

CS118 Homework 3 Due: 11:59pm April 23, 2014

1. Consider distributing a file of $F=15$ Gbits to N peers. The server has an upload rate of $u_s=30$ Mbps, and each peer has a download rate of $d_i=2$ Mbps and an upload rate of u . For $N=10, 100$, and $1,000$ and $u=300$ Kbps, 700 Kbps, and 2 Mbps, prepare a chart giving the minimum distribution time for each of the combinations of N and u for both client-server distribution and P2P distribution.
2. UDP and TCP use 1s complement for their checksums. Suppose you have the following three 8-bit numbers: 01010101, 01110000, 01001100.
 - a. What is the 1s complement of the sum of these 8-bit numbers? (Note that although UDP and TCP use 16-bit numbers in computing the checksum, for this problem, you are being asked to consider 8-bit summands.) Show all work.
 - b. UDP takes the 1s complement of the sum. In this scheme, how does the receiver detect errors?
 - c. What if we just use the sum as the checksum? In this scheme, how does the receiver detect errors?
 - d. Is it possible that a 1-bit error will go undetected? How about a two-bit error?
3. In protocol rdt3.0, the ACK packets flowing from the receiver to the sender do not have sequence numbers (although they do have an ACK field that contains the sequence number of the packet they are acknowledging). Why is it that our ACK packets do not require sequence numbers?
4. Consider a reliable data transfer protocol that uses only negative acknowledgments. Suppose the sender sends data only infrequently. Would a NAK-only protocol be preferable to a protocol that uses ACKs? Why? Now suppose the sender has a lot of data to send and the end-to-end connection experiences few losses. In this second case, would a NAK-only protocol be preferable to a protocol that uses ACKs? Why?
5. Consider the cross-country example shown in Figure 3.17. The speed-of-light round-trip propagation delay between these two end systems, RTT, is approximately 30 milliseconds. Suppose that they are connected by a channel with a transmission rate, R , of 1 Gbps (10^9 bits per second). How big would the window size have to be for the channel utilization to be greater than 95 percent? Suppose that the size of a packet is 1,500 bytes, including both

header fields and data.