CS224 (m): Computer Networks (minor)
Tutorial 11, 14/21 Oct 2016

Concepts tested: Framing, Error Control, Error Detection

1. Can bit errors in one frame affect the next frame? How?

2. Suppose the last two bytes of the BiSYNC protocol are DLE ETX (before byte stuffing), what sequence of bytes precede the CRC?

3. What is the actual bit sequence transmitted over the link after bit stuffing, if the HDLC encoder receives the following sequence?
   10111111111110

4. If the following bit pattern is received as part of HDLC data, what does the HDLC decoder output after removing stuffed bits?
   1101111101001

5. Can this sequence A DLE DLE ETX appear in the data portion of the transmission when using the Bisync protocol, where A is the ASCII character 'A'. Explain.

6. The triplication mechanism of encoding can detect 2-bit errors and can correct 1-bit errors. Can it do both simultaneously? Explain.

7. If a code has a hamming distance of 7, how many errors can it detect? How many bit errors can it correct? Can it do both simultaneously?

8. If a code contains the following code words:
   c1 = 0000000, c2 = 0101010, c3 = 1010101, c4 = 1001001 and c5 = 1111111
   What is the hamming distance of this code?

9. Mr. Error Prone wants to decide on whether to use error correction or detection on a link with packet error rate of 10^{-5}. Assume the packet size is 923 bits. If using error correction, he is considering BCH (Bose-Chaudhuri-Hocquenghem) where 1023 code bits are sent for 923 data bits. If using error detection, he is considering CRC where 32 bits are added to 923 data bits. Note that when using error detection, the receiver will ask for a retransmission of the packet till it succeeds in correctly receiving the packet.

   The metric he wishes to optimize on is "Transmission Overhead", which is defined as the percentage of 'additional' bits transmitted per data bit.

   What is the transmission overhead for the error correction scheme?

   What is the transmission overhead for the error detection scheme?

10. [**Extra: 20HP**] A bit challenging but fun nonetheless...

    An absent minded professor's glasses are inside one of three rooms. He wants to send five of his students in groups to the three rooms to check for his glasses. One of his students may lie, while others always tell the truth about whether they found the glasses in the room or not.

    How should the professor divide the students into groups so that he can determine where his glasses are?

    Also, how can he determine in which room his glasses are?

    Could the professor determine where his glasses are if there were only four students, and only one of them might lie?

    Map this problem to the Hamming error correcting code scheme (look up as to what this is) and solve.