City University of Hong Kong
Department of Electronic Engineering

EE3009 Data Communications and Networking

Tutorial 4

1. Suppose a transmission channel operates at 3 Mbps and has a bit error rate of 10^{-3}. Bit errors occur at random and independent of each other. Suppose that the following code is used. To transmit a 1, the codeword 111 is sent; to transmit a 0, the codeword 000 is sent. The receiver takes the three received bits and decides which bit was sent by taking the majority vote of the three bits. Find the probability that the receiver makes a decoding error.

2. Suppose a header consists of four 16-bit words: (11111111 11111111, 11111111 00000000, 11110000 11110000, 11000000 11000000). Find the Internet checksum for this code.

3. A CRC is constructed to generate a 4-bit frame check sequence for a 10-bit message. The generator polynomial is x^4+x+1.

   i) Draw the shift register circuit that would perform this task.

   ii) Encode the data bit sequence 1101011011 (rightmost bit is the least significant bit) using the generator polynomial and give the code word.

   iii) Now assume that bit 7 (counting from the least significant bit) in the codeword is in error and show that the detection algorithm detects the error.