Department of Computer Science and Engineering, National Sun Yat-sen University
First Semester of 2004 Ph.D. Qualifying Exam: Computer Networks

1. In HTTP 1.0, a server marked the end of a transfer by closing the connection. Explain why, in terms of TCP layer, this was a problem for servers. Can you avoid this? (10%)
2. What is the sorcerer's apprentice bug? (5%)
3. Consider the multicast routing protocol. (1) Reverse path forwarding (RPF) guarantees that each network receives a copy of the multicast packet without formation of loops. However, RPF does not guarantee that each network receives only one copy. What is the reason? (5%) (2) Why do we further need pruning and grafting operations for reverse path broadcasting (RPB)? You need NOT describe the detail of both operations. (5%)
4. Please explain: (1) MBONE; (2) pointer query; (3) HTTP persistent connection; (4) virtual private networks. (8%)
5. One important point about TFTP is that there is no provision for security: There is no user identification or password. Please design an approach to add security by using some application program in conjunction with TFTP. (5%)
6. Why can timestamp solve the jitter problem of multimedia transmission? (5%)
7. An Ethernet swith is simply a bridge that has the ability to forward some number of packets in parallel, assuming the input and output ports are all distinct. Suppose two such N-port switches, for a large value of N, are each able to forward individually up to three packets in parallel. They are then connected to one another in series by joining a pair of ports, one from each switch; the joining link is the bottleneck as it can, of course, carry only one packet at a time. (a) Suppose we choose two connections through this combined switch at random. What is the probability that both connections can be forwarded in parallel? Hint: This is the probability that most one of the connections crosses the link. (7%) (b) What if three connections are chosen at random? (8%)
8. Suppose a bridge has two of its ports on the same network. How might the bridge detect and correct this? (5%)
9. You are hired to design a reliable byte-stream protocol that uses a sliding window (like TCP). This protocol will run over a 100 Mbps network. The RTT of the network is 100 ms, and the maximum segment lifetime is 60 seconds. (a) How many bits would you include in the *AdvertisedWindow* and *SequenceNum* fields of your protocol header? (5%) (b) How would you determine the numbers given above, and which values might less certain? (5%)
10. The Nagle algorithm, built into most TCP implementations, requires the sender to hold a partial segment's worth of data (even if PUSHed) until either a full segment accumulates or the most recent outstanding ACK arrives. Suppose that mouse position changes are being sent over the connection. Assuming that multiple position changes are sent each

RTT, how would a user perceive the mouse motion with and without the Nagle algorithm? (10%)

11. Suppose a host wants to establish the reliability of a link by sending packets and measuring the percentage that are received; router, for example, do this. Explain the difficulty of doing this over a TCP connection. (7%)

12. Consider an ARQ protocol that uses only negative acknowledgments (NAKs), but no positive acknowledgments (ACKs). Describe what timeouts would need to be scheduled. Explain why an ACK-based protocol is usually preferred to a NAK-based protocol. (10%)