

Statistics 506
Final Exam

1. A researcher studied 5 factors in two blocks in a replicated eight-run design. The goal of the experiment is to minimize the response and minimize variation.

Block	Factor settings	Response
1	(1,-1,-1,1,-1)	12.0, 7.6, -9.3
1	(-1,1,-1,-1,1)	-6.4, -6.6, -2.1
1	(1,-1,1,-1,1)	10.6, 4.5, 6.7
1	(-1,1,1,1,-1)	1.3, 0.5, -0.2
2	(-1,-1,-1,1,1)	-5.5, -4.1, -2.9
2	(1,1,-1,-1,-1)	-6.1, 14.6, -3.5
2	(-1,-1,1,-1,-1)	-13.6, -4.0, -13.2
2	(1,1,1,1,1)	6.5, 2.2, 0.8

- (a) Compute the standard deviation and SN_S for each run.
- (b) Identify factors that affect the mean using a *replicated* analysis (you'll need to click the Design button in Define Custom Factorial Design in order to specify the Block column). Identify factors that affect the variance. What are your conclusions from the two analyses?
- (c) Analyze the data using SN_S . What are your conclusions? How do they compare with your earlier analysis?
- (d) Does Block seem to be important?
2. Analyze the centerpoint design below for factor effects and curvature. Construct a contour plot. If we were searching for a maximum, we would add design points in the direction of steepest ascent; sketch in a vector on the contour plot showing the direction of steepest ascent. You can confirm the slope of your vector by computing $\frac{B\ effect}{A\ Effect}$. How close does the slope of your vector agree with this computation? What would be a reasonable choice for the *first* design point in a follow-up experiment to find the maximum (starting from the design point with the highest response)?

Factor settings	Response
(-1,-1)	2.9
(1,-1)	-1.2
(-1,1)	-2.5
(1,1)	5.0
(0,0)	-.3
(0,0)	-.1
(0,0)	.3
(0,0)	.2