Introduction to Coding Theory Assignment 11

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1 Q1

We can do this by constructing a Hadamard matrix of order 8. This gives us a (8,8,4) linear code, or a [8,3,4] linear code. We drop the first column of this matrix, to get the required code:

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

2 Q2

To have an [8,4,4] code, we must build a (8,16,4) linear code. For this we use a Hadamard matrix of order 8, and then add the complements of each row of the matrix to get the resulting code:

3 Q3

We can do this by constructing a Hadamard matrix of order 12, and dropping the first column to get a code with the parameters (11,12,6)

```
0
                                   1
                                1
                                   0
                     0
                        0
                                   1
                        0
                     0
          1
              1
                     1
                        0
                                   1
   1
1
              1
                                   0
0
              0
                                   0
                                   0
              1
                 1
                            1
                                   1
1
   0
       0
          0
                     1
                        0
                            1
                                   0
              1
                 1
                                1
          0
   1
              0
                 1
                     1
                        1
```

4 Q4

We can simply take the matrix from the previous question, and add the complement of each row to get the required code:

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

5 Question 5

For this, we simply take a Hadamard matrix of order 12, and add the complement of each row.

0	0	0	0	0	0	0	0	0	0	0
1	0	1	0	0	0	1	1	1	0	1
1	1	0	1	0	0	0	1	1	1	0
0	1	1	0	1	0	0	0	1	1	1
1	0	1	1	0	1	0	0	0	1	1
1	1	0	1	1	0	1	0	0	0	1
1	1	1	0	1	1	0	1	0	0	0
0	1	1	1	0	1	1	0	1	0	0
0	0	1	1	1	0	1	1	0	1	0
0	0	0	1	1	1	0	1	1	0	1
1	0	0	0	1	1	1	0	1	1	0
0	1	0	0	0	1	1	1	0	1	1
1	1	1	1	1	1	1	1	1	1	1
0	1	0	1	1	1	0	0	0	1	0
0	0	1	0	1	1	1	0	0	0	1
1	0	0	1	0	1	1	1	0	0	0
0	1	0	0	1	0	1	1	1	0	0
0	0	1	0	0	1	0	1	1	1	0
0	0	0	1	0	0	1	0	1	1	1
1	0	0	0	1	0	0	1	0	1	1
1	1	0	0	0	1	0	0	1	0	1
1		1	0	0	0	1	0	0	1	0
0	1	1	1	0	0	0	1	0	0	1
1	0	1	1	1	0	0	0	1	0	0
	1 1 0 1 1 1 0 0 0 1 0 0 1 0 0 0 0 1 0 0 0 0 1 1 0 0 0 0 1	1 0 1 1 0 1 1 0 1 1 1 1 0 0 0 0 0 0 1 0 0 0 1 1 0 0 0 1 0 0 1 0 0 0 1 0 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 0 1	1 0 1 1 1 0 0 1 1 1 1 0 1 1 1 0 1 1 0 0 1 0 0 1 0 0 1 1 0 0 1 0 0 0 0 1 0 0 1 0 0 1 0 0 0 1 0 0 1 0 0 1 1 0 1 1 1 0 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 0 1 0 1 1 0 1 0 1 1 0 1 0 1 1 1 1 1 0 0 1 1 1 0 0 1 1 0 0 0 0 1 1 0 0 1 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 0 0 1 1 0 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 1 0 0 <	1 0 1 0 0 1 1 0 1 0 0 1 1 0 1 1 0 1 1 1 1 1 0 1 1 1 1 1 0 1 0 0 1 1 1 0 0 0 1 1 1 0 0 0 1 0 1 0 0 0 1 1 0 0 0 1 1 0 0 1 0 1 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 0 0 1 0 1 0 0 0 1 1 1 0 0 0 1 1 0 <td>1 0 1 0 0 0 1 1 0 1 0 0 0 0 1 1 0 1 0 1 1 0 1 1 0 1 1 0 1 1 1 0 1 1 0 1 1 0 1 1 1 1 0 1 1 1 1 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 1 <td< td=""><td>$\begin{array}{cccccccccccccccccccccccccccccccccccc$</td><td>1 0 1 0 0 0 1 1 1 1 0 1 0 0 0 1 0 1 1 0 1 0 0 0 1 0 1 1 0 1 0 0 1 1 0 1 1 0 1 0 1 0 1 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 0</td><td>1 0 1 0 0 0 1 1 1 1 1 0 1 0 0 0 1 1 0 1 1 0 1 0 0 0 1 1 0 1 1 0 1 0 0 0 1 1 0 1 1 0 1 0 0 1 1 1 0 1 1 0 1 0 1 0 1 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 <</td><td>1 0 1 0 0 0 1 1 1 0 1 1 0 1 0 0 0 1 1 1 0 1 1 0 1 0 0 0 1 1 1 0 1 1 0 1 0 0 0 1 1 1 1 0 1 1 0 1 0 1 1 0 0 1 1 0 1 1 0 0 1 1 1 0 1 1 1 0 1 1 1 0 1</td></td<></td>	1 0 1 0 0 0 1 1 0 1 0 0 0 0 1 1 0 1 0 1 1 0 1 1 0 1 1 0 1 1 1 0 1 1 0 1 1 0 1 1 1 1 0 1 1 1 1 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 1 <td< td=""><td>$\begin{array}{cccccccccccccccccccccccccccccccccccc$</td><td>1 0 1 0 0 0 1 1 1 1 0 1 0 0 0 1 0 1 1 0 1 0 0 0 1 0 1 1 0 1 0 0 1 1 0 1 1 0 1 0 1 0 1 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 0</td><td>1 0 1 0 0 0 1 1 1 1 1 0 1 0 0 0 1 1 0 1 1 0 1 0 0 0 1 1 0 1 1 0 1 0 0 0 1 1 0 1 1 0 1 0 0 1 1 1 0 1 1 0 1 0 1 0 1 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 <</td><td>1 0 1 0 0 0 1 1 1 0 1 1 0 1 0 0 0 1 1 1 0 1 1 0 1 0 0 0 1 1 1 0 1 1 0 1 0 0 0 1 1 1 1 0 1 1 0 1 0 1 1 0 0 1 1 0 1 1 0 0 1 1 1 0 1 1 1 0 1 1 1 0 1</td></td<>	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1 0 1 0 0 0 1 1 1 1 0 1 0 0 0 1 0 1 1 0 1 0 0 0 1 0 1 1 0 1 0 0 1 1 0 1 1 0 1 0 1 0 1 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 0	1 0 1 0 0 0 1 1 1 1 1 0 1 0 0 0 1 1 0 1 1 0 1 0 0 0 1 1 0 1 1 0 1 0 0 0 1 1 0 1 1 0 1 0 0 1 1 1 0 1 1 0 1 0 1 0 1 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 <	1 0 1 0 0 0 1 1 1 0 1 1 0 1 0 0 0 1 1 1 0 1 1 0 1 0 0 0 1 1 1 0 1 1 0 1 0 0 0 1 1 1 1 0 1 1 0 1 0 1 1 0 0 1 1 0 1 1 0 0 1 1 1 0 1 1 1 0 1 1 1 0 1