rity Generators and Checkers:-

Errors can occurs as digital codes are being transferred from one point to another within a digital system or while codes are being transmitted from one system to another. The errors take the form of undesired changes in the bits that make up the coded information; that is, a "1" can change to "0", or a "0" to "1", due to component malfunction or electrical noise.

-Parity bit Generator methods:-

Many systems, employ a parity bit as a means of detecting a bit error. A word always contains either an even or an odd number of 1's. For this reason digital system employs some method for detection (somtimes correction) of errors. one of the simplest and most widely used schemes for error detection is "the parity bit method" and the two different methods used are:-

1- Even parity Generator method
2- Odd parity Generator method.

1- Even Parity Generator method:-

Even parity means attaching an extra bit to a group of bits to produce an even number of 1's as shown in Table 1.

2- Odd parity Generator method:-

Odd parity means attaching an extra bit to a group of bits to produce an odd number of 1's. as shown in Table 2.

Table 1- Even parity Generator for three bits

A B C	Even Parity P_e
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

$X = A\bar{B} + \bar{A}B = A \oplus B$

$\bar{X} = \bar{A}\bar{B} + AB = \overline{A \oplus B}$

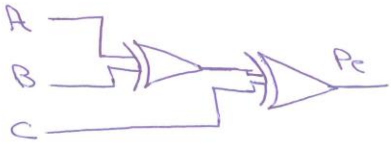
$P_e = \bar{A}\bar{B}C + \bar{A}B\bar{C} + A\bar{B}\bar{C} + ABC$

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

$P_e = C\bar{X} + \bar{C}X$

$P_e = C \oplus X$

$P_e = C \oplus A \oplus B$



Logic diagram of even parity generator.

Table 2- Odd parity Generator for three bits.

ABC	odd parity P_o
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

$X = \bar{A}B + A\bar{B} = A \oplus B$

$\bar{X} = \bar{A}\bar{B} + AB = \overline{A \oplus B}$

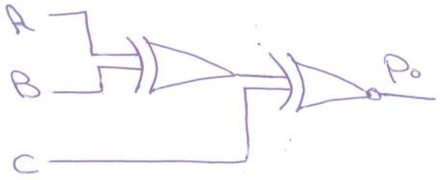
$P_o = \bar{A}\bar{B}\bar{C} + \bar{A}BC + A\bar{B}C + AB\bar{C}$

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

$P_o = CX + \bar{C}\bar{X}$

$P_o = C \odot X$

$P_o = C \odot (A \oplus B)$



Logic diagram for odd parity generator.

Asst. lect. Besma Nazar

Parity Checking:-

Ex:- show how to design a even parity checker cct. for a 3-bit data:-

Solution:-

even Parity checker

A B C	C_o
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

$X = A\bar{B} + \bar{A}B = A \oplus B$

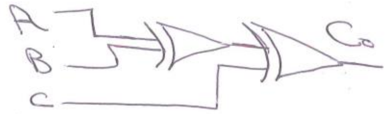
$\bar{X} = AB + \bar{A}\bar{B} = \overline{A \oplus B}$

$C_o = \bar{A}\bar{B}C + \bar{A}B\bar{C} + A\bar{B}\bar{C} + ABC$

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

$C_o = C\bar{X} + \bar{C}X$

$C_o = C \oplus A \oplus B$



Ex:- Design a logic cct to provide the odd parity bit for BCD code using NAND gates only:-

Solution:-

A B C D	P_o
0 0 0 0	1
0 0 0 1	0
0 0 1 0	0
0 0 1 1	1
0 1 0 0	0
0 1 0 1	1
0 1 1 0	ϕ
0 1 1 1	0
1 0 0 0	0
1 0 0 1	1

$d = \sum 10, 11, 12, 13, 14, 15$

$P_o = \sum 0, 3, 5, 6, 9$

CD \ AB	$\bar{A}\bar{B}$ 00	$\bar{A}B$ 01	AB 11	$A\bar{B}$ 10
$\bar{C}\bar{D}$ 00	1_{0}	0_{4}	X_{12}	0_{8}
$\bar{C}D$ 01	0_{1}	1_{5}	X_{13}	1_{9}
CD 11	1_{3}	$_{7}$	X_{15}	X_{11}
$C\bar{D}$ 10	0_{2}	1_{6}	X_{14}	X_{10}

$P_o = \overline{\overline{AD + B\bar{C}D + BC\bar{D} + \bar{A}\bar{B}\bar{C}\bar{D} + \bar{B}CD}}$

$P_o = \overline{\overline{AD} \cdot \overline{B\bar{C}D} \cdot \overline{BC\bar{D}} \cdot \overline{\bar{A}\bar{B}\bar{C}\bar{D}} \cdot \overline{\bar{B}CD}}$

H.W.:- Draw the cct using NAND gates only.

Asst. lect. Besma Nazar.

H.w:— 1- Design an even/odd parity generator for 4-bit data, then implement it's cct. diagram.

2. Design a parity checker cct for a 4-bit data, then implement it's cct diagram.