EE2302 Foundations of Information Engineering

Assignment 9 **Due: 6 pm, Nov 17 (Thu)**

Full Mark: 16 points

1. Consider the binary linear code which adds three parity bits c_3, c_4, c_5 to two information bits u_1, u_2 as follows: $c_3 = u_1, c_4 = u_1 + u_2, c_5 = u_2$.

    a) (1 marks) List all its codewords.
    b) (2 marks) Does the code (i.e., the set of all codewords) form a subspace of $\mathbb{B}^5$? Briefly explain your answer. (Note that binary addition is the same as logical XOR while binary multiplication is the same as logical AND.)
    c) (1 mark) Determine its minimum distance and state its error correction capability.
    d) (2 marks) Determine its generator matrix and parity check matrix.
    e) (1 mark) Suppose the vector $(1, 1, 0, 1, 1)$ is received. Compute the syndrome.
    f) (2 marks) Use the syndrome to identify the error bit, if any. Explain your reasoning.

2. Consider the (5, 1) repetition code.

    a) (1 mark) Is it a systematic code? Why?
    b) (2 mark) Determine its generator matrix and parity check matrix.
    c) (4 marks) Comment on the performance of this code. Compare it with the code in Question 1.