

Midterm

1. Consider the following 2^3 unreplicated factorial design:

Run	Response
(1)	67.55
a	68.91
b	69.41
ab	65.37
c	76.64
ac	73.82
bc	76.86
abc	73.73

- (a) Analyze the data in Minitab. Which effects are significant? Write the contrast coefficients for effect B, and confirm that your contrast for B is the same as the estimate of the effect for B provided in the Minitab output.
- (b) Look at the line Minitab fitted to the background noise for the normal effects plot. What is the estimated expected size for the largest positive effect if the largest positive effect is due to background noise? (Hint: run a horizontal line from the largest positive effect to the y-axis, and note where it crosses Minitab's fitted background noise line.)
- (c) Use PSE from Lenth's test as an estimate of experimental error. Suppose we want 80% power to detect an effect for B equal in size to the estimated expected effect size you provided in (b) ($\alpha = .05$). What sample size would be needed? What if we wanted to detect an effect for B one half the size of the estimated expected size you provided in (b)?
2. Suppose we have a 3 by 3 table with the following set of observed sample responses. Using SAS's e option, verify whether the row and column means in an additive model are estimable.

		B	
A	12,3		7
		12	
	13		19, 16, 17

3. Suppose we have a 2 by 3 table with the following set of observed sample responses.

		B		
A	9	14,23	16,18,19	
	10,11,3	3,7	4	

- (a) If factor A is tested first in an interaction model, the Type I hypotheses for A and B|A should test the hypotheses shown on page 170 of the text. Using the e1 option in SAS, confirm that these are the hypotheses being tested. Specifically, test whether the contrast for A corresponds to:

$$\tilde{\mu}_{1.} - \tilde{\mu}_{2.}$$

and whether the first contrast for B|A corresponds to (up to a scaling constant):

$$\left(\tilde{\mu}_{.1} - \frac{\sum_i n_{i1} \tilde{\mu}_{i.}}{n_{.1}} \right) - \left(\tilde{\mu}_{.3} - \frac{\sum_i n_{i3} \tilde{\mu}_{i.}}{n_{.3}} \right)$$

- (b) Run an additive model in SAS using the `e1` option and comment on the hypotheses. Can you rewrite the Type I hypotheses for A and B as functions of $\text{PMM}(\alpha)$ and $\text{PMM}(\beta)$ exclusively?
- (c) Compare the above hypothesis to tests of PMM hypotheses.