Information And Communication Tutorial
9-03-2025

1. Construct the standard array for a (7,4) Hamming Code. What are your observations with respect to the set of coset leaders? What are $d_{\min}$ and error correcting capability of this code?

2. For the given standard array:

Row # (Leader)	Codewords
Row 0 (leader 0000)	0000, 1011, 0111, 1100
Row 1 (leader 0001)	0001, 1010, 0110, 1101
Row 2 (leader 0010)	0010, 1001, 0101, 1110
Row 3 (leader 0100)	0100, 1111, 0011, 1000

   (a) Construct the Generator matrix and Parity Check matrix for these codes.

   (b) Decode the vector '1101' .

   (c) Calculate the probability of error if the codeword '1011' is transmitted.

   (d) What are $d_{\min}$ and error correcting capability of this code?

3. Prove that the Maximum Likelihood (ML) decoder and the Standard Array decoder yield the same decoding result when the probability of a bit error is $p < 0.5$

4. Consider a (5,2) linear code with the following generator matrix:

$$G = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 \end{bmatrix}$$

   Assume transmission over a Binary Symmetric Channel (BSC) with crossover probability $p = 0.2$. Given the received vector $r = 10110$, perform Maximum Likelihood (ML) decoding to determine the most likely transmitted codeword.