EE3009 Tutorial 11

(Error Detection & Correction, Digitization, and Source Coding)

Problems

1. Consider the CRC scheme with the five-bit generator 10111.
   a) Suppose the information bits are 1011. What is the corresponding CRC bit pattern? Show your calculation using the division method.
   b) Draw the shift register division circuit for this generator pattern.

2. Suppose that a parity check code has minimum Hamming distance d_{min}.
   a) Show that if the distance between one codeword and a given bit string (of the same length) is less than $d_{min}/2$, the distance between any other codeword and the given bit string must exceed $d_{min}/2$.
   b) Show that if a decoder maps a given received string into a codeword at smallest distance from the string, all combinations of fewer than $d_{min}/2$ errors will be corrected.

3. An audio digitizing utility in a PC samples an input signal at a rate of 44 kHz and 16 bits/sample. How big a file is required to record 20 seconds?

4. Suppose you want to encode a five-symbol alphabet. Which of the following codeword lengths for the five symbols are possible for a uniquely decodable code? Why?
   a) 1, 2, 3, 4, 6, 6
   b) 2, 2, 3, 3, 3, 4, 4, 4