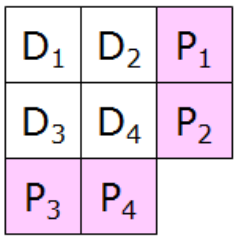
11.5 QUIZ INTRODUCTION

Assume that sequence of 12 bits is transmitted according to the following protocol:

1. The 12 bits are broken down into three 4 bit blocks.

2. Each block is encoded using the **(8, 4, 3)** block code discussed in the lecture. Each 8 bit codeword [**D1 D2 D3 D4 P1 P2 P3 P4**] is created by appending four parity bits **P1** through **P4** to the data bits **D1** through **D4**, where the parity bits are chosen so that each row and column in the diagram below has even parity.



3. Blocks of three codewords are interleaved to protect against burst errors.

4. Bit stuffing is applied, where a 0 is inserted after four consecutive 1's.

5. A sync sequence [0 1 1 1 1 1 0] is attached to the beginning of the interleaved and bit-stuffed block.

Suppose that we receive the following bitstream

011111011101000011110100110111100

Assume that during transmission, bit errors could have been introduced, but that

a. The maximum length of any burst of errors is less than or equal to three.

b. At most one bit in each codeword contains an error.

c. The bit errors do not appear in the sync sequence or near enough to the stuffed 0 bits to interfere with the destuffing, nor do they artificially create what appear to be stuffed 0 bits.

11.5 QUIZ QUESTION 1 (1 point possible)

How many 0 bits were stuffed into the transmitted bit sequence?

Please key in the numerical value of your answer in the box provided below.

2

2

Answer: 2

Help

EXPLANATION

First remove the sync pattern:

$$01111101110100001111010011011100 \rightarrow 11101000011110100110111100$$

Stuffed zeros occur after every four consecutive 1's (shown in green):

$$11101000011110100110111100$$

Thus, two 0s are stuffed into the interleaved block.

Hide Answer *You have used 0 of 2 submissions*

11.5 QUIZ QUESTION 2 (1 point possible)

What was the original sequence of 12 bits? Note that we are asking for the data or message bits only, **not** the entire codeword with parity bits.

Please key in your answer as a sequence of twelve 1's and 0's with no spaces between (e.g. 0110...) in the box below.

100111001010

100111001010

Answer: 101110011101

EXPLANATION

After removing the sync sequence, and destuffing the interleaved codeword block, we are left with the following 24 bit sequence:

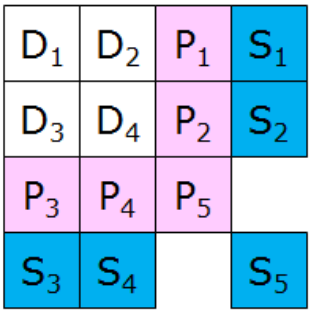
111 010 000 111 110 011 011 110

De-interleave the received bit stream to form three 8-bit codewords

10011001
11011111
10010110

Perform error correction by checking the syndrome bits S1-S5

Help



1. Error correction for the first codeword: 10011001

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

D3 is incorrect: 0→1. The message bits are 1011.

2. Error correction for the second codeword: 11011111

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

D2 is incorrect: 1→0. The message bits are 1001.

3. Error correction for the final codeword: 10010110

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

D2 is incorrect: 1→0. The message bits are 1101.

Thus, the original 12 bit sequence was 1011 1001 1101

Hide Answer *You have used 0 of 3 submissions*

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