

Statistics 506
Final Exam

1. A researcher wants to study 4 factors in 8 runs with 10 center points. The design appears below.

Factor settings	Response
(-1,-1,-1,-1)	118.6
(1,-1,-1,1)	118.6
(-1,1,-1,1)	159.2
(1,1,-1,-1)	166.4
(-1,-1,1,1)	127.6
(1,-1,1,-1)	129.8
(-1,1,1,-1)	147.9
(1,1,1,1)	170.1
(0,0,0,0)	129.7
(0,0,0,0)	136.9
(0,0,0,0)	123.6
(0,0,0,0)	139.4
(0,0,0,0)	135.2
(0,0,0,0)	127.9
(0,0,0,0)	140.2
(0,0,0,0)	133.2
(0,0,0,0)	113.2
(0,0,0,0)	130.2

- (a) What is s_c^2 ?
- (b) What is the t critical value for a .05 test?
- (c) Which factor effects are significant? (If making calculations by hand, note that k should be reduced by 1 since this is a 1/2 fraction)
- (d) Is there significant curvature?
- (e) Store the fits and then plot the fits against the levels of each factor. Which factor do you think caused the curvature?
2. Three factors were analyzed in a replicated full factorial design. The mean and sample variance appear below. The goal of the experiment is to achieve a process target of T=30 with as small a variance as possible.

Factor settings	Mean	Variance
(-1,-1,-1)	20.7	4.3
(1,-1,-1)	18.4	6.0
(-1,1,-1)	20.7	3.4
(1,1,-1)	18.9	6.8
(1,-1,1)	29.4	4.5
(-1,-1,1)	31.3	7.7
(1,1,1)	30.1	4.0
(-1,1,1)	30.5	6.5

- (a) Analyze the mean. Using only the significant effects, how would you adjust the process so that the target of 30 is met?

- (b) Analyze the natural log of the variance. Using only the significant effects, how would you adjust the process so that the variance is minimized?
- (c) Compute the statistic $(\bar{y} - T)^2 + s^2$. Analyze this response. Using only the significant effects, how would you adjust the process so that the response is minimized? Compare your conclusions among the different approaches.