Hand in problem 1
Internet–Techniques and Applications (EITF25)

November 2014

The first hand in contins three poblems and the deadline for handing in is Friday 28/11. If you have a problem with this deadline please contact Stefan or William.

The problems should be handed in as paper copies either directly to Stefan or William, or in the mailbox for the course (northern staircase 3rd floor in the E-building).

The problem solutions should be clear and easy to follow. It is meant to be hand written with paper and pen, and there is no need to pretty print with computer tools like LaTeX or Office.

Problem 1

Suppose a link protocol uses the HDLC flag, i.e. 01111110, for framing.

(a)   The following data frame is to be transmitted,

$$d = 111111100101111110011111100001100$$

Perform bit-stuffing.

(b)   The following data frame is received,

$$d = 11101011111000111110111101111101111$$

Remove the bit-stuffing bits.

Problem 2

Consider a data frame with six bits where we add a four bit CRC at the end, see Figure 2.1.

Data	CRC

Figure 2.1: Six data bits and four CRC bits.

To calculate the CRC bits the following generator polynomial is used

$$g(x) = (x+1)(x^3 + x + 1) = x^4 + x^3 + x^2 + 1$$

Assume the data vector $d = 010111$ should be transmitted. Find the CRC bits for the frame. Then, introduce an error pattern that is detectable and show how the detection works.

Problem 3

In a certain communication link the frame size in bits for each packet can vary according to the probability p as

$$L = \begin{cases} 500, & p = \frac{1}{4} \\ 1000, & p = \frac{1}{2} \\ 1500, & p = \frac{1}{4} \end{cases}$$

where the packet sizes are considered to be independent. The link uses the data rate $R_b = 1\,\text{Mbps}$. Find the expected time and the corresponding standard deviation to transmit 10^6 frames.

Hint: Consider the length of all transmitted frames,

$$M = \sum_{k=1}^{10^6} L_k$$

where each L_k is chosen according to the distribution above.