PARITY GENERATOR & CHECKER

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WHAT IS PARITY BIT?

Parity error -

- Irregular changes to data, as it is recorded when it is entered in memory. Different types of parity errors can require the retransmission of data or cause serious system errors, such as system crashes.
- The most common error detection code used is the parity bit.

Parity Bit-

- The parity generating technique is one of the most widely used error detection techniques for the data transmission.
- In digital systems, when binary data is transmitted and processed, data may be subjected to noise so that such noise can alter 0s (of data bits) to 1s and 1s to 0s.
- Hence, parity bit is added to the word containing data in order to make number of 1s either even or odd. Thus it is used to detect errors during the transmission of binary data.

WHAT IS PARITY GENERATOR?

- A Parity Generator is a Combinational Logic Circuit that Generates the Parity bit in the Transmitter.
- A Parity bit is used for the Purpose of Detecting Errors during Transmissions of binary Information.
- It is an Extra bit Included with a binary Message to Make the Number of 1’s either Odd or Even.

Two Types of Parity

- In Even Parity, the added Parity bit will Make the Total Number of 1’s an Even Amount.
- In Odd Parity, the added Parity bit will Make the Total Number of 1’s an Odd Amount.

ODD AND EVEN PARITY

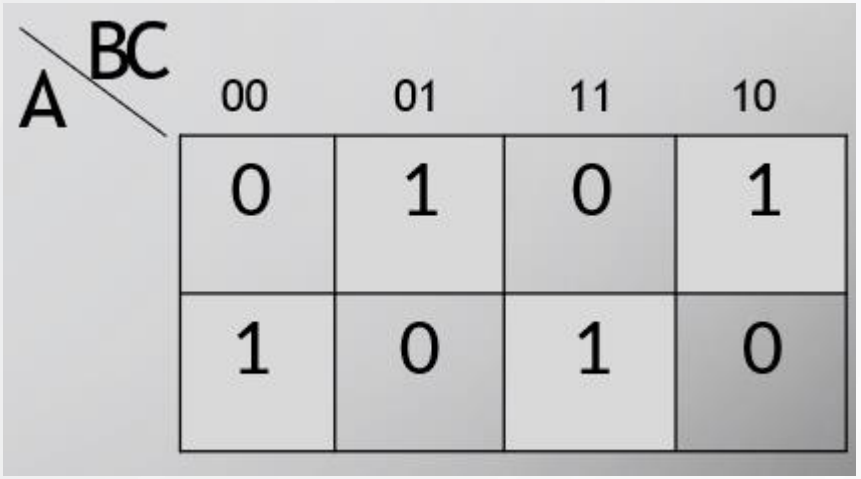
- When using even parity, the parity bit is set to 1 if the number of ones in a given set of bits (not including the parity bit) is odd, making the entire set of bits (including the parity bit) even.
- Example of even parity is **0**0000000, **1**1010001
- When using odd parity, the parity bit is set to 1 if the number of ones in a given set of bits (not including the parity bit) is even, keeping the entire set of bits (including the parity bit) odd.
- Example of Odd parity is **1**0000000, **0**1010001

PARITY BIT TABLE

7 bits of data (number of 1s)	8 bits including parity bit	
	Even	Odd
0000000 (0)	00000000	10000000
1010001 (3)	11010001	01010001
1101001 (4)	01101001	11101001
1111111 (7)	11111111	01111111

EVEN PARITY GENERATOR TRUTH TABLE AND BOOLEAN EXPRESSION

3-bit Message			Even Parity Bit
A	B	C	
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1



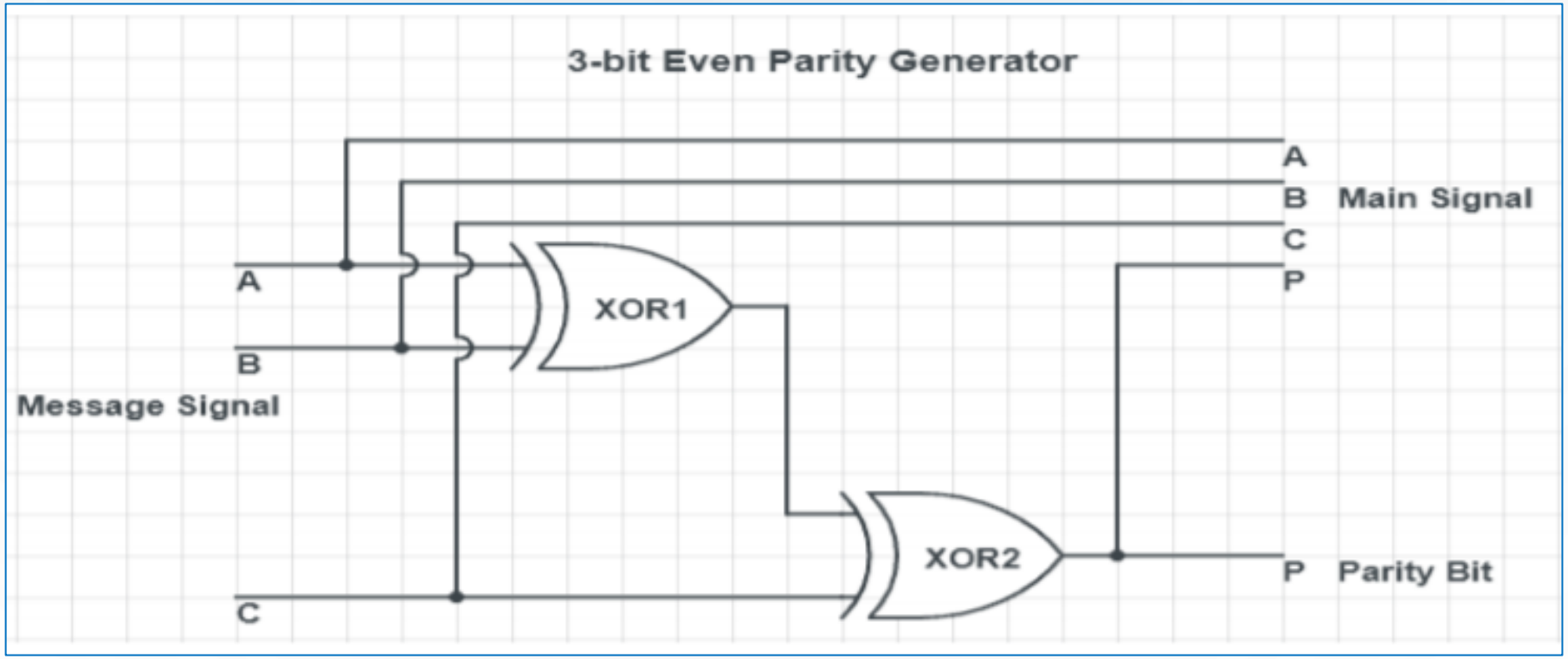
$$P = \bar{A}\,\bar{B}\,C + \bar{A}\,B\,\bar{C} + A\,\bar{B}\,\bar{C} + A\,B\,C$$

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

$$= \bar{A}\,(B \oplus C) + A\,(\overline{B \oplus C})$$

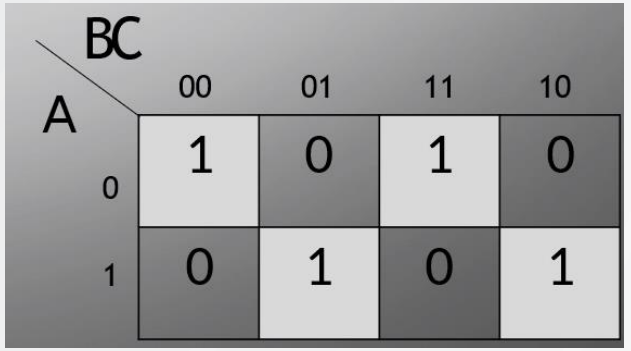
$$P = A \oplus B \oplus C$$

EVEN PARITY GENERATOR CIRCUIT DIAGRAM

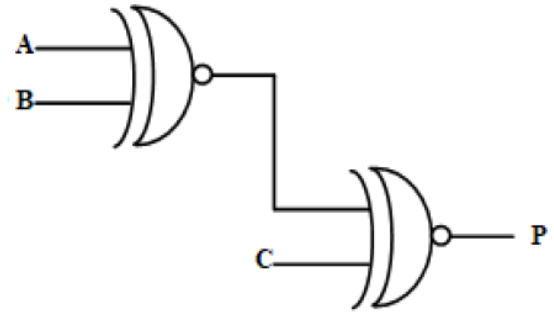


ODD PARITY GENERATOR TRUTH TABLE AND BOOLEAN EXPRESSION

3-bit Message			Odd Parity Bit
A	B	C	
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0



$$P = (A \oplus B \oplus C)'$$



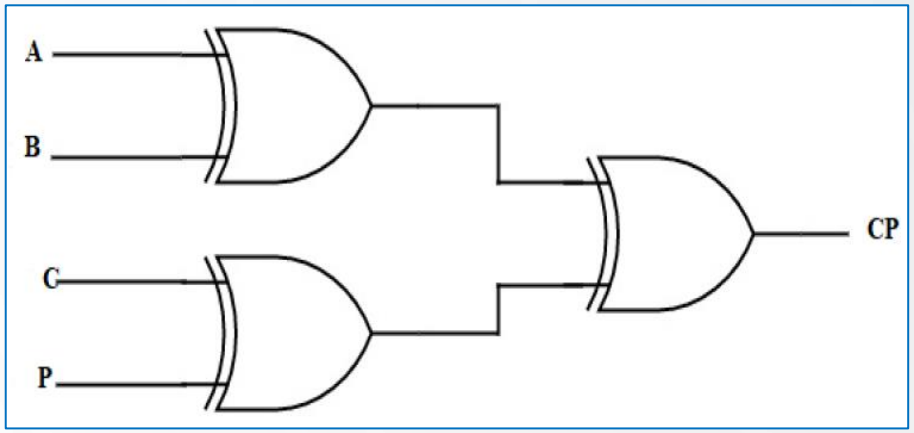
PARITY CHECKER

- A Circuit that Checks the Parity in the Receiver is called **Parity Checker**.
- The Parity Checker Circuit Checks for Possible Errors in the Transmission.
- Since the Information Transmitted with Even Parity, the Received must have an even number of 1's.If it has odd number of 1's, it indicates that there is a Error occurred during Transmission.
- The Output of the Parity Checker is denoted by PEC(Parity Error Checker).If there is error, that is,if it has odd number of 1's, it will indicate 1.If no then PEC will indicate 0.

EVEN PARITY CHECKER TRUTH TABLE

Decimal Equivalent	Four Bits Received				Parity Error
	P	A	B	C	PEC
0	0	0	0	0	0
1	0	0	0	1	1
2	0	0	1	0	1
3	0	0	1	1	0
4	0	1	0	0	1
5	0	1	0	1	0
6	0	1	1	0	0
7	0	1	1	1	1
8	1	0	0	0	1
9	1	0	0	1	0
10	1	0	1	0	0
11	1	0	1	1	1
12	1	1	0	0	0
13	1	1	0	1	1
14	1	1	1	0	1
15	1	1	1	1	0

LOGIC DIAGRAM



Boolean Expression

$$
\begin{aligned}
PEC = {} & \bar{P}\bar{A}(\bar{B}C + B\bar{C}) + \bar{P}A(\bar{B}\bar{C} + BC) + \\
& PA(\bar{B}C + B\bar{C}) + P\bar{A}(\bar{B}\bar{C} + BC) \\
= {} & \bar{P}\bar{A}(B \oplus C) + \bar{P}A(\overline{B \oplus C}) + PA(B \oplus C) + \\
& P\bar{A}(\overline{B \oplus C}) \\
= {} & (\bar{P}\bar{A} + PA)(\mathrm{B} \oplus C) + (\bar{P}A + P\bar{A})(\overline{B \oplus C}) \\
= {} & (\overline{P \oplus A})(B \oplus C) + (P \oplus A)(\overline{B \oplus C}) \\
= {} & (\mathrm{P} \oplus A) \oplus (B \oplus C)
\end{aligned}
$$

K-Map Simplification

PA \ BC	00	01	11	10
00	0	1	0	1
01	1	0	1	0
11	0	1	0	1
10	1	0	1	0

PARITY GENERATOR/CHECKER APPLICATIONS

- Parity is used to detect errors in transmitted data caused by noise or other disturbances.
- Parity is good for detecting a single bit error only.