HW5

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Assignment 5

Q1

Cell Means versus Additive Model

In class, we talked extensively about the two types of models when analyzing two treatment factors. For this question, consider your audience to be a first-year graduate student in a different discipline. Their understanding of statistics includes what you learned in Stat 5000 but they have not seen much Stat 5100 materials. The student is asking you for help trying to better understand:

a)

The two types of statistical models themselves.

Cell Means: Every combination of factors has their own mean. Individual Effects.

Additive Model: Assume no interactions and focus on the impact of particular factors. Consistent effects of a particular factor/treatment being studied.

b)

The difference between both types of statistical models.

Table 1: Comparison of Cell Means Model vs Additive Model

Feature	Cell.Means.Model	Additive.Model
Parameterization	Directly estimates means for each group	Decomposes into overall mean + main effects (+ interactions)
Number of Parameters	Equal to the number of groups	Fewer parameters due to imposed structure
Assumptions on Treatment Effects	No assumptions about the relationship between treatment means	Assumes additive (or additive + interaction) structure
Flexibility	More flexible (each group mean is separate)	Less flexible (requires sum-to-zero constraints)
Interpretability	Estimates individual group means	Allows estimation of main and interaction effects

c)

Which one they should use for their own experiment that they plan on carrying out studying the effect of two treatments on some response y.

Either work, in theory at least! They can lead to very similar results. But there are some key distinctions to think about.

Really reflect on whether, prior to collecting any data or running any experiment, what you believe about the underlying relationship you're trying to test. Of note, do any of the underlying assumptions of the two models readily incorrect? After that, the priority to emphasize is whether you are hoping to predict things, or whether you're hoping to better understand broad characteristics of your population of interest.

Q2

The Surprising Power of Reflection

a)

Watch the following video: The surprising power of reflection

b)

Statistical Flaw in the First Study

The video showcases two studies: one immediately in the beginning within the first minute of the video and a second one introduced in the last 45 seconds of minute two. Listen carefully to the descriptions of each study. What *flaw*, statistically speaking, does the first study suffer from that does not show up in the second study? Briefly explain.

Overall, I think the statistical concept is a *randomized study design*, which does not exist in the first and is being used in the second.

Details:

Participants selected which group they belong to, i.e. chose to practice or to reflect, in the study shown in the beginning of the video.

By contrast, participants in the second one were assigned their group, i.e. "treatments" were assigned and the sample under study was divided into a "control" group and an "experimental" group.

c)

Reflection on Learning

In 2012, I took a workshop at ISU with Dr. Jan Wiersema called Project LEA/RN. Dr. Wiersema shared the following advice with us during the workshop – it has stuck with me ever since:

It's the thinking about the doing that does the learning.

Reflect on, and briefly summarize how *you* best learn new things. Share one or two tips on how you deal with challenging course material to ensure you learn it. You can reference experiences you have made as a student since joining our program but you can also reference an experience at some other time in your life.

(Provide reflection and tips here.)

Q3

MS Exam Repository

Go to the old **MS exam repository** and look at the Methods I and II questions. Familiarize yourself with the questions in Methods I – you should have an idea on how to answer most questions that are part of Methods I. Familiarize yourself with the questions in Methods II – these you cannot answer yet, for the most part. Select one Methods II question you find intriguing and download the question document.

If you are in the PhD program in Statistics, in addition, pick and download a Methods II question from the old **PhD exam repository.**

a)

Selected Questions

Which questions did you pick? Answer by following this format:

YEAR Methods II MS repository (and *YEAR Methods II PhD repository* if you are a PhD student).

MS:

PhD:

b)

Submission of Selected Questions

Submit your question(s) as part of the homework. Note that I am not asking you to solve the question(s) (*yet*); I just want you to familiarize with them so you have an idea about expectations. For the new PhD qualifying exam, expect the level of difficulty to fall approximately in between old MS exam and old PhD exam questions.

c)

Reflection on Learning

Reflect on your Fall semester; what has helped you learn and why? Note that it is the *why-part* of your answer that I am most interested in.

References

- Di Stefano, Giada and Gino, Francesca and Pisano, Gary and Staats, Bradley R., Learning by Thinking: How Reflection Can Spur Progress Along the Learning Curve (February 6, 2023). Harvard Business School NOM Unit Working Paper No. 14-093, Kenan Institute of Private Enterprise Research Paper No. 2414478, Available at https://dx.doi.org/10.2139/ssrn.2414478
- Learning by Thinking: How Reflection Can Spur Progress Along the Learning Curve