Data Communications
Sample Questions

1. Using the generator function X^4+X^2+X+1 compute the CRC code for the following bit string. 10001010101111010
   Solution : 0001
2. For an 8-bit data, 1 bit error correction using parity bits is used. Compute the values of the parity bits and show that the error can be detected and corrected. Use the data: 10100011
   Using even parity
   P1=0, P2=1, P4=0, P8=0
   Assume one of the bits changes during transmission. Re-compute the parities and show that the bit in error can be detected.
3. A frame of 50 bytes is sent over a communication channel. For each of the following cases, compute the total number of bits transmitted:
   a. Asynchronous transmission with one start bit and two stop bits at each byte, and one start of frame and one end of frame characters.
      52*11 bits
   b. Synchronous transmission with one start of the frame and one end of the frame characters.
      52*8 bits
4. For the following data, parity bits are used for one bit error correction. However, CRC code is also used to make sure only one bit error has occurred in the data.
   Same as question 1 and 2
   a. Find the parity bits
   b. Compute the CRC using polynomial X^3+x+1
   c. Explain how the receiver can estimate if only one or more bits are in error and what it does in each case.

   Data: 10100011
5. Compare 1-persistent and non-persistent medium access control methods. Also explain how collision detection is combined with each of these methods.
   1-persistent senses the medium, if it is free starts transmission, if not repeats sensing the medium until it gets free. Then starts transmission immediately.
   Non-persistent senses the medium, if it is free starts transmission, if not waits for a random time, repeats sensing the medium until it gets free. Then starts transmission immediately.
   After sending a bit it is read back and compared with the transmitted bit. If they are different a collision has happened.
6. Explain the CSMA/CD mechanism used in standard Ethernet. 1-persistent with collision detection. Ethernet defines a max network size and a min frame size limits to avoid undetected collisions.
7. Find the odd and even parity bits for data = 10101100.
   Odd parity = 1

Even parity = 0

8. When does a burst error happen? What do we mean by a burst error?
   If error happens in more than 1 bit (a group of bits) it is called a burst error.
9. Why does standard Ethernet has a max network size limit?
   To avoid undetected collisions
10. How does CSMA/CA avoid collisions?
    Station asks for permission to send (RTS). When the permission is granted (CTS) it starts transmission. Whenever a station notices a(n) RTS/CTS message it marks the network as busy using a data structure names network allocation vector (NAV). RTS and CTS messages include the duration requested/granted.
11. How are collisions detected?
    Check question 5
12. Why is collision detection part of many MAC protocols?
    When a collision happens in a frame, the whole frame is re-transmitted. Therefore it is waste of time/bandwidth to continue transmission when a frame has collided with another frame.
13. Why does the stop and wait transmission need only 1 bit for sequence number?
    Because after sending a frame we always wait for an ACK message. Therefore, two consecutive 0s or 1s indicate a re-transmission. Hence, no re-transmission is confused with a new transmission.
14. What does P-persistent mode of medium access do?
    In case of detecting a free medium, the sender waits with a probability of 1-P and sends with a probability of P. Since it is used in discrete time networks (slotted time mode), the assumption is that there can be other hosts waiting for the medium.
15. Standard Ethernet has a minimum frame size of 64 bytes. Why?
    To avoid undetected collisions
16. What are the data rates of the Fast Ethernet with cat. 3 twisted pair wiring? Explain.
17. Explain how character stuffing for marking the frame boundary works.
18. Explain the difference between a wireless LAN with infrastructure and an ad-hoc network.
19. How is a frame re-transmitted in sliding window with selective repeat?
20. In sliding window with a window size of 8, 3 bits are used for message sequence number. Is there any possibility of having a duplicate frame accepted at the receiver? Explain.
21. Explain how fast Ethernet reaches 100Mbs data rate on twisted pair cat. 3 with 25 MHz of signaling rate.