Cairo University
Faculty of Engineering
Computer Engineering Dept.
CMP N405

sheet 2- part 1

Framing

1) The following character encoding is used in a data link protocol:
A: 01000111; B: 11100011; FLAG:01111110; ESC: 11100000
Show the bit sequence transmitted (in binary) for the four-character frame:
AB ESC FLAG when each of the following framing methods is used:

a. Character count.

b. Flag bytes with byte stuffing.

c. Starting and ending flag bytes, with bit stuffing.

2) One of your classmates has pointed out that it is wasteful to end each frame with a flag byte and then begin the next one with a second flag byte. One flag byte could do the job as well, and a byte saved is a byte earned. Do you agree?

3) When bit stuffing is used, is it possible for the loss, insertion, or modification of a single bit to cause an irrecoverable error? Give one example.

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Sheet 2- Part 2

Error Detection and Correction

1) Sixteen-bit messages are transmitted using a single-bit Hamming code. a) Show the bit pattern transmitted for the payload 1101001100110101. b) How many check bits are needed to ensure that the receiver can detect and correct single bit errors?. Assuming that even parity is used in the Hamming code. c)After transmission, the bit number 20 -starting with index 1- of the packet is modified, show the error correction steps.

2) Consider a datalink protocol that uses character count technique for framing. The data link protocol employs hamming error correction algorithm. Each frame consists of a one byte header consisting of the field "character count".
Assume that there can be no more than one bit error in any single frame.
Ahmed claims that because we have at most one bit error per frame and we use hamming error correction algorithm, then it is possible to resync after any error because if the error occurs in the header, the receiver can correct that error and hence can recover the original value of the "character count" field. Prove or disprove this claim.

3) Show the steps of computing the internet checksum for the stream of data: (0001f203f4f5f6f7)hex. Show how the receiver can check the correctness of the received stream. Arrange data in 16-bit words.

4) What is the remainder obtained by dividing $x^7 + x^5 + 1$ by the generator polynomial $x^3 + 1$?

5) A bit stream 10011101 is transmitted using the standard CRC method. The generator polynomial is $x^3 + 1$. Show the actual bit string transmitted. Suppose the third bit from the left is inverted during transmission. Show that this error is detected at the receiver's end.

6) Data link protocols almost always put the CRC in a trailer rather than in a header. Why?