CENG 3331 Intro to Telecommunication and networks- Homework 6

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Problem 1:

A) $A_6 \oplus A_5 \oplus A_3 \oplus A_2 = 0 \quad A_6 \oplus A_4 \oplus A_3 \oplus A_1 = 0 \quad A_5 \oplus A_4 \oplus A_3 \oplus A_0 = 0$

Parity Check Matrix:

$$H = \left[\begin{array}{ccccccc} 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 \end{array}\right]$$

Generator Matrix:

$$G = \left[\begin{array}{ccccccc} 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 \end{array}\right]$$

B)

$$\left[\begin{array}{ccccccc} 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 \end{array}\right] [1010] = \quad [1010 \mid 101]$$

C)

S_1	S_2	S_3	Error bit
0	0	1	a_0
0	1	0	a_1
1	0	0	a_2
1	1	1	a_3
0	1	1	a_4
1	0	1	a_5
1	1	0	a_6
0	0	0	No Error

D)

$$\begin{bmatrix} 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 \end{bmatrix} * \begin{bmatrix} 1 \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$

101 means an error in a_5 so 1010000 → 1110000 → m = 1110

Problem 2:

A) k = 3 k – 1 = 2

Generator matrix:

$$G(x) = \begin{bmatrix} x^2g(x) \\ xg(x) \\ g(x) \end{bmatrix}$$

Systematic Form:

$$\begin{bmatrix} x^2g(x) \\ xg(x) \\ g(x) \end{bmatrix} = \left[\begin{array}{ccc|cccc} 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 \end{array}\right] \rightarrow \left[\begin{array}{ccc|cccc} 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 \end{array}\right]$$

B)

$$\left[\begin{array}{ccc|cccc} 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 \end{array}\right] \quad [110] = \quad [110 \mid 0101]$$

C)

Syndromes	Error Bit
$x^3 + x + 1$	x^6
$x^3 + x^2 + x$	x^5
$x^2 + x + 1$	x^4

```
          101
       _______
10111 |1000000
       10111
       -----
       0011100
         10111
         -----
         01011
```

```
          10
       ______
10111 |100000
       10111
       -----
       001110
```

```
          1
       _____
10111 |10000
       10111
       -----
       00111
```

D)

```
          101
       _______
10111 |1001100
       10111
       -----
       0010000
         10111
         -----
         00111
```

111 means there is an error in x^4 so 1001100 → 1011100 → m = 101

Problem 3:

Michael Lankford Just now

RE: IoT

1. The Internet of Things or IoT is the connection of all devices to the internet, from a smartphone to a fridge to a dishwasher. All of these devices consistently exchange information with each other.

2. IoT works because each device is connected through sensors and are able to communicate to each other through the cloud, which has been becoming more efficient each year as more companies incorporate it into their systems.

3. The general architecture of IoT is based around 3 things: the devices that will gather information, the network structure that will be the medium to transfer information, and the cloud which will be the central point to transfer information between devices.

4. While IoT is mainly focused on connectivity, there are many more applications for it. Some of these examples are: smart manufacturing, smart power grids, smart power grids, monitoring human health analytics, fleet managment, etc.

5. The main challenge of IoT is security. With every device being connected, there are extreme vulnerabilities not just for corporations, but for each person. It leaves data open to a hacker who could more easily obtain it. Some more challenges of IoT are: scalability, how to regulate it, and the computing power needed to connect everything together.