

1. **2^p factorial experiments.** Read the description of the study in Exercise 40 (Chapter 11, Section 11.1, “In a study of processes used to remove impurities ...”). An ANOVA table for analyzing the dataset is given below. **Follow the instructions below.**

Source	DF	SS	MS	F	P-Value
A	1	0.168	0.168	0.08	0.788
B	1	1.940	1.940	0.87	0.366
C	1	8.161	8.161	3.64	0.074
D	1	13.082	13.082	5.84	0.028
A*B	1	3.419	3.419	1.53	0.235
A*C	1	0.263	0.263	0.12	0.736
A*D	1	0.911	0.911	0.41	0.533
B*C	1	0.738	0.738	0.33	0.574
B*D	1	0.781	0.781	0.35	0.563
C*D	1	6.771	6.771	3.02	0.101
A*B*C	1	0.020	0.020	0.01	0.926
A*B*D	1	0.775	0.775	0.35	0.565
A*C*D	1	0.622	0.622	0.28	0.606
B*C*D	1	1.758	1.758	0.78	0.389
A*B*C*D	1	0.004	0.004	0.00	0.967
Error	16	35.851	2.241		
Total	31	75.264			

- Identify the effects (main and interactions) that are significant at the $\alpha=0.10$ level.
- Compute the coefficient of determination R^2 and give a brief interpretation. (See Formula 11K and pages L-71 to L-72) of lecture notes.)
- Computed R^2_{adj} , the adjusted R^2 (See Formula 11K and pages L-71 to L-72) of lecture notes.)

- d. Assume that only the main and interaction effects of C and D are important (two-way interaction model). Complete the ANOVA table below in this case.

Source	DF	SS	MS	F	P-Val
C	1	8.161	8.161	?	0.036
D	?	?	?	?	0.010
C*D	1	6.771	6.771	?	0.055
Error	?	?	?		
Total	31	75.264			

Hint: You can derive the missing values from the previous ANOVA table.

- e. Compute R^2_{adj} for the ANOVA table in part (d).
- f. Assume that only the main effects of C and D (two-way additive model) are important. Below is the corresponding ANOVA table. Compute R^2_{adj}

Source	DF	SS	MS		P-val
C	1	8.1608	8.1608	4.38	0.045
D	1	13.0816	13.0816	7.02	0.013
Error	29	54.0214	1.8628		
Total	31	75.2638			

- g. Based on the R^2_{adj} values, which of the 3 fitted models do you prefer? Give a short explanation for your choice.

2. **A Fractional Factorial Design.** In a study of $p=5$ factors with two levels each, only 8 different combinations of levels of A, B, C, D, and E will be run (i.e. $q=2$ and the experiment is a quarter fractional). Use A, B, D as the independent factors and with generators

$$C = ABD \text{ and } E = AD$$

- List out the 8 treatments will be run.
- Which treatments, used in the experiment, have all of B and D at their low levels?
- What effects will be aliased with the A main effect?