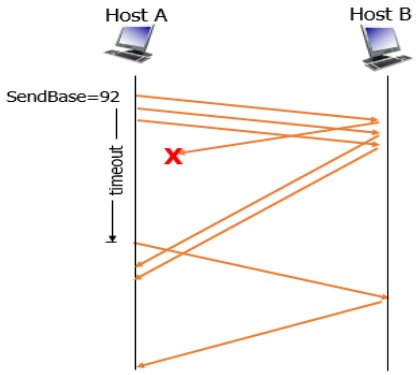
(v) If Host-A receives acknowledgments for segments 2 and 3 only, what will be the updated value of "'Send_Base" variable?

[1 point]

Send_Base will be advanced to 4. See sender FSM of Go-back-N.

Question 2 [6 Points]

Suppose Host A is sending some data to Host B using TCP and sent three segments back-to-back as shown in the following scenario. Consider initial timeout is of 0.3sec and Send Base of Host A is 92.



a). What will be the Sequence-No of these first three segments given their number of bytes equal to 10, 20, and 25?

[1 point]

92, 102, 122

b). What will be the Acknowledgment-No's in the three acknowledgement packets if these segments are successfully received by Host B?

[1 point]

Either 102, 122, 147 or 122, 147 if cumulative-ack is being used.

c). What will be the value of new timeout interval, if first acknowledgment is lost and the other two are received after timeout interval? Also specify Sequence-No of the segment(s) that will be retransmitted.

[2 points]

New time_out = 0.6 second
Retransmitted segment will be only the one with Sequence-No 92.

d). If acknowledgments for 2nd and 3rd segments are received at Host A before expiry of newly calculated timeout interval, will it cause the timeout interval to be changed (if yes, specify how) or will it remain the same? Justify your answer.

[1 point]

Yes it will cause the new timeout interval to be changed by using the following formula:

TimeoutInterval = EstimatedRTT + 4*DevRTT

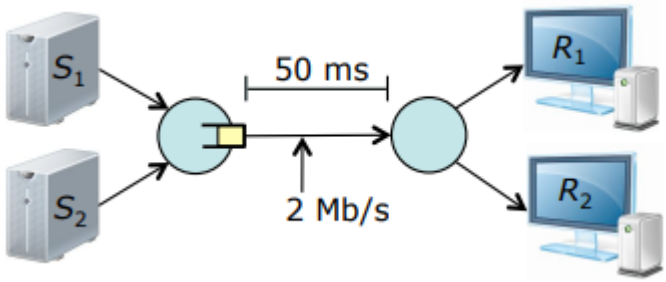
(e) If the retransmitted packet is received successfully by Host B, what Acknowledgment-No it will include in acknowledgment packet?

[1 point]

Finally the acknowledgment number will be 147.

Question 3 [10 Points]

The following diagram shows two TCP senders at left and the corresponding receivers at right. Both senders use TCP Reno. Assume that the MSS is 1 KB, that the one-way propagation delay for both connections is 50 ms and that the link joining the two routers has a bandwidth of 2 Mb/s.



(a) Assume that the link buffer overflows whenever **cwnd1+ cwnd2 ≥ 36 KB** and that at time 0, cwnd1=12 KB and cwnd2=24 KB. Approximately, what are the values of cwnd1 and cwnd2 one RTT later? Assume that all packet losses are detected by a triple duplicate ack.

Solution [6 points]

Cwnd = 36 KB when buffer overflows and congestion is detected. Therefore, ssthreshold would be updated and taken half.

New_ssthreshold1 = 12/2 KB = 6 KB
New_cwnd1 = New_ssthreshold1 + 3MSS
New_cwnd1 = 9 KB

New_ssthreshold2 = 24/2 KB = 12 KB
New_cwnd2 = New_ssthreshold2 + 3MSS
New_cwnd2 = 15 KB

(b) Suppose that a TCP Tahoe connection in the congestion avoidance state has a cwnd value of 64 KB, an MSS of 1 KB and an RTT of 100 ms. Suppose that at this point, it detects a lost packet. How does this change the value of cwnd and ssthresh? Approximately how much time passes before the sender goes back into the congestion avoidance state?

[4 points]

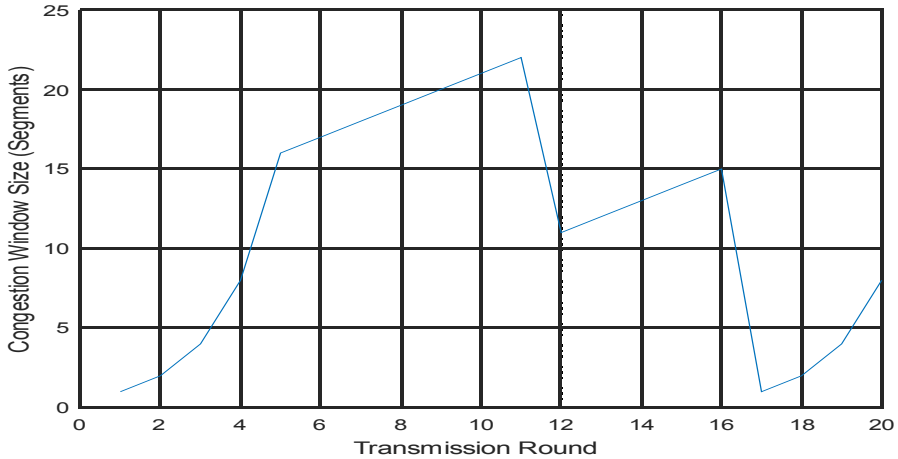
Solution

Using TCP Tahoe:
New_cwnd = 1 MSS = 1 KB
ssThreshold = 32 KB

Before retransmission, timeout would be doubled i.e. 200 ms and cwnd would get doubled everytime acks are received. Roughly, it will take (200+200+200+200+200) = 1000 ms (or 1 sec) to get the cwnd to 32 KB (ssThreshold) where onwards the congestion Avoidance state starts.

Question 4 [6 Points]

Given the following figure, suppose TCP Reno is being used as Transport layer protocol. Applying concepts of congestion control, answer the following questions:



i) Identify the interval(s) of time i.e Transmission Round when TCP slow start is operating.

[1 point]

Answer: 1 to 5 and 17 to 20

ii) Identify the interval(s) of time i.e Transmission Round when TCP congestion avoidance is

operating.

[1 point]

Answer: 5 to 11 and 12 to 16. (Even just 5-11 is also correct).

iii) Why there is sudden decrease in congestion window size at round 11?

[1 point]

Answer: This is due to three duplicate acknowledgments.

iv) Why there is more drastic decrease in congestion window size at round 16?

[1 point]

Answer: This is due to occurrence of timeout event.

v) What is the initial value of **ssthresh** at the first transmission round?

[1 point]

Answer: ssthresh = 16

vi) What is the value of **ssthresh** at the 14th transmission round?

[1 point]

Answer: ssthresh = 11

Question 5 [8 Points]

i). What can you say about the TCP segment in which the value of the control field is one of the following?

U	A	P	R	S	F

a). 000010

[1 point]

It is a SYN segment used for connection establishment.

b). 000001

[1 point]

It is a FIN segment used for connection termination.

c). 010001

[1 point]

It is an ACK segment against FIN segment.

d).010010

[1 point]

It is an ACK segment against SYN segment.

e). 100000

[1 point]

It is indicating that segment carries urgent data.

(ii) In a TCP connection, the value of cwnd is 4000 and the value of rwnd is 5000. The host has sent 1000 bytes which has not yet been acknowledged. How many more bytes can be sent?

3 points

Window size= minimum (cwnd, rwnd)
• Window size = minimum (4000 , 5000)=4000
• The number of bytes that can be sent = 4000 − 1000 = 3000 Bytes