**ECE/CS 4434/6434**

**Class Activity 4**

**Group Submissions Due Monday, October 7 in Class**

**Online Students: Email Submission to me and TAs by October 7, 11:59pm**

Write your names and UVa Email IDs here:

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**Problem 1** –The data packet d = (*d2, d1, d0*) is encoded using the following circuit before transmission on the network and the codeword c = (*d2, d1, d0, P*) is generated:



Parity Bit = 0

Determine the codeword that will be generated for data packet d = (1, 1, 0): C *=* ( 1*,* 1 *,*0 *,*0)

What is the code distance of this parity encoding scheme?How many single bit-errors can be detected or corrected using this scheme?

Code Distance = \_\_\_\_2\_\_\_\_\_\_\_ Detect = \_\_\_1\_\_\_\_\_\_\_\_ Correct = \_\_\_\_\_\_\_0\_\_\_\_

**Problem 2 –** The data packet d = (*d3, d2, d1, d0*) = (1, 1, 0, 1) is encoded using the following Hamming code circuit and the codeword c = (*d3,* *d2, d1, d0, p2, p1, p0*) is generated and transmitted on the network. The parity checking circuit at destination generates the parity vector on the received codeword p\* = (*p\*2, p\*1, p\*0*) = (1, 0, 1).



**Part A -** Calculate the syndrome C = (C2, C1, C0).

Assumed Even Bit Parity

Syndrome

**Part B -** Determine which bit is in error and explain why.

, The 7th bit is in error as the syndrome in base 10 points to the index of the incorrect bit.

**Problem 3** –Consider a (5, 4) cyclic code with the generator polynomial G(X) = X + 1. For each of the following parts, provide an answer in the space provided. Show your work and a justification for your answer to get partial credit.

**Part A -** For data word D1(X) = (0110), we obtain the codeword C1(X) = **1010**

**Part B -** The codeword C2(X) = X4+X is received with no error, the corresponding data word was D2(X) =

**Part C -** The codeword C3(X) = X4+X3+X2+X+1 is received, is an error detected or not?

Yes, a remainder of 1 is left behind so there is an error detected.

**Hint:** Remember that a cyclic code (n, k) encodes data into codewords of length *n*, by multiplying *k*-bit data word by a *n-k* degree polynomial.