1. Show the 4B/5B encoding and the resulting NRZI signal for the following bit sequence
   1110 0101 0000 0011

2. Assuming a framing protocol that uses bit stuffing, show the bit sequence transmitted over the link when the frame contains the following bit sequence:
   110101111101011111101011111110

3. Give an example of a 4-bit error that would not be detected by two dimensional parity. What is the general set of circumstances under which 4-bit errors will be undetected?

4. Suppose Ethernet physical addresses are chosen at random (using true random bits).

   (a) What is the probability that on a 1024-host network, two addresses will be the same?

   (b) What is the probability that the above event will occur on one or more of 2^{20} networks?

   (c) What is the probability that, of the 2^{30}hosts in all the networks above, some pari has the same address? (Hint: for the first and third part, think about the birthday problem from applied probability.)

5. Suppose that N Ethernet stations, all trying to send at the same time, require $N/2$ slot times to sort out who transmits next. Assuming that the average packet size is 5 slot times, express the available bandwidth as a function of N.

6. How can a wireless node interfere with the communications of another node when the two nodes are separated by a distance greater than the transmission range of either node?

7. How can hidden terminals be detected in 802.11 wireless networks?

8. Having ARP table entries time out after 10 to 15 minutes is an attempt at a reasonable compromise. Describe the problems that can occur if the timeout value is too small or too large.

9. IP currently uses 32 bit addresses. If we could redesign IP to use the 6-byte MAC address instead of the 32 bit address, would we be able to eliminate the need for ARP? Explain why or why not.

10. Suppose hosts A and B have been assigned the same IP addresses on the same Ethernet, on which ARP is used. B starts up after A. What will happen to A's existing connections? Explain how "self-ARP" (querying the network on start-up for one's own IP address) might help with this problem.