Regression Analysis and Design of Experiments

Sta 674 **Assignment #6**
Experimental Design

Submission:

You must format your assignments as a pdf. Handwritten assignments will not be accepted.

When are ready to submit your assignment, copy your R (or RStudio work) or SAS code and paste it at the end of your document. *Don't forget to address the "software initiative" portion of this assignment, via comments to help me follow your work, re-doing variable names, etc.* Collaboration during the process of solving the problems is not only allowed but encouraged; that said, the submissions are each expected to be an individual effort reflecting the individual's work. Identical submissions or even submissions found to be **"too close to be coincidental" will be flagged and given no credit**.

Problems are worth the indicated points. Please submit it to your instructor **at or before the due date** via electronic submission on Canvas.

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Homework Questions

(20 points) Based on Kuehl, Chapter 8, #1 (page 299). An irrigation experiment was conducted in a randomized complete block design in a Valencia orange grove. Six irrigation treatments were used in eight blocks of trees. The data that follow are the weight in pounds of harvested fruit from each plot.

	Block							
Method	1	2	3	4	5	6	7	8
Trickle	450	469	249	125	280	352	221	251
Basin	358	512	281	58	352	293	283	186
Spray	331	402	183	70	258	281	219	46
Sprinkler	317	423	379	63	289	239	269	357
Sprinkler & Spray	479	341	404	115	182	349	276	182
Flood	245	380	263	62	336	282	171	98

The file assignment_6.csv on Canvas contains the data to answer the following questions.

1) (8 points) Fit the analysis of variance model using the 8 blocks of trees as a blocking factor.

a) Test for an effect of irrigation method on the weight of oranges harvested at the $\alpha = 0.05$ level of significance. State the hypotheses in words, identify the appropriate test statistic and p-value, and state your conclusion.

b) Perform a retrospective power analysis to compute the power to detect a difference between the irrigation methods from the analysis with blocks. Provide a one sentence explanation of this value.

c) If possible, test for an interaction between blocks and factors to check the key blocking assumption. If this is not possible, explain why not.

2) (12 points) Using the same data/setting, fit the analysis of variance model ignoring the blocks of trees.

a) Test for an effect of irrigation method on the weight of oranges harvested at the $\alpha = 0.05$ level of significance. State the hypotheses in words, identify the appropriate test statistic and p-value, and state your conclusion.

b) Perform a retrospective power analysis to compute the power to detect a difference between the irrigation methods from the analysis without blocks. Provide a one sentence explanation of this value.

c) Explain why the power is so much lower for the analysis without blocks than the analysis with blocks.

d) How many replicates per treatment would be needed to obtain the same power as the analysis including the blocks?