Q Determine the Single error correcting code for the BCD no 1001 using even parity.

Soln:- Step1:- Find the no of parity bits

$2^p \geq m+p+1$

$m \rightarrow$ data bits $p =$ parity bits.

$p = 0$

$2^0 = 1$. $m+p+1$

$4+0+1$ ×

$p = 1$

$2^1 = 2$ $4+1+1$ ×

$p = 2$

$2^2 = 4$ $4+2+1$ ×

$p = 3$

$2^3 = 8 \geq 4+3+1$ ✓

$P = 3$

3 bits are sufficient.

Total code bits $= 4+3 = 7$.

Step 2:- Construct a bit position table, and enter the information bits. Determine the parity bits.

D_7	D_6	D_5	P_4	D_3	P_2	P_1
1	0	0	1	1	0	0
7	6	5	4	3	2	1

Parity bit position

2^p $\{p = 0, 1, \cdots p)$

$2^0 = 1$ $\quad 2^1 = 2$ $\quad 2^2 = 4$

$P_1 = 3\ 5\ 7$ $\qquad P_2 = 3\ 6\ 7$

$\underline{0}\quad 1\ 0\ 1$ $\qquad 0\quad 1\ 0\ 1$

$P_4 = 3\ 5\ 6\ 7$

$1\quad 0\ 0\ 1$

Q Determine the single error correcting code for the Instruction code 10110 for odd parity

Step 1:- $m = 5$ $\longrightarrow$ Apply $2^P \geq m+p+1$

$P = 0$ $\qquad P = 1$ ✗

$2^0 = 1$ $\quad 5+0+1$ $\qquad P = 2$ ✗

$P = 3$ ✗

$2^4 = 16 \geq 5+4+1$ $\qquad \underline{P = 4}$

∴ The total no. of bits are

$5+4=9$

Step 2:- Position of P

D_9	P_8	D_7	D_6	D_5	P_4	D_3	P_2	P_1
1		0	1	1		0		
9	8	7	6	5	4	3	2	1

1001

$2^0 = 1$, $2^1 = 2$, $2^2 = 4$, $2^3 = 8$

P_1 P_2 P_4 P_8

$P_1 = 3\ 5\ 7\ 9$

1   0 1 0 1

$P_2 = 3\ 6\ 7$

1   1 1 0

$P_4 = 5\ 6\ 7$

1   1 1 0

$P_8 = 9$

0   1

D_9	P_8	D_7	D_6	D_5	P_4	D_3	P_2	P_1
1	0	0	1	1	1	0	1	1
9	8	7	6	5	4	3	2	1

Detecting and Correcting an Error

Q Assume that the code word (0011001) is transmitted and that 0010001 is received. The receiver doesnot know what was transmitted and must look for proper parities to determine if the Code is correct. Desiginate any error that has occured in transmission if even parity is used:-

Soln:-

Step 1:- Start with the group checked by P_1

Step 2:- Check the group for proper parity. A 0 represents a good parity check and 1 represents a bad check.

Step 3:- Repeat step 2 for each parity.

Step 4:- The binary no formed by the result of the parity check desiginates the position of the code bit that is error. This is error position code

	D_7	D_6	D_5	P_4	D_3	P_2	P_1
	0	0	1	0	0	0	1
	7	6	5	4	3	2	1

$P_1 = 3\ 5\ 7$

$1 \quad 0\ 1\ 0$

Parity check is good $\longrightarrow P_1 \rightarrow 0$

$P_2 = 3\ 6\ 7$

$0 \quad 0\ 0\ 0$

Parity check is good $\longrightarrow P_2 \Rightarrow 0$

$P_4 = 5\ 6\ 7$

$0 \quad 1\ 0\ 0$

Parity check is wrong $\longrightarrow P_4 = 1$

Binary Code (P_4 P_2 P_1)

1 0 0 = 4 bit position

It is 0 which should be 1

	D_7	D_6	D_5	P_4	D_3	P_2	P_1
	0	0	1	1	0	0	1
	7	6	5	4	3	2	1

Q Determine single-error-correcting code for the information 0110 using even parity

Q If the Hamming code sequence 1100110 is transmitted and due to error in one bit position is received 1110110, locate the position of error, assuming even parity.

Boolean Algebra

- Set of rules, used to simplify the given logic expression without changing its functionality.
- It is used when no. of variables are less
- For more Variables K-Map are used
- To check the functionality Truth Table is used.
- Switching theory

Set of Rules or laws

i) ~~law~~ Idempotent law

$a \cdot a = a$

$a + a = a$

2) $A + 0 = A$ $\quad 1 + 0 = 1$

$0 + 0 = 0$

3) Complement Rule

A complement $= \overline{A}$ or not (A)

$\overline{0} = 1$, $\overline{1} = 0$

$\overline{\overline{A}} = A$

ii) <u>AND</u>

$A \cdot A = A$

$A \cdot 0 = 0$

$A \cdot 1 = A$

$A \cdot A' = 0$

iii) <u>OR</u>

$A + A = A$

$A + 0 = A$

$\boxed{A + 1 = 1}$ Imp.

$A + A' = 1$

$0 + 1 = 1$

$1 + 1 = 1$

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

iv) <u>Distributive Law</u>

$A \cdot (B + C) = A \cdot B + A \cdot C$

$\boxed{A + (BC) = (A + B)(A + C)}$

Imp.

* $A + \bar{A}B$

$= (A + \bar{A})(A + B)$

$= (A + B)$

$A + \bar{A}B = (A + B)$

Imp.

$\bar{A} + AB = (\bar{A} + B)$ Imp.

v) Commutative Law.

$A + B = B + A$

$AB = BA$

vi) Associative law

$(A \cdot B) \cdot C = A \cdot (BC)$

Priority → NOT, AND, OR

NOT ↓ Complement

vii) De morgan's law .

$\overline{A+B} = \bar{A} \cdot \bar{B}$

$\overline{A \cdot B} = \bar{A} + \bar{B}$

Ex:- $B\underline{AC'} + B'\underline{AC'} + BC' = (A+B) \cdot C'$

$\Rightarrow AC'[\cancel{B+B'}] + BC'$ 1

$\Rightarrow AC' + BC'$

$\Rightarrow C'[A+B]$

H.W

i) $(A+B+C)(A+B'+C)(A+B+C') = AB + AC$

2) $Y = (A+B)(A+B')(A'+B)(A'+B')$