Exam 2 Information

CMPSC 381
Data Communications and Networks
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The second midterm examination will be given in class on Wednesday, 30 March. It is closed book, closed notes; however, you may bring one 8 1/2 by 11 sheet of paper with anything written on it that you wish. Use of calculators or other electronic devices is not allowed. If an answer requires numerical calculation it can be left in partially-evaluated form as “A \times 10^P” where A may be a simple arithmetic expression and P is a single integer.

The exam will cover material from Monday, 15 February, through Friday, 18 March (chapter 3 in Kurose & Ross, plus sections 4.1–4.4 of chapter 4).

Here are examples of the kinds of questions that might be asked. This is not intended to be a sample exam; the topics covered below are not intended to be an exhaustive review. In particular, knowing the answers to all the questions below will not guarantee a good grade on the exam!

1. **(One more time.)** Explain the differences in demultiplexing with respect to UDP segments and TCP segments.

2. True or false:
   
   (a) Flow control is achieved with the use of the cwnd field in the header of the TCP segment.
   
   (b) “Fast retransmit” refers to resending a segment before its timer has expired; it is triggered by receiving three duplicate acknowledgements.
   
   (c) The size of the “receive window” is always less than or equal to the size of the “congestion window.”
   
   (d) TCP is an example of a “Selective Repeat” protocol.

3. Figure 1 shows a “flight” of six segments being sent in a general RDT protocol (*not necessarily* TCP!). Each segment’s sequence number is shown; each segment is 100 bytes in length. The unlabeled arrows going from right to left are ACKs. The third and fifth segments are lost. The acknowledgements for the first and fourth segments are also lost. Assume that none of the segments times out until after the final ACK has been received.

   (a) If a strict “Go-Back-N” protocol is enforced using cumulative ACKs, which segments will be re-sent?
   
   (b) If a strict “Selective Repeat” protocol is enforced using segment-specific (not cumulative) ACKs, which segments will be re-sent?
   
   (c) If this is, in fact, TCP, and if the receiver discards segments if they are not received in consecutive order, what segments will be re-sent?
4. Host A and host B alternate between sending messages to each other over a TCP connection. All of host A’s messages (which we’ll call $A_1, A_2, \ldots$) are 100 bytes long; all of host B’s messages (which we’ll call $B_1, B_2, \ldots$) are 50 bytes long. Each host includes a new message along with the ACK for the previously received message. See Figure 2.

Assume $A_1$ has a sequence number of 12 and $B_1$ has a sequence number of 10. What are the values of the sequence number and acknowledgement number fields of the TCP segments for the first 6 segments in the exchange? (Assume the first segment’s ACK field is zero.)

5. Assuming that the current estimated RTT is 40 ms and that the current estimated deviation of the RTT is 5 ms.

   (a) What timeout interval should be used when sending a segment via TCP?

   (b) After sending the segment and receiving an acknowledgement, we observe that the actual RTT was 20 ms. What are the updated values of estimated RTT and estimated deviation?
6. Figures 3 and 4 show the finite state machines for a sender and a receiver in a reliable data transfer protocol that allows for corrupted packets but assumes all packets are delivered.

Suppose the sender is in the initial state (“Wait for call 0 from above”) and the receiver is in its initial state (“Wait for 0 from below”). The sender receives a request to send a 0-packet, sends it, but the packet arrives corrupted at the receiver.

(a) In what state is the sender after the above sequence of actions?

(b) What actions does the receiver take upon receiving the corrupted packet?

(c) In what state is the receiver after taking these actions?

(d) Assume the receiver’s message arrives at the sender uncorrupted. What actions does the sender take?
(e) In what state is the sender after taking these actions?

7. In our discussion of the “flags” in a TCP segment, we did not discuss the PSH, URG, or RST flags. As the book points out, PSH and URG are not used in practice. However, the RST flag is used when a SYN request cannot be satisfied. It means “reset” and signals the sender that a three-way handshake cannot be achieved because there is no socket waiting on the requested port.

Give a simple example of a situation where a particular port may not be available. (Hint: does every host have a Web server?)

8. Explain the difference between flow control and congestion control.

9. Define the following terms:
   (a) Cumulative ACK
   (b) MSS
   (c) slow-start
   (d) receive window

10. In the graph in Figure 5, identify the places where slow-start is occurring. Same question for congestion avoidance. Are there any places where a timeout occurred? If so, identify them. Are the any places where a triple-duplicate ACK event occurred? If so, identify them.

Figure 5: See problem 10.