

EE 706: Communication Networks

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Spring 2011

Assignment 2 : 30 points

Due date: February 4, 2011

Each question is worth 6 points.

- Figure 1 shows an empty block diagram of the communication process involving FEC and CRC codes. Fill in the labels for the blocks from the following list: Noise Source, FEC Decoder, CRC Encoder, Information Destination, CRC Decoder, Modulator, Demodulator, Channel, FEC Encoder, Information Source. In the labelled block

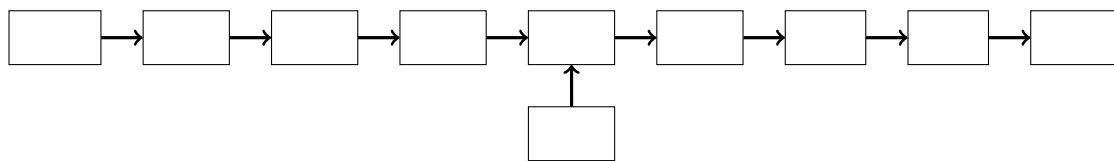


Figure 1: Basic block diagram of the communication process

- diagram, suppose the FEC encoder is interchanged with the CRC encoder and the FEC decoder is interchanged with the CRC decoder. Explain why this system will not function correctly.
- Draw the unipolar NRZ, polar NRZ, polar RZ, NRZI, Manchester and differential Manchester waveforms corresponding to the bit string 1101101. State any assumptions you made with respect to the level of the signal to the left of the first bit's waveform.
 - A data link layer framing protocol uses bit stuffing to prevent the flag byte 01111110 (01^{60}) from appearing in the payload.
 - What is the bit stuffing rule used at the sender?
 - What is the bit destuffing rule used at the receiver?
 - Apply the bit stuffing rule to the bit strings 11111111111111111111111111111111 (1^{25}) and 11111011111111111110111110 ($1^601^{11}01^{50}$).
 - Apply the bit destuffing rule to the following bit string and show where the actual flags are located. 01111101110110011111001111101100111111010111110
 - Suppose a CRC scheme uses the generator polynomial $g(X) = (X + 1)(X^3 + X + 1)$.
 - Generate CRC check bits for the information bits strings 1111 and 1010.
 - Give an example of a double-bit error which is detected by this CRC scheme.
 - Give an example of a double-bit error which is **not** detected by this CRC scheme.

- (d) Given an example of a burst error of burst length 5 which is detected by this CRC scheme.
 - (e) Given an example of a burst error of burst length 5 which is **not** detected by this CRC scheme.
5. (a) Show that $X^n + X^{n-1} + \cdots + X^2 + X + 1$ is not a primitive polynomial for all positive integers $n > 2$.
- (b) Does $X + 1$ divide $X^{n^2+n} + X^{n^2+n-1} + X^{n^2+n-2} + \cdots + X + 1$ for all positive integers n ?