

Homework 5

1. (Montgomery, 1997) An industrial engineer is conducting an experiment using a simulation model of an inventory system. The factors are order quantity (A), reorder point (B), setup cost (C), backorder cost (D) and carrying cost rate (E). The response variable is average annual cost. The design analyzed was a 2_{III}^{5-2} design with generators I=ABD and I=BCE. Observations from the first run appear below:

(A,B,C,D,E)	Average Annual Cost
(-1,-1,-1,1,1)	95
(1,-1,-1,-1,1)	134
(-1,1,-1,-1,-1)	158
(1,1,-1,1,-1)	190
(-1,-1,1,1,-1)	92
(1,-1,1,-1,-1)	137
(-1,1,1,-1,1)	155
(1,1,1,1,1)	185

- (a) Analyze the data from this experiment— which effects appear important?
- (b) The design was folded over on all factors and the following observations were obtained. Re-analyze the data using the additional observations. Was your analysis affected? Is your new design Resolution IV? Why or why not?

(A,B,C,D,E)	Average Annual Cost
(1,1,1,-1,-1)	189
(-1,1,1,1,-1)	154
(1,-1,1,1,1)	135
(-1,-1,1,-1,1)	96
(1,1,-1,-1,1)	193
(-1,1,-1,1,1)	152
(1,-1,-1,1,-1)	137
(-1,-1,-1,-1,-1)	98

2. (Montgomery, 1997) An experiment was run in a semiconductor plant in an effort to increase yield. Five factors were studied: Aperture setting, Exposure time, Development time, Mask dimension and Etch time. The data from the full factorial experiment appears below:

Aperture	Exposure	Development	Mask	Etch	Yield
-1	-1	-1	-1	-1	7
1	-1	-1	-1	-1	9
-1	1	-1	-1	-1	34
1	1	-1	-1	-1	55
-1	-1	1	-1	-1	16
1	-1	1	-1	-1	20
-1	1	1	-1	-1	40
1	1	1	-1	-1	60
-1	-1	-1	1	-1	8
1	-1	-1	1	-1	10
-1	1	-1	1	-1	32
1	1	-1	1	-1	50
-1	-1	1	1	-1	18
1	-1	1	1	-1	21
-1	1	1	1	-1	44
1	1	1	1	-1	61
-1	-1	-1	-1	1	8
1	-1	-1	-1	1	12
-1	1	-1	-1	1	35
1	1	-1	-1	1	52
-1	-1	1	-1	1	15
1	-1	1	-1	1	22
-1	1	1	-1	1	45
1	1	1	-1	1	65
-1	-1	-1	1	1	6
1	-1	-1	1	1	10
-1	1	-1	1	1	30
1	1	-1	1	1	53
-1	-1	1	1	1	15
1	-1	1	1	1	20
-1	1	1	1	1	41
1	1	1	1	1	63

- (a) Suppose only a half-fraction of the data could be run and only eight observations could be analyzed each day. Construct an appropriate design; which runs would be conducted each day?
- (b) Analyze the design. Does the block coefficient appear to be large? Graduate students should run a model with only the significant terms included and report the results of an F test on block.