

Homework IV (2021)

1. An engineer is interested in the effects of cutting speed (A), tool geometry (B), and cutting angle on the life (in hours) of a machine tool. Two levels of each factor are chosen, and three replicates of a 2^3 factorial design are run. The results are as follows:

			Treatment	Replicate		
A	B	C	Combination	I	II	III
-	-	-	(1)	21	31	25
+	-	-	a	33	43	29
-	+	-	b	34	34	50
+	+	-	ab	56	47	46
-	-	+	c	43	45	38
+	-	+	ac	41	37	36
-	+	+	bc	61	50	54
+	+	+	abc	40	41	47

- (a) Estimate the factor effects. Which effects appear to be large?
 - (b) Use the analysis of variance to confirm your conclusions for part (a).
 - (c) Write down a regression model for predicting tool life (in hours) based on the results of this experiment.
 - (d) Analyze the residuals. Are there any obvious problems?
 - (e) Based on the analysis of main effects and interaction plots, what levels of A, B, and C would you recommend using?
2. Consider the data from the first replicate of Problem 1. Suppose that these observations could not all be run using the same bar stock. Set up a design to run these observations in two blocks of four observations each with ABC confounded. Analyze the data.

Block 1	Block 2
(1)	a
ab	b
ac	c
bc	abc

3. Repeat the analysis of Problem 1 assuming that ABC was confounded with blocks in each replicate.