Review Questions for Final Exam

The final exam is on Monday evening, 14 December, from 7 to 10 p.m.

It will be comprehensive, covering the entire semester, although there might be several more questions on it about more recent material than about earlier material.

Please see the documents “Review for midterm 1,” “A few more review questions for midterm 1,” “Midterm 2 review questions” (links on course web site) for additional problems.

1. In the following graph, the horizontal axis represents “rounds” of packet transmissions between a sender and a receiver; the vertical axis represents the size of the congestion window. For each of the sections of the graph, explain what is going on in terms of packet loss, duplicate acknowledgements, slow-start, congestion avoidance, etc. What do the two horizontal dotted lines indicate?

2. What does the phrase “exponential backoff” mean and what protocol did we study that makes use of it?

3. Two hosts, A and B, are connected through an Ethernet cable of length 100 meters. Each one transmits at a rate of 10MBps. The propagation speed is $2 \times 10^8$ meters/sec. At time $t_0$ A begins to transmit a 1500-byte frame.

   (a) How long does it take for the first bit of A’s message to reach B?

   (b) At almost exactly the same time that A’s first bit arrives at B, B begins to transmit. It immediately detects a collision. Describe what happens next, from both B’s point of view and A’s point of view — for instance, when does A realize that a collision has occurred?

   (c) Once A is able to transmit again, how long does it take to transmit the entire 1500-byte frame, assuming no further collisions occur?
4. What is the difference between a router, a switch, and a hub? Your answer should mention things like layers in the network protocol stack, collisions at the link layer level, and anything else you find relevant.

5. What is a VLAN? Tell me everything you know about VLANs.

6. At the link layer, when a message needs to be sent to a host that’s in a different subnet, e.g., a network in another country, how does the sender know what MAC address to put in the frame?

7. Do you believe in “datagram heaven”? (page 475)

8. What is the importance of “endianness” for networking?

9. Which layers of the Internet protocol stack (not including the application layer) provide facilities for detecting bit errors? Describe the mechanisms used.

10. Which layers of the Internet protocol stack provide facilities for reliable delivery (guaranteed delivery, in order)? Describe the mechanisms used.

11. What is a “distributed hash table” and in what kinds of situations would it be used?

12. A router has the property that its switching speed (time needed to move a packet from an input queue to an output queue) is \( n \) times faster than the fastest rate at which packets arrive at any of the router’s \( n \) input ports. The transmission rate at the output ports is also at least as fast as the fastest input rate. Can queueing delays still occur? If not, why? If so, how?

13. You enter the Alden 101 classroom, log on to a machine, start up a Web browser, and visit an off-campus site where you watch a streaming video.

Describe as many of the various protocols used along the way as you can, including things like UDP, TCP, IP, DNS, ARP, BGP, etc. You can’t give a comprehensive answer to this in the available time, but you should try to squeeze in as much as possible. You can make up numbers (IP addresses, etc.) to illustrate what’s happening.