Homework from ~~4/24~~ 4/25/2013

Math 431: Algebra II

Pelsmajer

(1) Which of these are sets of mutually orthogonal Latin Squares?

1	3	2	4
3	1	4	2
2	4	1	3
4	2	3	1

3	1	4	2
2	4	1	3
1	3	2	4
4	2	3	1

2	4	1	3
1	3	4	2
3	1	4	2
4	2	3	1

(a)

1	2	3	4	5
2	3	4	5	2
3	4	5	1	2
4	5	1	2	3
5	1	2	3	4

1	2	3	4	5
3	4	5	1	2
5	1	2	3	4
2	3	4	5	1
4	5	1	2	3

1	2	3	4	5
5	1	2	3	4
4	5	1	2	3
3	4	5	1	2
2	3	4	5	1

(b)

(2) Convert each of these orthogonal arrays (rows are vectors) into a set of MOLS.

$$\begin{bmatrix} 2 & 2 & 2 & 2 \\ 2 & 1 & 1 & 1 \\ 2 & 3 & 3 & 3 \\ 1 & 2 & 1 & 3 \\ 1 & 1 & 3 & 2 \\ 1 & 3 & 2 & 1 \\ 3 & 2 & 3 & 1 \\ 3 & 1 & 2 & 3 \\ 3 & 3 & 1 & 2 \end{bmatrix} \cdot \qquad \begin{bmatrix} 1 & 4 & 4 & 4 & 4 \\ 2 & 4 & 3 & 2 & 1 \\ 2 & 3 & 4 & 1 & 2 \\ 3 & 3 & 1 & 2 & 4 \\ 4 & 4 & 1 & 3 & 2 \\ 4 & 3 & 2 & 4 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 2 & 1 & 2 & 3 & 4 \\ 1 & 3 & 3 & 3 & 3 \\ 4 & 1 & 4 & 2 & 3 \\ 3 & 4 & 2 & 1 & 3 \\ 4 & 2 & 3 & 1 & 4 \\ 1 & 2 & 2 & 2 & 2 \\ 3 & 1 & 3 & 4 & 2 \\ 2 & 2 & 1 & 4 & 3 \\ 3 & 2 & 4 & 3 & 1 \end{bmatrix} .$$

(3) Using the method in the proof of the theorem, construct a set of MOLS(n) for $n=8$ and $n=9$.

(You'll need your knowledge of finite fields, too!)