Exam 2 Review Solutions

CMPSC 381
Data Communications and Networks
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1. Recall (page 191) that demultiplexing is the process of sorting out segments arriving at a host and sending them to the correct sockets in the application layer. For UDP segments, “a UDP socket is fully identified by a two-tuple consisting of a destination IP address and a destination port number” (page 194). Thus, all incoming segments that have the same values for these two quantities go to the same socket.

For TCP segments, we need not only the destination information but also the source IP address and source port number. “When a TCP segment arrives at the host, all four fields (source IP address, source port, destination IP address, destination port) are used to direct (demultiplex) the segment to the appropriate socket” (page 196).

2. True or false:
   
   (a) FALSE. There is no such thing as a cwnd header field. However, there is a rwnd, or “receive window,” field.
   
   (b) TRUE.
   
   (c) FALSE. The opposite is true—the congestion window is less than or equal to the receive window. The receive window represents the maximum amount of data that the receiver can handle; the congestion window might be smaller due to network conditions.
   
   (d) FALSE. TCP uses cumulative acknowledgements; it does not acknowledge segments received when there is a gap in sequence numbers. Your book describes it as, at best, “a hybrid” of Go-Back-N and Selective Repeat.

3. (a) The two ACKs that make it back to the sender both acknowledge only the first two segments (since the third segment never arrived); therefore the third, fourth, fifth, and sixth segments (sequence numbers 200, 300, 400, and 500) will be re-sent.

   (b) Only the second and sixth segments were ACK-ed, so the first, third, fourth, and fifth will be re-sent (sequence numbers 0, 200, 300, and 400).

   (c) The third segment will be re-sent when it times out; the fourth, fifth, and sixth segments will each be re-sent as they time out.

<table>
<thead>
<tr>
<th>Segment</th>
<th>Sequence</th>
<th>Ack</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>112</td>
</tr>
<tr>
<td>3</td>
<td>112</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>60</td>
<td>212</td>
</tr>
<tr>
<td>5</td>
<td>212</td>
<td>110</td>
</tr>
<tr>
<td>6</td>
<td>110</td>
<td>312</td>
</tr>
</tbody>
</table>
5. (a) $\text{TimeoutInterval} = \text{EstRTT} + 4 \times \text{DevRTT} = 40 + 4(5) = 60 \text{ ms}$.
   (b) $\text{EstRTT} = .875(40) + .125(20) = 37.5$
       $\text{DevRTT} = .75(5) + .25(|40 - 20|) = 8.75$

6. (a) The sender is in state “Wait for ACK or NAK 0”
   (b) The receiver creates a “NAK” and sends it back to the sender
   (c) The receiver is still in state “Wait for 0 from below”
   (d) The sender re-sends the data packet
   (e) The sender is still in state “Wait for ACK or NAK 0”

7. Not every machine has an active port 80. For instance, here is a Wireshark snapshot of an attempt to telnet to port 80 on a machine with no web server—note the “RST” flag in the response:

   ![Wireshark snapshot]

8. Flow control is negotiated between sender and receiver; it is solely concerned with matching the speed of the sender to the speed of the receiver. Congestion control is about responding to network conditions (lost packets, long delays, etc.) and depends on many factors besides the speeds of the sender and receiver.

9. (a) A cumulative ACK acknowledges that all data up to and including the ACK-ed data have been received.
   (b) MSS is the “maximum segment size”, denoting the maximum amount of data that may be placed into a segment.
   (c) Slow-start is one of the states of TCP’s congestion-control mechanism, in which the amount of data sent begins with one MSS and keeps doubling as long as there are no timeouts or until the slow-start threshold has been reached.
   (d) The receive window is a field in the TCP header used in flow control; it denotes the maximum amount of available buffer space in a receiver.

10. Slow-start is in effect at times 1–4, 29–33, and 40.
    Congestion avoidance is in effect at times 4–28 and 34–39.
    Timeouts occur at times 28 and 39.
    A triple-ACK event occurs at time 33.