CMPUT 313 - Assignment #3 (6%)

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Part 1 Due: Tuesday, November 24, 2015 (in classroom)
Part 2 Due: Tuesday, December 1, 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. What is the fastest line speed at which a host can blast out 1500-byte TCP payloads with a 120-sec maximum packet lifetime without having the sequence numbers wrap around? Take TCP, IP, and Ethernet overhead into consideration. You may assume that the IP protocol adds a 20 byte header to each TCP segment. In addition, the Ethernet protocol adds a 26 byte overhead to every IP datagram. Assume that Ethernet frames can accommodate such packets, and the frames may be sent continuously. Explain your answer.

2. (a) Consider the effect of using slow start in TCP on a line with a 10-msec RTT and no congestion. The receive window is 24 KB and the maximum segment size is 2 KB. How long does it take before the first full window can be sent? Explain.

   (b) Suppose the TCP congestion window is set to 18 KB and a timeout occurs. How big will the window be if the next four transmission bursts are all successful? Explain. Assume that the maximum segment size is 1 KB.

3. Read Section 3.7.1 on TCP Fairness and answer the following questions.

   (a) Write in point-form the assumptions behind the argument associated with the connection throughput figure.

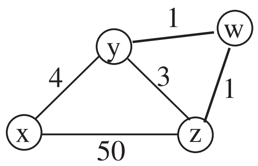
   (b) In this part, assume the following conditions for the network in Section 3.7.1 that shows two contending TCP connections:

   - the bottleneck router transmits data at rate $R = 2560$ Kbps,
   - RTT= 200 msec, and MSS= 1 KByte for each of the two contending connections,
   - at some instant, $CongWin_1 = 56$ MSS, and $CongWin_2 = 12$ MSS, and
   - the two connections use an implementation of TCP with a **modified** congestion control mechanism. In the modified scheme, if the bottleneck router becomes congested then the scheme decreases $CongWin_1$ by 2 MSSs, and $CongWin_2$ by 1 MSSs (that is, whenever there is a loss event, connection 1 decreases its window by twice the amount of connection 2).

   Would the resulting scheme converge to an equal share algorithm? Justify your answer using the numerical values mentioned above. Your answer should include a connection throughput diagram similar to the one illustrated in Section 3.7.1 and a table showing the key numerical values in your diagram.

Part 2

4. Answer the following questions on distance-vector routing on the network shown below.



Routing information to x				
x	y	z	w	time slot
	distance, next hop	distance, next hop	distance, next hop	Initially
	—, —	—, —	—, —	After first exchange
	—, —	—, —	—, —	After second exchange

(a) Assume that the initial time step corresponds to a step where all computed distance vectors are stabilized. Fill in the values for this row.

(b) Assume that **poisoned reverse** is used. What distance values to node x are exchanged among the remaining routers?

(c) Now assume that immediately prior to the beginning of the first exchange (the second row) the link cost between x and y changes to 60. Redraw the table, and fill in the values in the second and third rows assuming **poisoned reverse** is used.

5. Consider the operation of the reverse path forwarding (RPF) algorithm on the graph in Fig. 4.44, page 402 (5/E, page 410), with a newly added link between C and G (the modified graph has 10 links) where A is the broadcast source. Is it possible to assign costs to the links so that the following conditions are satisfied simultaneously: (a) node C receives copies of A's broadcast message from nodes A, B, E, and F, (b) node C accepts the copy received from F, and ignores the remaining three received copies, and (c) node C forwards the received copy to node G, and node G accepts the received copy? If yes, draw the graph with a possible set of link weights. Explain your answer.