DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SUBJECT CODE: 19CS2109
COMPUTER NETWORKS AND SECURITY

ERROR DETECTION#2

Date of the Session: ___/___/___   **Time of the Session: _____to_____**
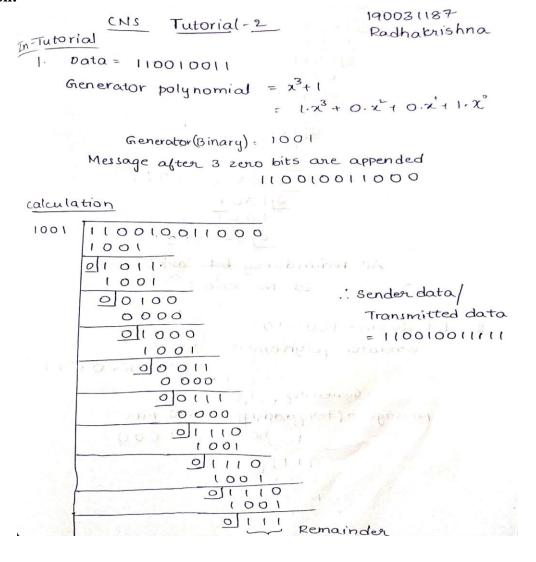
Learning outcomes:
- General idea of what Error Control is. [stanford.edu]
- Understand the Error Detection methods like CRC and parity.

IN-TUTORIAL:

1. The message 110010011 is to be transmitted using the generator polynomial x^3+1 to protect it from errors. Find the final data to be transmitted after performing CRC.Also check for errors on the received data using CRC.

Solution:

Receiver Side

```
          _____
1 0 0 1 | 1 1 0 0 1 0 0 1 1 1 1 1 1
          1 0 0 1
          _____
        0 1 0 1 1
          1 0 0 1
          _____
        0 0 1 0 0
            0 0 0 0
            _____
          0 1 0 0 0
            1 0 0 1
            _____
          0 0 0 1 1
              0 0 0 0
              _____
            0 0 1 1 1
              0 0 0 0
              _____
            0 1 1 1 1
                1 0 0 1
                _____
              0 1 1 0 1
                1 0 0 1
                _____
              0 1 0 0 1
                1 0 0 1
                _____
                0 0 0 0
```

All redundancy bits are zeroes

so No errors.

2. A bitstream 10011101 is transmitted using the standard CRC method. The generator
    polynomial is x^3+1
    a.   What is actual bit string transmitted?
    b.   Suppose the third bit from the left is inverted during transmission. How
         will receiver detect the error?

Solution:

2.   Bit stream – 10011101

Generator polynomial = $x^3 + 1$

$= 1 \cdot x^3 + 0 \cdot x^2 + 0 \cdot x^1 + 1 \cdot x^0$

Generator – 1 0 0 1

Message after adding 3 zero bits

100 11101 000

```
1001 | 1001110 1000
       1001
      0| 0001
         0000
        0| 0011
           0000
          0| 0110
             0000
            0| 1101
               1001
              0| 1000
                 1001
                0| 0010
                   0000
                  0| 0100
                     0000
                    0| 100
                         ⌣ Remainder
```

Transmitted
    Data =
100111011100

a) Actual bit string tramsitted — 100111011100

b) Inverted third bit from left — 100111101000

```
1001 | 100111101000
       1001
      0| 0001
         0000
        0| 0011
           0000
          0| 0110
             0000
            0| 1101
               1001
              0| 1000
                 1001
                0| 0010
                   0000
                  0| 0100
                     0000
                    0| 100
                        ⌣
```

All bits are not
zeroes

∴ Error is detected
at third bit
from left.

POST-TUTORIAL:

1. Consider the message M=101001011 and do the Cyclic Redundancy check for the above message using the following divisor polynomial $x^5 + x^3 + x^2 + 1$.

Solution:

post -Tutorial

1.   M = 101001011

   Divisor polynomial $= 1 \cdot x^5 + 0 \cdot x^4 + 1 \cdot x^3 + 1 \cdot x^2 + 0 \cdot x^1 + 1$

```
101101 | 101001011100000 0
          101101
          0 001000 0
          000000
            0 010001
            000000
              0 100011
              101101
                0 011100
                000000
                  0 111000
                  101101
                    0 101010
                    101101
                      0 001110
                      000000
                        0 011100
                        000000
                          0 11100
```

∴ Transmitted Data =

                101001011111100

2. For the given message 11011101, find the even and odd parity and then write a python code.

Solution:

2. Message is   11011101

    Since no. of 1's is even

                odd parity is   1

                Even parity is   0