

**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:**

190031187  
Radhakrishna

CNS Tutorial-2

In-Tutorial

1. Data = 110010011

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

Generator(Binary) = 1001

Message after 3 zero bits are appended  
 110010011000

calculation

1001	110010011000
	1001
	01011
	1001
	00100
	0000
	01000
	1001
	00011
	0000
	00111
	0000
	01110
	1001
	01110
	1001
	01110
	1001
	0111

∴ Sender data/  
Transmitted data  
= 110010011111

Remainder

Receiver side

$$\begin{array}{r}
 1001 \overline{) 110010011111} \\
 \underline{1001} \phantom{0000000000} \\
 01011 \phantom{000000000} \\
 \underline{1001} \phantom{000000000} \\
 00100 \phantom{00000000} \\
 \underline{0000} \phantom{00000000} \\
 01000 \phantom{0000000} \\
 \underline{1001} \phantom{0000000} \\
 00011 \phantom{0000000} \\
 \underline{0000} \phantom{0000000} \\
 00111 \phantom{0000000} \\
 \underline{0000} \phantom{0000000} \\
 01111 \phantom{0000000} \\
 \underline{1001} \phantom{0000000} \\
 01101 \phantom{0000000} \\
 \underline{1001} \phantom{0000000} \\
 01001 \phantom{0000000} \\
 \underline{1001} \phantom{0000000} \\
 0000 \phantom{0000000}
 \end{array}$$

All redundancy bits are zeroes

so No errors.

2. A bitstream 10011101 is transmitted using the standard CRC method. The generator polynomial is  $x^3+1$
- What is actual bit string transmitted?
  - 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 - 1001

Message after adding 3 zero bits

10011101000

$$\begin{array}{r}
 1001 \overline{) 10011101000} \\
 \underline{1001} \phantom{00000} \\
 0001 \phantom{00000} \\
 \underline{0000} \phantom{00000} \\
 0011 \phantom{00000} \\
 \underline{0000} \phantom{00000} \\
 0110 \phantom{00000} \\
 \underline{0000} \phantom{00000} \\
 1101 \phantom{00000} \\
 \underline{1001} \phantom{00000} \\
 1000 \phantom{00000} \\
 \underline{1001} \phantom{00000} \\
 0010 \phantom{00000} \\
 \underline{0000} \phantom{00000} \\
 0100 \phantom{00000} \\
 \underline{0000} \phantom{00000} \\
 100 \phantom{00000} \\
 \underline{000} \phantom{00000} \\
 000 \phantom{00000}
 \end{array}$$

Transmitted Data = 10011101100

Remainder

- a) Actual bit string transmitted - 10011101100
- b) Inverted third bit from left - 10011101000

$$\begin{array}{r}
 1001 \overline{) 10011101000} \\
 \underline{1001} \phantom{00000} \\
 0001 \phantom{00000} \\
 \underline{0000} \phantom{00000} \\
 0011 \phantom{00000} \\
 \underline{0000} \phantom{00000} \\
 0110 \phantom{00000} \\
 \underline{0000} \phantom{00000} \\
 1101 \phantom{00000} \\
 \underline{1001} \phantom{00000} \\
 1000 \phantom{00000} \\
 \underline{1001} \phantom{00000} \\
 0010 \phantom{00000} \\
 \underline{0000} \phantom{00000} \\
 0100 \phantom{00000} \\
 \underline{0000} \phantom{00000} \\
 100 \phantom{00000} \\
 \underline{000} \phantom{00000} \\
 000 \phantom{00000}
 \end{array}$$

All bits are not zeroes  
 $\therefore$  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  $= 1 \cdot x^5 + 0 \cdot x^4 + 1 \cdot x^3 + 1 \cdot x^2 + 0 \cdot x + 1$

$$\begin{array}{r}
 101101 \overline{) 101001011000000} \\
 \underline{101101} \phantom{000000} \\
 0001000 \phantom{00} \\
 \underline{000000} \phantom{00} \\
 010001 \phantom{00} \\
 \underline{000000} \phantom{00} \\
 100011 \phantom{00} \\
 \underline{101101} \phantom{00} \\
 011100 \phantom{00} \\
 \underline{000000} \phantom{00} \\
 111000 \phantom{00} \\
 \underline{101101} \phantom{00} \\
 0101010 \phantom{00} \\
 \underline{101101} \phantom{00} \\
 001110 \phantom{00} \\
 \underline{000000} \phantom{00} \\
 011100 \phantom{00} \\
 \underline{000000} \phantom{00} \\
 11100
 \end{array}$$

$\therefore$  Transmitted Data =

1010010111100

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

*(For Evaluator's use only)*

Comment of the Evaluator (if Any)

Evaluator's Observation

Marks Secured: \_\_\_\_\_ out of \_\_\_\_\_

Full Name of the Evaluator:

Signature of the Evaluator    Date of Evaluation:

NAME: NERELLA VENKATA RADHAKRISHNA

ID: 190031187

## TUTORIAL-2

In [2]:



```
bit = input("Enter bit stream:")
l = list(bit)
e = 1
for i in range(len(bit)):
    l[i] = int(l[i])
    if(l[i]!=1 and l[i]!=0):
        print("Incorrect bit stream (it should contain only 0 and 1)")
        e=0
        break
if e!=0:
    s = sum(l)
    if s%2==0:
        print("Odd parity = 1")
        print("Even parity = 0")
    else:
        print("Odd parity = 0")
        print("Even parity = 1")
```

Enter bit stream:1011101

Odd parity = 0

Even parity = 1