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1) Data word: 1010011110

Divisor: 1011

Arithmetic modulo = 1010011110 000

as divisor is of 4 bit, so appends 3 zeros.

now

```
1011 | 1010011110 000 | 11111
     | 1011
     |  1011
     |   1100
     |   1011
     |    1110
     |    1011
     |     1010
     |     1011
     |     0001   => CRC
```

sender =>

So, as remainder |001| so CRC becomes 001

receiver =>

```
1011 | 1010011110 001 | 11111
     | 1011
     |  1011
     |   1100
     |   1011
     |    1110
     |    1011
     |     1011
     |     1011
     |     0000
```

∴ as the remainder in receiver side is 000,

so there is no error. Ans

Q) 2^p >= k+p+1 Demonstrate how receiver corrects an error in 6th position of 10th bit. '0111010111' using Hamming code

→ number of Parity bit p : needed can be determined.

$2^p \geq k+p+1$ — [k = 10]

p = 3, $2^3 \geq 10+3+1$, no sufficient

p = 4, $2^4 \geq 10+4+1$, sufficient.

So, we need 4 Parity bits.

now

| 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 1 | 0 | 1 | $P_4$ | 0 | 1 | 1 | $P_3$ | 1 | $P_2$ | $P_1$ |

we put, $P_1, P_2, P_3$ & $P_4$ in $2^0, 2^1, 2^2, 2^3$ Position..

Calculate Parity,

| | 0 | 1 | 1 | 1 | 0 | 1 | $P_4$ | 0 | 1 | 1 | $P_3$ | 1 | $P_2$ | $P_1$ | Priority |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $P_1$ | X | 1 | X | 1 | X | 1 | X | 0 | X | 1 | X | 1 | X | ✓ | 1 |
| $P_2$ | 0 | X | X | 1 | 0 | X | X | 0 | 1 | X | X | 1 | ✓ | | 1 |
| $P_3$ | 0 | 1 | 1 | X | X | X | X | 0 | 1 | 1 | ✓ | | | | 0 |
| $P_4$ | 0 | 1 | 1 | 1 | 0 | 1 | ✓ | | | | | | | | 0 |

Sent code word = 01110100110 11

Recieved " " = 01110 1 00010 111

to verify the error at 6th bit, we check again with receiver end.

So

| | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | error syndrome |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $P_1$ | 0 | 1 | X | 1 | X | 1 | X | 0 | X | 1 | X | 1 | X | 1 | 0 |
| $P_2$ | 0 | X | X | 1 | 0 | X | X | 0 | 0 | X | X | 1 | 1 | | 1 |
| $P_3$ | 0 | 1 | 1 | X | X | X | X | 0 | 0 | 1 | 0 | | | | 1 |
| $P_4$ | 0 | 1 | 1 | 1 | 0 | 1 | 0 | | | | | | | | 0 |

error syndrome = 0110, which is 6 in decimal & the error is 0 bit also. Therefore, the error is the 6th bit from the right is verified

3) From the given problem to allocate IP, for block 190.100.0.0/16 according to the need of customers, we should design this way,

Block, 190.100.0.0/16 provides $2^{32-16}$ = 65,536 IP

G-1 64 customer each need 256 address,

so, 64 × 256 = 16,384 address

Range 190.100.0.0/24 - 190.100.63.0/24

G-2 128 customer each need 128,

so 128 × 128 = 16,384 address

Range, 190.100.64.0/24 - 190.100.127.0/25

G-3 128 customers each need 64,

128 × 64 = 8192

so, total address = 40,960

unallocated address = 65536 - 40960 = 245