

Statistics 506
Final Exam

1. A full factorial 4-factor design needs to be run in 4 blocks.

A	B	C	D	Response
-1	-1	-1	-1	418
1	-1	-1	-1	404
-1	1	-1	-1	422
1	1	-1	-1	418
-1	-1	1	-1	429
1	-1	1	-1	407
-1	1	1	-1	423
1	1	1	-1	401
-1	-1	-1	1	411
1	-1	-1	1	468
-1	1	-1	1	409
1	1	-1	1	474
-1	-1	1	1	429
1	-1	1	1	473
-1	1	1	1	421
1	1	1	1	462

- (a) Use Minitab's default settings for a 4-factor full factorial 4-block design and analyze the data. Which factors are aliased with block?
- (b) Suppose we wanted to analyze a half-fraction of the data while still using 4 blocks. What is Minitab's default design? Analyze the data using Minitab's default half-fraction 4-block design—compare it to the analysis from (a).
- (c) Given the block generators from (a), discuss the advantages and disadvantages of the following three options for the half-fraction design generator: $I=ABCD$, $I=ABD$, $I=ABC$. Would you recommend any of these designs?
2. An experiment replicated a 3-factor full factorial design 5 times; the target response value is 125.

A	B	C	Response
-1	-1	-1	94.2, 151.4, 144.8, 116.2, 177.8
1	-1	-1	124.2, 127.4, 123.2, 125.2, 122.8
-1	1	-1	142.6, 103.0, 111.8, 125.0, 151.4
1	1	-1	126.4, 124.8, 123.4, 127.4, 123.4
-1	-1	1	96.0, 67.4, 104.8, 120.2, 120.2
1	-1	1	118.8, 148.2, 135.6, 152.4, 215.4
-1	1	1	71.8, 118.0, 67.4, 60.8, 102.6
1	1	1	198.6, 152.4, 165.0, 139.8, 223.8

- (a) For each set of 8 factor combinations, compute \bar{y} , $\ln s$, $\ln(\bar{y}/s)$ (related to SN_T), $\ln((\bar{y} - 125)^2 + s^2)$ (This is log Mean Square Error). We will use each of these 4 statistics to analyze factors in the design; the last two statistics are meant to capture changes in mean and variation simultaneously.
- (b) Analyze the data. Which effects are important for each of your 4 responses?
- (c) Compare conclusions from the analysis of (1) \bar{y} and $\ln(s)$ jointly, (2) $\ln(\bar{y}/s)$, and (3) $\ln((\bar{y} - 125)^2 + s^2)$. Which of the three approaches to analyzing location and variation do you prefer?