

**Department of Computer Science and Engineering**  
**National Sun Yat-sen University**  
**Ph.D. Qualifying Exam, Spring 2019**

Date: January 14 (Mon.), 2019

Subject: Computer Networks

1. Spurious retransmission is a undesirable TCP retransmission when no data has been lost. It is caused by spurious timeout (timeout firing too early) and other reasons such as packet reordering, packet duplication, or lost ACKs. Can you detect spurious retransmission? (10%)
2. Why is TCP performance more affected by losses over high-delay and high-speed network paths (Long-Fat Pipes)? (5%)
3. Which are the main factors leading to TCP throughput degradations over wireless links (e.g., satellite networks)? (5%)
4. Please describe how *cwnd* is incremented respectively in both phases of slow start and congestion avoidance. (5%)
5. There are two indications of packet loss: a timeout occurring and the receipt of duplicate ACKs. For both cases, the congestion window size (*cwnd*) increasing or decreasing? Please explain them. In the case of receipt of the duplicate ACKs which tell us a packet may possibly have been lost, why don't we perform slow start in this situation? (10%)
6. Please explain the *2MSL Wait* State in TCP state transition diagram. What is the purpose for it? (5%)
7. Please explain *self-clocking* behavior of TCP and *silly window syndrome* (SWS)? (10%)
8. You are hiring to design a reliable byte-stream protocol that uses a sliding window (like TCP). This protocol will run over a 1 Gbps network. The RTT of the network is 100 ms, and the maximum segment lifetime is 60 seconds. How many bits would you include in the *AdvertisedWindow* and *SequenceNum* fields of your protocol header? (10%)
9. 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 the second case, would NAK-only protocol be preferable to protocol that uses ACKs? Why? (10%)
10. Please explain *proxy ARP* and *gratuitous ARP*. (10%)
11. What is *binary exponential backoff*? (2 points) Why do we need it? (5%)
12. What is *IP source routing*? Then further describe strict and loose source routing. (5%)
13. Why can not CSMA/CD be used in wireless channels? However, CSMA/CA is suitable. Please describe your reasons. (10%)