Introduction to Computer Networks

Midterm Exam#1

April 25, 2003

1. In your own words, describe the principal responsibilities for each of the five layers in the Internet protocol stack. (15%)
2. Suppose two hosts, A and B, are separated by 10,000 kilometers and are connected by a direct link of $\boldsymbol{R}$ = 1Mbps. Suppose the propagation speed over the link is $2.5*10^8$ meters/sec. Calculate the "bandwidth-delay product," $\boldsymbol{R*t}_{prop}$. (5%) Provide an interpretation of the bandwidth-delay product. (5%) Derive a general expression for the width (in meters) of a bit in terms of the propagation speed $\boldsymbol{s}$, the bandwidth $\boldsymbol{R}$, and the length of the link $\boldsymbol{m}$ (5%)
3. Why does HTTP run on top of TCP rather than UDP and most streaming video players use UDP? (10%)
4. Consider query flooding in P2P file sharing. In order to reduce excessive flooding, a limit on the radius of the query flooding is introduced. Suppose that each peer is connected to at most $\boldsymbol{N}$ neighbors in the overlay network and the limit is initially set to K. Suppose Alice makes a query. Find an upper bound on the number of query messages that are sent into the overlay network. (10%)
5. Consider two end hosts connected by a link with round-trip propagation delay $\boldsymbol{RTT}$ = 30 milliseconds and bandwidth $\boldsymbol{R}$ = 1 Gbps. With a packet size $\boldsymbol{L}$ of 1000 bytes. How big would the sender's window size have to be for the link to be 90% utilized? (10%)
6. Describe in what sense that TCP's error-recovery mechanism looks like a Go-Back-N protocol. (7%) What are the differences between TCP and Go-Back-N? (8%)
7. We see that Reno TCP waits until it has received three duplicate ACK before performing a fast retransmit. Why do you think the TCP designers chose not to perform a fast retransmit after the first duplicate ACK for a segment is received? (10%) Why a fast recovery mechanism that essentially cancels the slow-start after a fast retransmission is used? (10%)
8. Explain why the Internet normally does not use the network-assisted congestion control? (10%)