

STAT 8010–003 Statistical Methods I

Homework 5

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Due Date: November 25, 1:25pm

Problem 1

Suppose you are manufacturing concrete cylinders for bridge supports. There are three ways of drying green concrete (say A, B, and C), and you want to find the one that gives you the best compressive strength. The concrete is mixed in batches that are large enough to produce exactly three cylinders, and your production engineer believes that there is substantial variation in the quality of the concrete from batch to batch. You have data from $B = 5$ batches on each of the $J = 3$ drying processes. The measurements of compressive strength of this experiment can be found below:

Treatment	Batch				
	1	2	3	4	5
A	52	47	44	51	42
B	60	55	49	52	43
C	56	48	45	44	38

- Calculate the **treatment means**, **block means**, and the **overall mean**.
- Compute the **total sum of square**, **treatment sum of square**, **block sum of square**, and **error sum of square**.

- c. Compute the **treatment mean square**, **block mean square**, and **mean square of the error**.
- d. Construct the ANOVA table and perform F-test for **treatment effect** and **block effect**, respectively.
- e. Create an interaction plot to assess the additive assumption.
- f. The R output below shows the one-way ANOVA without block effect. Explain whether it is a good idea to account for the block effect in assessing the treatment effect.

Analysis of Variance Table

Response: x

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
trt	2	89.2	44.6	1.3041	0.3073
Residuals	12	410.4	34.2		

Problem 2

The following contingency table contains enrollment data for a **random sample** of students from the college of Liberal Arts and Engineering at a University during the 2016-2017 academic year. The table lists the number of male and female students enrolled in each college.

(Observed)	Female	Male	Total
Liberal Arts	155	75	
Engineering	80	320	
Total			

- Let $p = \mathbb{P}(\text{Female}|\text{Liberal Arts})$ in that university. Construct a 95% confidence interval for p .
- Let $p_1 = \mathbb{P}(\text{Female}|\text{Liberal Arts})$ and $p_2 = \mathbb{P}(\text{Female}|\text{Engineering})$. Perform a hypothesis test with $H_0 : p_1 = p_2$ vs. $H_a : p_1 \neq p_2$.
- Use the contingency table to conduct a χ^2 test for independence from beginning to end. Use $\alpha = .01$.

Problem 3

The following information represents data gathered during an observational study of Clemson residents. The table depicts the number of people in categories based on marital status and level of happiness.

	Happy	So-So	Unhappy	Totals
Married	60	80	140	
Single	100	80	160	
Totals				

- Calculate and fill in the row and column totals as well as the overall total.
- Use the information above to create a table of expected counts.
- Construct a table of partial χ^2 values (a χ^2 value for each individual cell).

d. What is the χ^2 value?

e. What are the degrees of freedom (df)?

f. At the $\alpha = .01$ level, what is the χ^2 critical value?

g. What is your conclusion?