CMPUT 313 - Assignment #2 (6%)

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Part 1 Due: Tuesday, October 13, 2015 (in classroom)
Part 2 Due: Tuesday, October 20, 2015 (in classroom)

Guidelines:

- **Start the answer of each question on a separate page.**
- **Write neatly (or use a computer to typeset and spell your answers).**

Part 1

1. Alice clicks on a link within a WEB browser to obtain a WEB page. The IP address of the associated URL is not cached on her laptop, so that a DNS look-up is necessary to obtain the IP address. The requested WEB page is a small HTML text file that indexes three small GIF pictures (all four files are on the same WEB server). Suppose that $k = 5$ DNS servers are visited before Alice's host receives the IP address of the target WEB server, and the following round-trip delays are known:

   - $RTT_{dns} = 60$ msec: the RTT between any two DNS servers, and between Alice's laptop and any DNS server,
   - $RTT_{WEB} = 200$ msec: the RTT between Alice's laptop and the target WEB server.

   Assuming negligible transmission times of the HTML text file and the GIF pictures, calculate the system's response time (i.e., the time from when Alice clicks on the URL until all 4 objects are received) in each of the following cases:

   (a) non-persistent HTTP with no parallel TCP connections,
   (b) non-persistent HTTP with parallel TCP connections, and
   (c) persistent HTTP with pipelining.

   Note. In each case give an algebraic expression, as well as the final numerical answer. Explain your answer.

2. Please read the section on peer-to-peer applications in Chapter 2 and answer the following questions.

   (a) Problem P23, page 177, part (a)
   (b) Problem P23, page 177, part (b)

   For each part, present the distribution scheme in point form. Explain how the scheme achieves the required distribution time, and how the scheme is *feasible*; that is, it does not violate the given bandwidth constraints.

3. Please read the section on peer-to-peer applications in Chapter 2 and answer the following questions.

   (a) In BitTorrent, explain the difference(s) between *unchoked* peer, and *optimistically unchoked* peer.

(b) Suppose that Bob joins a BitTorrent torrent, but he does not upload to any other peer (so called free-riding). Can Bob receive a complete copy of the file that is shared by the swarm? **Explain** your justification and assumptions.

(c) In the circular DHT example of figure 2.27(a), suppose that a new peer 6 wants to join the DHT and peer 6 initially only knows peer 15's IP address. Explain in point form the steps taken and the messages exchanged.

4. Problem P6, page 289, on rdt2.1. Recall that rdt2.1 is designed for channels that do not re-order, or lose messages.

Part 2

5. The sender side of rdt3.0 simply ignores (that is, takes no action on) all received packets that are either in error or have the wrong value in the `acknum` field of an acknowledgment packet. Suppose that in such circumstances, rdt3.0 were simply to transmit the current data packet.

   (a) Would the protocol still work? Explain.

   (b) Assume the sender has three packets to transmit, and the sender prematurely times out on each of the three packets (all data and ACK packets are delivered correctly), how many packets are transmitted by the protocol given the above modification? Explain by drawing a timing diagram.

6. (a) A channel has a bit rate of 4 Kbps and a propagation delay of 20 msec. For what range of frame sizes does stop-and-wait give link utilization of at least 60%? **Explain your answer.**

   (b) A 3000-km-long T1 trunk (1.544 Mbps) is used to transmit 64-Byte frames using a Go-Back-N protocol. If the propagation speed is 6 microsec/km, how many bits should the sequence number be to maximize the throughput? **Explain your answer.**

7. Consider a Go-Back-N protocol with window size $N = 3$, and a 1024 sequence number space. Suppose that at time t, the next in-order packet that the receiver is expecting has sequence number k.

   (a) What are the possible ranges of sequence numbers inside the sender's window at time t? **Explain.**

   (b) What are the possible values of the ACK field in all possible messages currently propagating back to the sender at time t? **Explain.**