ARYAMAN MISHRA

19BCE1027

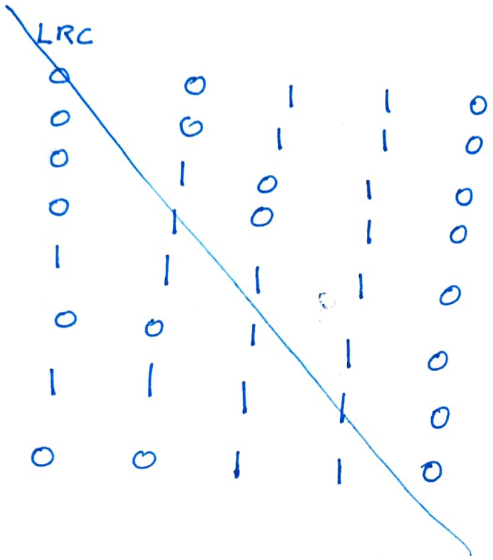
1)

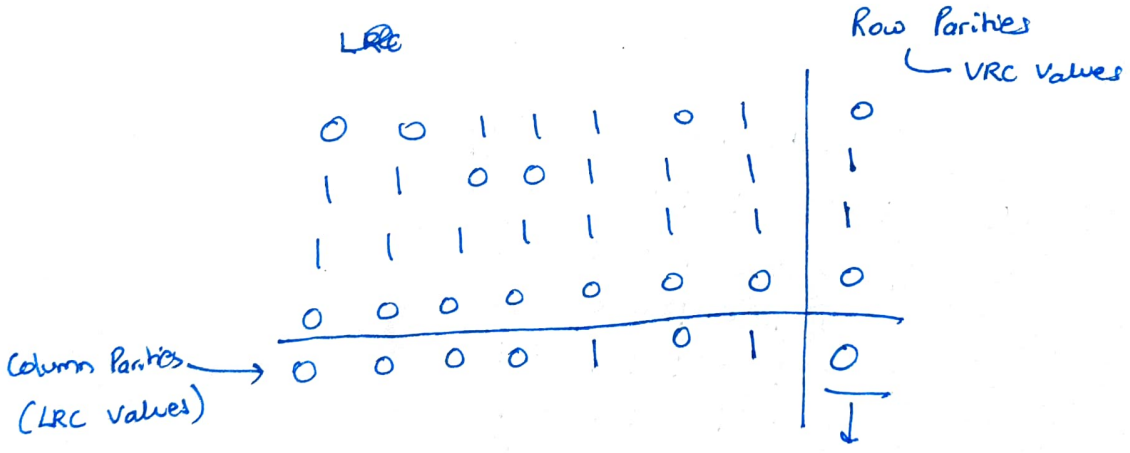
0011101

1100111

1111111

0000000





2) Sender - 01110001 0 (VRC)

Receiver - 01000001 0

Resulting parity is even.

Error will not be detected.

3)

N – 78
E – 69
T – 84
ω – 87
o – 79
R – 82
K – 75

2	78
2	39 – 0
2	19 – 1
2	9 – 1
2	4 – 1
2	2 – 0
2	1 – 0
	0 – 1

2	69
2	34 – 1
2	17 – 0
2	8 – 1
2	4 – 0
2	2 – 0
2	1 – 0
	0 – 1

2	87
2	43 – 1
2	21 – 1
2	10 – 1
2	5 – 0
2	2 – 1
2	1 – 0
	0 – 1

Append

2	84
2	42 – 0
2	21 – 0
2	10 – 1
2	5 – 0
2	2 – 1
2	1 – 0
	0 – 1

2	79
2	39 – 1
2	19 – 1
2	9 – 1
2	4 – 1
2	2 – 0
2	1 – 0
	0 – 1

Parity Bit VRC

2	82
2	41 – 0
2	20 – 1
2	10 – 0
2	5 – 0
2	2 – 1
2	1 – 0
	0 – 1

Data bits

N	1	0	0	1	1	1	0	– 0
E	1	0	0	0	1	0	1	– 1
T	1	0	1	0	1	0	0	– 1
ω	1	0	1	0	1	1	1	– 1
o	1	0	0	1	1	1	1	– 1
R	1	0	1	0	0	1	0	– 1
K	1	0	0	1	0	1	1	– 0
LRC	1	0	1	1	1	1	0	– 1

2	75
2	37 – 1
2	18 – 1
2	9 – 0
2	4 – 1
2	2 – 0
2	1 – 0
	0 – 1

Original data

10011100	10001011	10101001	10101111	10011111	10100101	1001011
N	E	T	ω	o	R	K

K = 7, m = 8

Sender

```
   1 1
   1 0 0 1 1 1 0 0      1
 + 1 0 0 0 1 0 1 1      2
 -------------------
   1 0 0 1 0 0 1 1 1
 ---------------------
   0 0 1 0 1 0 0 0
 + 1 0 1 0 1 0 0 1      3
 ---------------------
   1 1 0 1 0 0 0 1
 + 1 0 1 0 1 1 1 1      4
 ---------------------
   1 1 0 0 0 0 0 0 0
 ---------------------
   1 0 0 0 0 0 0 1
   1 0 0 1 1 1 1 1      5
 ---------------------
   1 0 0 1 0 0 0 0 0
 ---------------------
   0 0 1 0 0 0 0 1
   1 0 1 0 0 1 0 1      6
 ---------------------
   1 1 0 0 0 1 1 0
 + 1 0 0 1 0 1 1 0      7
 ---------------------
   1 0 1 0 1 1 1 0 0
 + ---------------------
   0 1 0 1 1 1 0 1
```

Checksum: 10100010

Receiver

```
   1 0 0 1 1 1 0 0
 + 1 0 0 0 1 0 1 1
 ---------------------
   1 0 0 1 0 0 1 1 1
 ---------------------
   0 0 1 0 1 0 0 0
 + 1 0 1 0 1 0 0 1
 ---------------------
   1 1 0 1 0 0 0 1
 + 1 0 1 0 1 1 1 1
 ---------------------
   1 1 0 0 0 0 0 0 0
 ---------------------
   1 0 0 0 0 0 0 1
   1 0 0 1 1 1 1 1
 ---------------------
   1 0 0 1 0 0 0 0 0
 + ---------------------
   0 0 1 0 0 0 0 1
 + 1 0 1 0 0 1 0 1
 ---------------------
   1 1 0 0 0 1 1 0
 + 1 0 0 1 0 1 1 0
 ---------------------
   1 0 1 0 1 1 0 0
 + ---------------------
   0 1 0 1 1 1 0 1
   1 0 1 0 0 0 1 0
 ---------------------
Sum: 1 1 1 1 1 1 1 1
Complement: 0 0 0 0 0 0 0 0
```

Conclusion: Accept Data

4) Append n-bits

$$\begin{array}{r} 1011001100 \\ +\quad\quad\quad 111 \\ \hline 1011001111 \end{array}$$

divisor of length n+1 : 1001

$1011001111 = x^{10} + x^8 + x^7 + x^4 + x^3 + x^2 + x^1 + x^0$

$1001 = x^3 + x^0 = x^3 + 1$

$$
\begin{array}{r|l}
x^3+1 & x^7 + x^5 - x^2 + x + 1 \\
\hline
 & x^{10} + 0x^9 + x^8 + x^7 + 0.x^6 + 0.x^5 + x^4 + x^3 + x^2 + x + 1 \\
- & x^{10} + 0x^9 + 0x^8 + x^7 \\
 & (-)\quad (-)\quad (-)\quad (-) \\
\hline
 & x^8 + 0.x^7 + 0.x^6 + 0.x^5 + x^4 + x^3 + x^2 + x + 1 \\
- & x^8 + 0.x^7 + 0.x^6 + x^5 \\
 & (-)\quad (-)\quad (-)\quad (-) \\
\hline
 & -x^5 + x^4 + x^3 + x^2 + x + 1 \\
- & -x^5 + 0.x^4 + 0.x^3 - x^2 \\
 & (+)\quad (-)\quad (-)\quad (+) \\
\hline
 & x^4 + x^3 + 2x^2 + x + 1 \\
- & x^4 + 0.x^3 + 0.x^2 + x \\
 & (-)\quad (-)\quad (-)\quad (-) \\
\hline
 & x^3 + 2x^2 + 0.x + 1 \\
- & x^3 + 0.x^2 + 0.x + 1 \\
 & (-)\quad (-)\quad (-)\quad (-) \\
\hline
 & 2x^2
\end{array}
$$

$$
\frac{x^{10} + x^8 + x^7 + x^4 + x^3 + x^2 + x + 1}{x^3 + 1} = x^7 + x^5 - x^2 + x + 1 + \frac{2x^2}{x^3+1}
$$

Error detected

```
            10011111
      _______________
1001 ) 10110011111
     - 1001
       ----------
         10001
       - 1001
       ----------
          10001
        - 1001
        ---------
           10001
         - 1001
         --------
            10001
          - 1001
          -------
             10001
           - 1001
           ------
              1000
```

Error detected

5

a) $G(x) = x^4 + x + 1$

$m(x) = x^7 + x^6 + x^4 + x^2 + x$

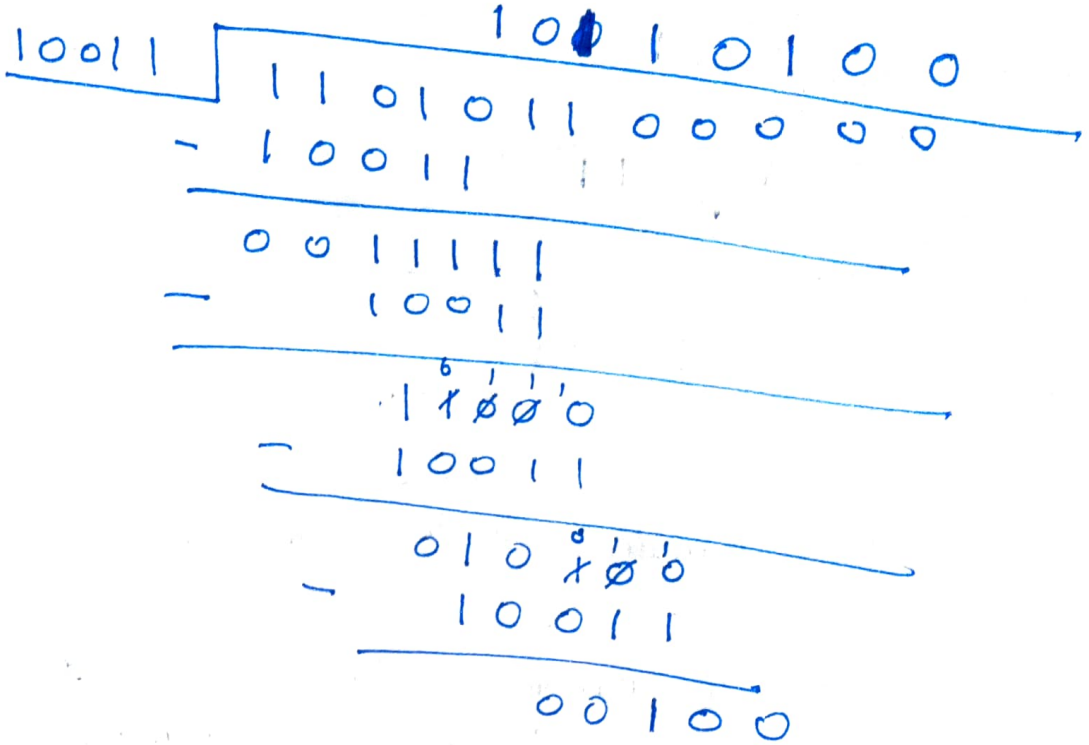
~~$T(x)$~~

$G(x) = 10011$

$m(x) = 11010110$

1 1 1
1 0 0 1

append by n bit – 11010110000 0



a) $T(x) = 11010110000 0 + 100$

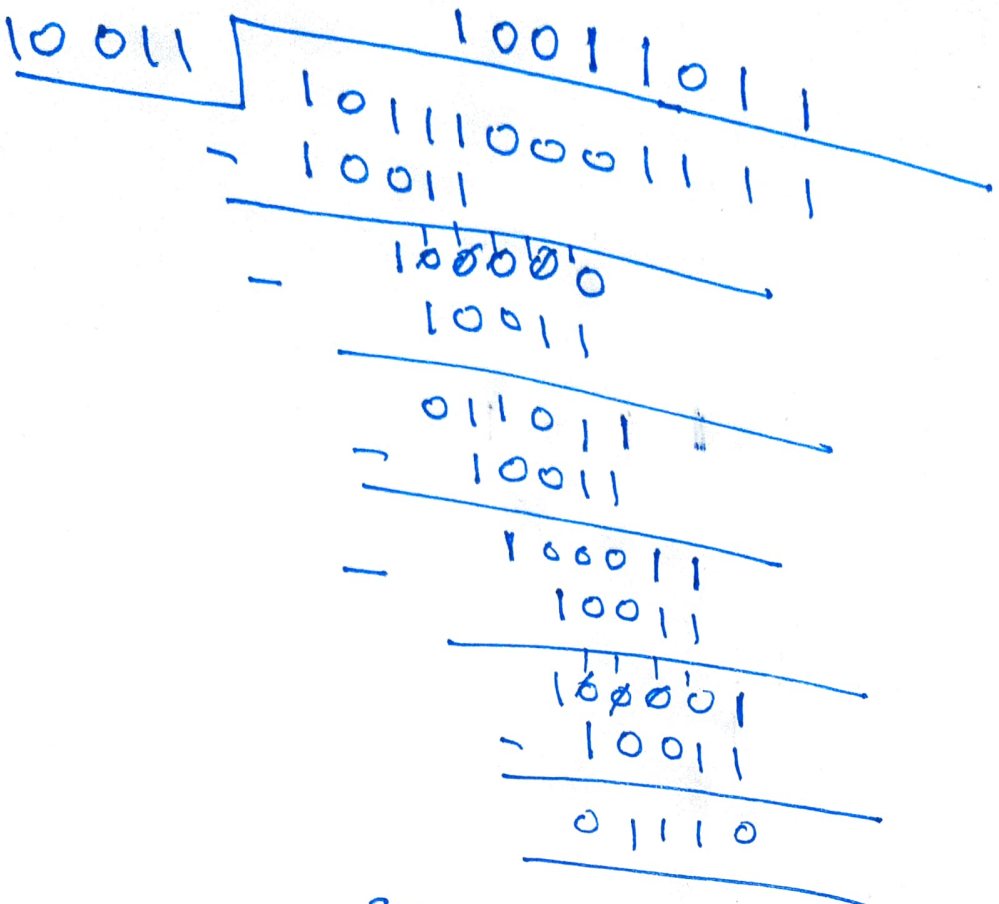
$= 11010110010 0$

$T(x) = x^{11} + x^{10} + x^8 + x^6 + x^5 + x^2$

b) $R(x) = x^{11} + x^9 + x^8 + x^7 + x^3 + x^2 + x + 1$

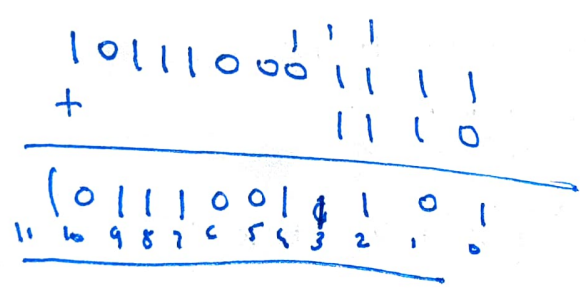
$= 10111000 1111$

$G(x) = 10011$



Since remainder is there, an error will be detected.

Thus the remainder should be added to R(x) and converted to function.



$R(x) = x^{11} + x^9 + x^8 + x^7 + x^4 \quad x^3 + x^2 + 1$