EECS 122: Introduction to Communication Networks

Homework 7

(6 points)

Due: 1999-Oct-22-Fri (in class, or 467 Cory by 2pm)

Problem 1. (2 points) (This is a clearer statement of chapter 5 problem 8.) Consider a 40 Mbps physical layer connecting a customer's machine to a network provider's switch, carrying contiguous frames (no gaps between consecutive frames), each frame consisting of ten contiguous ATM cells plus 95 bytes of header/trailer. Assume that the switch does not wait for a whole frame to arrive before extracting the cells, but rather receives each cell as soon as that cell has arrived. This stream of ATM cells (which includes every cell in every frame) is considered constant bit rate, but because of the framing structure the cells are not evenly spaced. What is the minimum peak cell rate (PCR) that the stream conforms to? Given that PCR, what is the minimum cell delay variation tolerance (CDVT) that it conforms to?

Problem 2. (2 points) Suppose the alternating bit protocol is used with 440 byte data packets and 60 byte ack packets on a link with a 5 ms propagation delay in each direction. In the absence of transmission errors, what are the throughput (in packets per second) and efficiency if the link data rate is 1 kbps? 100 kbps? 10 Mbps? 1 Gbps?

Problem 3. (2 points) Assume the round-trip time of a channel is less than T. Then the stop-and-wait protocol is correct:

```
source:  S ← 0                          sink:  R ← 0
         M ← first message                      while true
         while true                               wait for any seq,message
           send S,M                               if seq = R then
           wait up to T for ack                     deliver message
           if received ack then                     R ← not R
             M ← next message                     endif
             S ← not S                            send ack
           endif                                endwhile
         endwhile
```

(This version of the protocol assumes there is an infinite supply of messages to be sent.) Stop-and-wait puts a one-bit sequence number in the packets going from source to sink, but not in the packets going the other way (the acks). Write down a protocol similar to stop-and-wait, where the source and sink again use variables S and R respectively, both

initialized to 0, but where the one-bit sequence number appears only in the packets going from sink to source, not in the ones going from source to sink. Like stop-and-wait, the new protocol must be correct under the assumption that the round-trip time is less than T.