Cpr E 489 Spring 2023
Homework #2
Due Date: 2/21/2023 (Tue) by 11:59 PM
Type or scan your answers and submit on Canvas.

1. (30 points) Consider the 2-out-of-5 error detection code. In this code, each codeword is 5-bit long; 2 out of 5 bits are 1's and the others are 0's. For example, 01001 is a valid codeword, but 11110 is not.
   a. (10 points) List all the codewords.
   b. (10 points) What fraction of errors is undetectable by this code, i.e., what is FUE of this code? Justify your answer.
   c. (10 points) What fraction of 4-bit errors is undetectable by this code, i.e., what is FUE(M = 4) of this code? Justify your answer.

2. (70 points) Consider a CRC code with a generator polynomial of $g(x) = x^3 + x^2 + 1$.
   a. (10 points) Show the shift-register circuit that implements this CRC code.
   b. (10 points) Show step by step (using the longhand division) how to find the codeword that corresponds to five information bits of 11111.
   c. (10 points) Suppose the codeword length is 8. What fraction of errors is undetectable by this code, i.e., what is FUE of this code? Justify your answer.
   d. (10 points) Suppose the codeword length is 8. What fraction of error bursts of length 6 is undetectable by this code, i.e., what is FUE(L = 6) of this code? Justify your answer.
   e. Suppose the codeword length is 8. Answer the following questions, with proper justifications.
      i. (10 points) Give an example error vector of undetectable error burst of length 6 (L = 6).
      ii. (10 points) Give an example error vector of undetectable 6-bit error (M = 6).
      iii. (10 points) Give an example error vector of undetectable error that is both a 3-bit error and an error burst of length 7 (M = 3 and L = 7).