Write a Programming for Hamming code C(7,4) for Error correction and detection.

Solution:

Hamming code C(7, 4) and n=7, k = 4

Dataword = k = 4 bits and Codeword = n = 7 bits

Example:

Dataword: 1110

a_3	a_2	a_1	a_0
1	1	1	0

Codeword:

a_3	a_2	a_1	a_0	r_2	r_1	r_0

Modulo 2 arithmetic:

$r_0 = a_2 + a_1 + a_0$

$r_1 = a_3 + a_2 + a_1$

$r_2 = a_1 + a_0 + a_3$

$r_0 = a_2 + a_1 + a_0 = 1 + 1 + 0 = 0$

$r_1 = a_3 + a_2 + a_1 = 1 + 1 + 1 = 1$

$r_2 = a_1 + a_0 + a_3 = 1 + 0 + 1 = 0$

Codeword:

a_3	a_2	a_1	a_0	r_2	r_1	r_0
1	1	1	0	0	1	0

Codeword at Receiver:

b_3	b_2	b_1	b_0	q_2	q_1	q_0

Received codeword by the Receiver:

b_3	b_2	b_1	b_0	q_2	q_1	q_0
1	1	1	0	0	1	0

Calculating the syndrome at the receiver:

$s_0 = b_2 + b_1 + b_0 + q_0 = 1 + 1 + 0 + 0 = 0$

$s_1 = b_3 + b_2 + b_1 + q_1 = 1 + 1 + 1 + 1 = 0$

$s_2 = b_1 + b_0 + b_3 + q_2 = 1 + 0 + 1 + 0 = 0$

Syndrome:

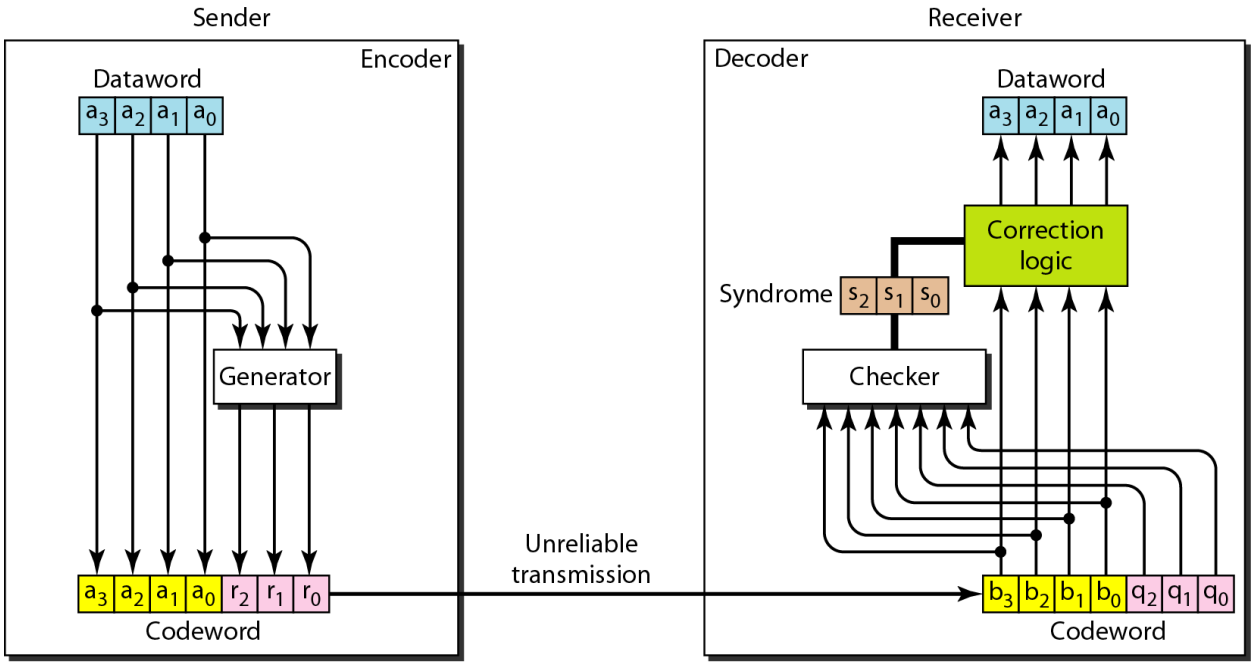
s_2	s_1	s_0
0	0	0

Based on final syndrome, single bit error position can be found with below Table.

Logical decision made by the correction logic analyzer:

Syndrome	000	001	010	011	100	101	110	111
Error	None	q_0	q_1	b_2	q_2	b_0	b_3	b_1

Note: Identify the error in the respective position and modify the bit from 0 to 1 or 1 to 0 and pass the correct dataword.



Example for Programming:

Enter 4 bit Dataword : 1110

Codeword is : 1110010

Any Error in data Transmission (Yes/No)?: No

If No:

Received Codeword: 1110010

The syndrome: 000

Final Result: No Error in Data

Final Codeword: 1110010

Final Dataword: 1110

Any Error in data Transmission (Yes/No)?: Yes

If Yes:

Error position 1 to 7 (1-b3/2-b2/3-b1/4-b0/5-q2/6-q1/7-q0): 3

Received Codeword: 11**0**0010

The syndrome: 011

Final Result: Single bit Error in Data at: ‘b1’

Final Codeword: 1110010

Final Dataword: 1110