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Assignment 5

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Q: 2 for 1001010101 as D

```
        1000110000
10011 | 1001010101 0000
        10011
        00011
         00000
          00110
          00000
           01101
           00000
            11010
            10011
             10011
             10011
              00000
              00000
               00000
               00000
                00000
```

∴ As the remainder is 0 there is no error in the message.

∴ The transmitted data is $\boxed{1000110000}$ → over 1001010101

∴ Trans... data = 1001010101

for 0101101010 as D

```
        0101010101
10011 | 01011010100000
        00000
         10110
         10011
          01011
          00000
           10110
           10011
            01011
            00000
             10110
             10011
              01010
              00000
               10100
               10011
                01110
                00000
                 11100
                 10011
                  1111
```

∴ As remainder is 1111 the data transmitted will be 01011010101111 on $\boxed{0101010101}$

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Q: 3

Step 1: Convert the Input data into Binary data for applying Hamming code. C=01000011, A=01000001, D=01000100

Now before going to step2: I want you to understand the other way of solving this which is more clear. The 2D way of Hamming code.

	A	B	C	D
X	0	1	2	3
Y	4	5	6	7
Z	8	9	10	11
W	12	13	14	15

For reference.

We will be using 11 bits out of 16 bits as data and 5 bits will be redundancies.

For parity checks we will use Positions 1, 2, 4, 8 (why? will know in a min).

For this example lets take C's bits and after ~~afo~~ adding parity bits we get

•	0	1	0
0	1	0	0
0	0	0	1
1	X	X	X

- P_1 checks for column B & D
- P_2 checks for column C & D
- P_4 checks for column Y & W
- P_8 checks for column Z & W

As this positions will reveal the 1bit error cell in the grid if we ask a simple question.

(We will come back at the 0^{th} bit at the end).

Now error detaction of this data.

for example we have ~~some~~ an error at position 10. Instead of 0 we got 1. Then following questions will give us the error sell and solves it.

~~1)~~ for reference

·	0	1	0
0	1	0	0
0	0	**1**	1
1	X	X	X

1) Is P_1 correct? $P_1 = 0$ and number of ~~even~~ 1's bit in column B & D is 2 which is even so, Yes.
2) $P_2 \rightarrow$ No, as there are 3 (odd) 1's bit.
3) $P_4 \rightarrow$ Yes , 4) $P_8 \rightarrow$ No.

Now, reading it out as binery in reverse order as 0, 1, 0, 1

So 0101 wait I just made a mistack, ~~appdo~~ apology. Instead of asking If it is correct? we need to ask is there any errors. But if we reverse the answers we are all set for now.

So 1010 → which 8+2=10, thats the position of the error.

Now for the zeroth position, we can use it as an ~~alarm~~ alarm for 2 bit errors. Although we can not solve it but atleast we can know.

So 0^{th} bit will be a parity check of all the bits. So if there is one bit error we can check it from the 4 questions ~~But if there~~ is and also 0^{th} bit will be wrong. But if there are 2 bits changed we can say that although the question will see some changes the 0^{th} bit will remain same and confirs 2 bit error. This is Extended Hamming Code.

(All the data with redundancies are displayed ~~bellow~~ below).

Ans: For C the data with the redundancies is

0	0	1	0
0	1	0	0
0	0	0	1
1			

For A = 01000001 the data with the redundancies is

0	1	0	0
0	1	0	0
1	0	0	0
1			

So if the 5th bit of A which is 0 had an error and got converted to 1 so now the data will be;

0	1	0	0
0	1	0	0
1	1	0	0
1			

Now answering 4 question

1. Is there any error in B and D - YES
2. Is there any error in C and D - NO
3. Is there any error in Y and W - NO
4. Is there any error in Z and W - YES

So the binary will be 1001 which is 9 and at the ninth position we change the bit to 0 again.

For D = 01000100 the data with the redundancies is

0	1	1	0
1	1	0	0
1	0	1	0
0			

4. (10 points) Consider three LANs interconnected by two routers as shown below.

a. Assign IP addresses to all of the interfaces. For Subnet 1 use addresses of the form 192.168.1.xxx; for Subnet 2 use addresses of the form 192.168.2.xxx; and for Subnet 3 use addresses of the form 192.168.3.xxx.

Ans: For Subnet 1,

Router will get the first ip address as: 192.168.1.001

Then comes Host A with ip address: 192.168.1.002

Host B with ip address: 192.168.1.003

For Subnet 2,

Router 1's ip address as: 192.168.2.001

Router 2's ip address as: 192.168.2.002

Host C with ip address: 192.168.2.003

Host D with ip address: 192.168.2.004

For Subnet 3,

Router's ip address as: 192.168.3.001

Host E with ip address: 192.168.3.002

Host F with ip address: 192.168.3.003

b. Assign MAC addresses to all of the adapters.

Ans: MAC addresses on each subnet we have,

For Subnet 1,

Router will get the first mac address as: 00:00:00:00:00:00

Host A with mac address: 11:11:11:11:11:11

Host B with mac address: 22:22:22:22:22:22

For Subnet 2,

Router 1's mac address as: 33:33:33:33:33:33

Router 1's mac address as: 44:44:44:44:44:44

Host C with mac address: 55:55:55:55:55:55

Host D with mac address: 66:66:66:66:66:66

For Subnet 3,

Routers mac address as: 77:77:77:77:77:77

Host E with mac address: 88:88:88:88:88:88

Host F with mac address: 99:99:99:99:99:99

c. Consider sending an IP datagram from Host E to Host B. Suppose all of the ARP tables are up to date. Enumerate all steps, as done for the single router example in Section 5.4.1.

Ans: Considering that the ARP tables are all up to date, if we want to send the datagram from Host E to Host B following steps will be taken in the network;

1. From the forwarding table Host E knows that passing datagram to Host B requires it to send its data to the Subnet 3's router at the IP address 192.168.3.001.

2. From the IP address Host E will get the MAC address of the router as 77:77:77:77:77:77
3. Router 2 (which connects subnet 2 and 3) will receive the datagram and knows that inorder to send datagram to Host B it needs to send it to Router 1 (which connects Subnet 1 and 2).
4. Router 2 has the IP address of Router 1 as 192.168.2.002
5. From the forwarding table, Router 2 sends datagram to MAC address 33:33:33:33:33:33 (Router 1)
6. Again doing the same steps from Router in the Subnet 1 to Host B.

d. Repeat (c), now assuming that the ARP table in the sending host is empty (and all other tables are up to date).

Ans: If Host E does not have an ARP table up to date but everyone else has, than the following steps will be performed for Host E to send datagram to Host B;

1. Host E will ask for the mac address of the router via its ip address 192.168.3.001 from forwarding table.
2. Router will respond to Host E with its MAC address 77:77:77:77:77:77
3. Now Host E will send the datagram to Router and then the steps will be continued as Router will have ARP of its own up to date.