

City University of Hong Kong  
Department of Electrical Engineering

**EE3009 Data Communications and Networking**

**Assignment 3**

**Due Date: 16 November 2024**

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.

[5 marks]
2. Suppose a header consists of four 16-bit words: (11111111 11111111, 11111111 00000000, 11110000 11110001, 11000000 11000000). Find the Internet checksum for this header information.

[5 marks]
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.

[3 marks]
  - ii) Encode the data bit sequence 1101011011 using the generator polynomial and give the code word.

[7 marks]