16.881 – Robust System Design

Quiz #6
Constructing Orthogonal Arrays

NOTE: You may wish to refer to the table of orthogonal arrays on the last page.

The first four problems relate to the catapult experiment. The control factors and their levels are:

Cup position – High, Medium, Low
Post Pin – Up, Middle, Down
Stop pin – Fore, Aft
Draw angle -- 10, 20, and 30 degrees

1) If you are interested in main effects only, how many degrees of freedom does the system have?

2) What experiment would you conduct to resolve these main effects? Explain your choice and name any techniques you applied.

3) If you are interested in post position / draw angle interactions in addition to main effects, how many degrees of freedom does the system have?

4) What experiment would you conduct? How many columns of what type (i.e., two factor, three factor, etc) would you leave unassigned?

5) Given the data from the L18 below, sketch the interaction plot for factors 1 and 2. Note: The L18 has the special property that interaction between columns 1 and 2 is orthogonal to the other columns. Hence, the interactions between 1 and 2 can be resolved even when no columns are left unassigned.

	Columns								
Exp. No.	1	2	3	4	5	6	7	8	η(dB)
1	1	1	1	1	1	1	1	1	12
2	1	1	2	2	2	2	2	2	13
3	1	1	3	3	3	3	3	3	11
4	1	2	1	1	2	2	3	3	18
5	1	2	2	2	3	3	1	1	17
6	1	2	3	3	1	1	2	2	19
7	1	3	1	2	1	3	2	3	18
8	1	3	2	3	2	1	3	1	20
9	1	3	3	1	3	2	1	2	16
10	2	1	1	3	3	2	2	1	10
11	2	1	2	1	1	3	3	2	9
12	2	1	3	2	2	1	1	3	11
13	2	2	1	2	3	1	3	2	17
14	2	2	2	3	1	2	1	3	16
15	2	2	3	1	2	3	2	1	15
16	2	3	1	3	2	3	1	2	19
17	2	3	2	1	3	1	2	3	18
18	2	3	3	2	1	2	3	1	17

Standard Orthogonal Arrays

Orthogonal Array	Number of Rows	Maximum Number of Factors	Maximum Number of Columns at These Levels			
			2	3	4	5
L_4	4	3	3	-	-	-
L_8	8	7	7	-	-	-
L_9	9	4	-	4	-	-
L_{12}	12	11	11	-	-	-
L_{16}	16	15	15	-	-	-
L'_{16}	16	5	-	-	5	-
L_{18}	18	8	1	7	-	-
L_{25}	25	6	-	-	-	6
L_{27}	27	13	1	13	-	-
L_{32}	32	31	31	-	-	-
L'_{32}	32	10	1	-	9	-
L_{36}	36	23	11	12	-	-
L'_{36}	36	16	3	13	-	-
L_{50}	50	12	1	-	-	11
L_{54}	54	26	1	25	-	-
L_{64}	64	63	63	-	-	-
L'_{64}	64	21	-	-	21	-
L_{81}	81	40	-	40	-	-