EE 334 Homework: Error Detection and Correction

Problems (Based on problems from Chapter 7 of the Beige Book):

1. A Cross Parity Check is associated with an entire block of characters. For instance, at the end of a block of ***even*** parity BCD characters, an entire redundant character is added, the bits in this character being chosen so as to establish ***even*** parity in each "channel," that is, the 8-bit channel, the 4-bit channel, the 2-bit channel, etc. Parity checks on this block of information are made in two directions: "vertically" for each character and "horizontally" for each channel.
    a. Using Cross Parity checking on the example below determine if there is an error(s) in the block transmission received. If an error(s) are found

	Characters								
	9	5	7	1	4	3	8	2	R
8	1	0	0	0	0	0	1	0	0
4	0	1	1	0	1	0	0	0	1
2	0	0	1	0	0	1	0	1	1
1	1	1	1	1	0	0	0	0	1
R	0	0	1	1	1	0	1	1	1

    b. A blank table is provided below. Modify the table provided below to use ***odd*** parity with ***no errors***.

	Characters								
	9	5	7	1	4	3	8	2	R
8									
4									
2									
1									
R									

2. A four-bit BCD code was used for information transmission. Three additional bits were added to allow for a single-error correction Hamming Code. Overall seven (7) bits were used to transmit each four-bit BCD character. These seven bits can be labeled as follows:

1	2	3	4	5	6	7
C_1	C_2	8	C_4	4	2	1

The values of the check bits C_1 , C_2, and C_4 , for each coded character were determined as follows:

C_1 was chosen so as to establish ***even*** parity for positions 1, 3, 5, and 7.
C_2 was chosen so as to establish ***even*** parity for positions 2, 3, 6, and 7.
C_4 was chosen so as to establish ***even*** parity for positions 4, 5, 6, and 7.

The following three BCD Hamming Coded characters were received:

1	2	3	4	5	6	7	
0	0	1	1	0	1	1	First Received
0	0	1	1	0	0	1	
1	0	0	0	1	1	1	Last Received

What are the correct BCD characters that were originally transmitted, assuming that for each character only a single error may have occurred during transmission?

First BCD Character **:** _____ ***(Decimal Value)***

Second BCD Character**:** _____ ***(Decimal Value)***

Last BCD Character**:** _____ ***(Decimal Value)***

3. Insert Hamming Bits into the following sequence of *eleven* information bits. Fifteen bits will result and constitute the transmitted bit sequence.

1 0 0 1 1 1 0 0 1 0 1

(You should end up with a 15 bit sequence)

___	___	___	___	___	___	___	___	___	___	___	___	___	___	___
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**

(Bit Position)

Using the Hamming Forward Error Correction (FEC) Code developed for the *eleven* information bits in Problem #3, insert an error *(i.e. if it is a "1" change it to a "0"or if it is a "0" change it to a "1")* into the 9^{th} bit position of the generated 15-bit sequence *(number from right to left).* Demonstrate that using the Hamming FEC coding scheme that you can now identify the error location of the received bit sequence and correct it, if necessary, leaving you with the original error free information bits.

Additional Problems (Instructor Option):

- **Any as assigned by instructor**