1. List for the Link Layer
   a. The purpose it serves and the client for these services
   b. Where are these services carried out?
   c. What are key problems that are solved by the Link Layer?
   d. What does PPP not address that is usually considered part of the Link Layer?

2. Run the Go-Back-N Protocol Demo at
   http://media.pearsoncmg.com/aw/aw_kurose_network_2/applets/go-back-n/go-back-n.html using
   the following steps:
   i. Click on "Send New" 4 times to send 4 packets to the receiver
   ii. Click on "Stop Animation" before the first packet reaches the destination
   iii. Click on the third packet and then on "Kill packet" to simulate a loss of the
        third packet
   iv. Click on "resume" and allow the packets to reach destination. (see a) below.)
   v. After the acknowledgement arrive at the sender, wait 30 seconds and observe the
      demo. (see b) below.)
   vi. Click on "Send New" 4 times to send a new set of 4 packets to the receiver.
   vii. Allow the packets to reach the destination and click stop BEFORE the first
        acknowledgement reaches the sender.
   viii. Kill the second acknowledgement.
   ix. Click on "resume" to continue the demo. (see question c) below)
   x. Repeat setps vi and vii.
   xi. Kill the fourth acknowledgement.
   xii. Click on "resume" to continue the demo. (see question d) below)
   xiii. Wait for 30 seconds and observe the demo. (See question e) below)

   a) How many packets are received by the receiver and how many packets are
      acknowledged?
   b) How many packets are resent? Compare the number of packets resent and the number
      of packets you "killed". Is there a difference? If yes, explain why.
   c) After you killed the second acknowledgement, did it affect the acknowledgement of all
      packets? why?
   d) After you killed the fourth acknowledgement, did it affect the acknowledgement of all
      packets? why?
   e) After waiting for 30 seconds in step xiii, what do you notice?

3. A 64-kbps pure ALOHA channel is to be shared among a number of stations, each
   sending a 1k bit frame, on average one frame every 10 seconds. (Assume the sender
   can buffer frames to handle variations in successful sending vs. this generation rate).
   What is the maximum number of stations this network can support?
4. Repeat problem 3. for
   a. a slotted ALOHA channel.
   b. a 1-persistent CSMA channel.

5. Suppose the measurements made on a slotted ALOHA channel for a very large number of users shows that on average 20% of the slots are idle.
   a. What is the channel load G?
   b. What is the throughput of the channel?
   c. Is this channel overloaded or under loaded (vs. optimal use)?

6. Using the wireless MACAW protocol, with multiple stations active, under what conditions can simultaneous transmissions take place successfully?

7. A LAN using Manchester encoding runs at 100 megabaud. What is its bit rate?

8. A CSMA/CD LAN is 1 km in length, and has a bandwidth of 10 Mbps. There are no repeaters. Data frames are 512 bits long, including 32 bits used for header, CRC etc. The first bit slot following a successful data transmission is reserved for use by the receiver to send back a 32 bit acknowledgment frame. What is the maximum effective data rate this channel can achieve, assuming no collisions? (Assume a transmission speed of 200 m/μsec.)

9. Why does the clock for a 1000-Base-SX Ethernet run at 1250 MHz?

10. If a 64 byte IP packet (including all headers, etc.) is to be transmitted by Ethernet, how much padding of this is needed when put into an Ethernet frame?