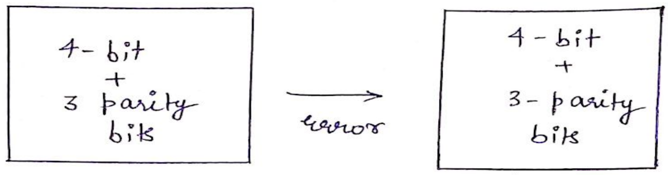
Single bit ECC with display

Group - 11

Extension of the circuit to 2-bit EDC

The minimum **hamming distance** between two bits in 1-bit is 3. So we can clearly detect 2-bit errors. So the procedure to follow to detect a 2-Bit error is as follows. Let the initial sequence be $D_1D_2D_3D_4P_1P_2P_3$. Where $P_1 = D_2 \oplus D_3 \oplus D_4$ and the others are defined similarly. Let the bits after 2-bit error be $D_1'D_2'D_3'D_4'P_1'P_2'P_3'$. Now compute the following, $P_1'' = D_2' \oplus D_3' \oplus D_4'$. Similarly compute the other P_i''. So, if we have for any i, $P_i' \neq P_i''$, we can confirm that the code is wrong. The circuit is shown below.



$D_1' D_2' D_3' D_4' \; P_1' P_2' P_3'$

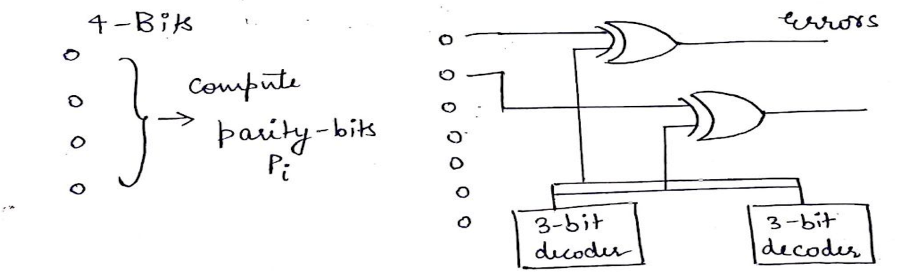
compute

$P_1'' = D_2' \oplus D_3' \oplus D_4'$

For any i, if $P_i' \neq P_i''$

$\Rightarrow$ there is an error in the code.

The circuit can be realized in the following way :-



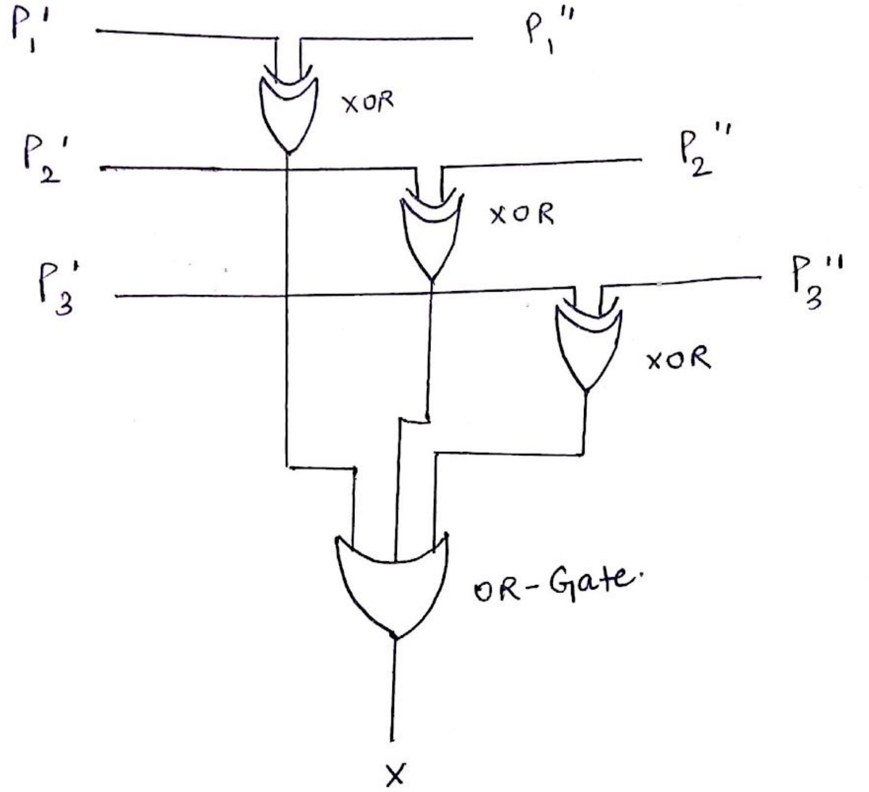
We get New $D_1' D_2' D_3' D_4' \; P_5' P_2' P_3'$

compute parity $(D_1' D_2' D_3' D_4')$

$\downarrow$

$(P_1'' \; P_2'' \; P_3'')$

Now, create a new circuit so that we can detect if for any i, $P_i' \neq P_i''$.



If $X = 1$, there is an error. Else no.

Extension of the circuit to 3-bit error detection.

To detect 3-bit errors, the minimum hamming distance between any two codes should be at least 4. But there are lots of correct code pairs with hamming distance = 3. Hence we cannot extend this circuit to 3-bit error detection.

Example of code pairs with hamming distance 3:

BCD Code 1 = 0101, parity bits = 010, total code = 0101010
BCD Code 2 = 0111, parity bits = 001, total code = 0111001

Clearly these both are valid codes, and the hamming distance between them is 3. So we cannot extend our circuit to detect 3-bit errors or higher.

**********END**********

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