

# Introduction to Computer Networks

## Midterm Exam#1

April 9, 2004

1. In your own words, describe the principal functions for each of the five layers in the Internet protocol stack. (15%)
2. Suppose two hosts, A and B, are separated by  $m$  meters and are connected by a direct link of rate  $R$  bps. Suppose the propagation speed over the link is  $s$  meters/sec. Host A is to send a packet of size  $L$  bits to host B. (a) What is the propagation delay  $d_{prop}$  between host A and B? (3%) (b) What is the transmission time of the packet  $d_{trans}$ ? (3%) (c) Ignoring processing and queuing delays, what is the end-to-end delay? (4%) (d) Suppose  $s = 2.5 \times 10^8$ ,  $L = 100$ , and  $R = 28K$ . Find the distance  $m$  so that  $d_{prop}$  equals  $d_{trans}$ . (5%) (e) Provide a meaning of the bandwidth-delay product  $R * d_{prop}$ . (5%)
3. Why does HTTP run on top of TCP rather than UDP and most streaming video players use UDP? (10%)
4. Give one situation in which it is suitable to use recursive queries for domain name resolution. Give another situation in which it is suitable to use iterative queries for domain name resolution. (10%)
5. Consider two end hosts connected by a link with round-trip propagation delay  $RTT = 30$  milliseconds and bandwidth  $R = 100$  Mbps. With a packet size  $L$  of 1000 bytes. How big would the sender's window size have to be for the link to be at least 90% utilized? (10%)
6. In your own words, 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. Explain why three-way instead of two-way handshake is used in TCP connection establishment procedure? (6%)
8. Draw a state diagram starting at ESTABLISHED state and ending at CLOSED state of Figure 3.40 on page 252 of the textbook for a client TCP, (a) when server TCP sends ACK+FIN after receiving client's FIN packet, (7%) and (b) when both client and server want to shut down at the same time. (7%)