

**Ph.D. Qualifying Exam: Computer Networks (Date: Jan. 17, 2012)**  
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1. (a) The transmission of a wireless signal may encounter the problems of path loss and multipath propagation. Please explain these two problems. (6%)  
(b) Supposing that you have two modulation schemes, BPSK and QAM16, and the current SNR is quite low, which modulation scheme should you adopt? Please give your reason. (4%)
2. When transmitting a packet from one router A to its neighboring router B, what are the four types of delays that should be taken into account? You should detail each delay. (10%)
3. Please explain how the cipher-block chaining algorithm operates. (10%)
4. (a) Please explain the SYN flood attack for TCP connections. (2%)  
(b) The SYN flood is a serious problem. Fortunately, a solution called SYN cookies can conquer the problem. Please explain how the solution works. (8%)
5. Leaky bucket mechanism is a good abstraction used to characterize the average rate, peak rate, and burst size of a packet flow.  
(a) Please draw the leaky bucket model and describe how to add the tokens. (4%)  
(b) Please explain how you use the leaky bucket model to police the behavior of a packet flow (in terms of average rate, peak rate, and maximum burst size). (6%)
6. (a) What is the purpose of ARP (address resolution protocol)? (2%)  
(b) Please explain how ARP works. (8%)
7. In uncontrolled flooding, when a node receives a broadcast packet, it forwards the packet to all of its neighbors, except the neighbor from which it received the packet.  
(a) What is the major problem of the uncontrolled flooding? (2%)  
(b) Please give two controlled flooding schemes. (8%)
8. (a) Please explain the hidden terminal problem. (3%)  
(b) IEEE 802.11 adopts CSMA/CA to solve this problem. How does it work? (4%)  
(c) Do you think that CSMA/CA completely solve the hidden terminal problem? Why or why not? (3%)

9. Please explain how the message authentication code operates. (10%)

10. As we know, TCP provides an elegant congestion control mechanism. It seems that TCP should perform better than UDP. However, many applications prefer using UDP rather than TCP. Why? Please give four reasons. (10%)