Course Project Specifications

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The purpose of the Course Project is multifaceted. On the one hand, you get to put into practice (and show off) your understandings of the course material in an authentic way. That is to say, there is little room to hide what you do and do not understand. On the other, you will further practice your communication and teamwork skills that are vital to you getting a job and becoming a top-notch statistician, data scientist, or other wielder of statistical tools.

The course project is fairly straightforward with two options:

- **Option 1**: Design and carryout an experiment to collect data and then analyze that data to answer your research question.
- **Option 2**: Find and adopt a data set that works for your research question (you must describe the way the data was collected and for what original purpose) and then analyze the data to answer your research question.

In either option, you will be submitting a single report (including an Executive Summary) at the end of the semester.

Since this is a project for our ANOVA class, your central analysis **must** come from the ANOVA Toolkit. You may not propose a regression project. If you are proposing multiple analyses, the primary one should be ANOVA. Any secondary analyses are up to you.

Details

Let's take a look at the details a bit more closely. Short assignment names appear in parentheses.

1) Begin thinking about ideas and teams (GP #1)
2) Teams get formed
    A) Neil will help people to form teams of roughly 2-4 people. Final team formation will be joint enterprise between the class and Neil.
    B) At the end of the semester, each member of a team will be responsible for anonymously grading each team member as well as themselves.
3) Develop a Statistical Research Question (GP #2)
    A) As a team, develop a statistical research question.
    B) You will have to get approval from Neil.
4) Develop your Study/Experiment
    A) As a team, develop your experiment or observational study (as the case might be)
    B) You will have to get your plan approved by Neil
    C) Special Note–Involvement of Human and Animal Subjects
        i) In the event you need to use either Humans or Animals subjects, you will need to have your study scrutinized carefully in coordination with Neil.
        ii) If you need to go down this route, your timetable is now ASAP.
        iii) Data may NOT be collected until after IRB approval is secured.
5) Collect your Data
    A) As a team, carry out your experiment or observational study to collect your data.

B) If you are adopting data, you need to identify whether any Data Sharing Agreements need to be signed. If so, you need to work with Neil so that we can get you access to the data. DO NOT FILL OUT ANY DATA AGREEMENT ON YOUR OWN.
C) I have limited funds which may help to defray costs.

6) Analyze your Data

A) Clean your Data
B) Write your Data Narrative
C) Carry out the appropriate method(s) of analysis from the **ANOVA toolkit**. (Note: you can't use a regression model for this project)

7) Write your report.

A) Structure (You're structure should look similar to this)
    1) Executive Summary (2 page max)
    2) Introduction
        a) Literature Review & Background, as appropriate
        b) Statement of Research Questions and Hypotheses
    3) Methods
        a) Describe the experiment/study
        b) Describe the analytical/statistical methods you used
        c) Describe the sample (if applicable; Exploratory Data Analysis)
    4) Results
        a) Assumption Checking
        b) Omnibus Results
        c) Post Hoc Results (as applicable)
    5) Discussion
        a) Limitations
        b) Future Work
    6) References (include where others can get access to your data)
    7) Author Contributions
    8) Code Appendix
B) Make sure that you answer your SRQ.

8) Submit your Project Report (GP #3).

9) Complete Peer Evaluations (GP #4)

Potential Topics

You are only bound by four things: 1) ethics, 2) what you can complete (i.e., collect and analyze) in the remaining time this semester, 3) the interests of your team, and 4) what you can afford.

I will not approve any SRQ and subsequent study design (experimental or observational) that I believe to be ethically questionable. The same is true for using data obtained by someone else. I will do my best to help your team refine your SRQs into something that you can explore this semester and I will give you pointers on your study design. Try to draw from your experiences for inspiration.

I have a few suggestions for projects that I would like to see students pick up and complete this semester.

Cost of Voting with Voter ID Laws

Much of the focus on Voter ID laws is on their discriminatory impacts on minorities. My curiosity with these laws is different: I want to know more about the *cost* to vote in a federal/state election. There are at least two ways to opertionalize cost here: what is the minimal cost for a typical voter to obtain the ID; what is the maximal cost for a typical voter to obtain the ID? Further, I would like to know whether the party in power of each state's legislature and governor's office has an impact on these costs.

Note: because of the multiple ways to operationalize cost here, several different groups may explore this issue... provide they have different operationalizations.

Wisconsin Fast Plants and Fertilizer

Several years ago, I had a couple of students do an Honors project where they looked at the impacts of different kinds of fertilizer on different species of Wisconsin Fast Plants. (They primarily looked at plant height.) However, they ran into a couple of issues that confounded their results. Their original study could be re-done or you could propose something new. For example, some fertilizers don't impact plant height, but rather plant "bushy-ness".

Oreos

I'm always open to new explorations of Oreos, especially since they keep coming out with different sizes (Thin, Regular, Double Stuf, Mega Stuf, the Most Stuf) and flavors. What are the differences in the amount of créme filling? What are the differences in the ratios of créme filling to wafer cookies?

Additional Project Ideas

Here are some ideas that have been done by students in the past:

Factors	Response
seat height, generator, tire pressure	bike course completion time/pulse rate
popcorn brand, batch size, popcorn to oil ratio	yield of popcorn
amount of yeast, amount of sugar, liquid type, rise temp, rise time	quality of bread
hours of illumination, water temp, specific gravity of water	growth rate of algae
blending speed, amount of water, water temp, soaking time	blending time for soy beans
width/height ratio of balsa wood, slant angle, dihedral angle, weight added, wood thickness	flight length for model airplane
type of drink, number of drinks, rate of drinking, hours after last meal	time to get ball through maze
stamp type, zip code, time of day when mailed	days required for delivery of letter
distance to target, type of gun, type of powder	number of shot penetrating 1ft diameter circle on target
amounts of cooking wine, oyster sauce, sesame oil	taste of stewed chicken
ambient temp, choke setting, number of charges	number of kicks to start motorcycle
amounts of flour, eggs, milk	taste of pancakes (consensus of housemates)
brand of tape deck, bass level, treble level, synthesizer	clearness and quality of sound
child's weight, spring tension, swing orientation	number of swings and duration of an infant swing
orientation of football, kick, steps taken prior, shoe type	distance football is kicked
amount of detergent, bleach, fabric softener	ability to remove oil and grape juice stains
weight of bowling ball, spin, bowling line	bowling pins knocked down
freq. of watering, use of plant food, temp of water	plant growth rate
temp of gas chromatograph column, tube type, voltage	size of unwanted droplet
concentration of lactose crystal, crystal size, rate of agitation	spreadability of caramel candy
proportional band, manual reset, regulator pressure	sensitivity of pneumatic valve control system
temp, nitrate concentration, amount of added preservatives	nitrate concentration in sewage
pH, dissolved oxygen content of water, temp	extent of iron corrosion
amperage, contact tube height, travel speed, edge preparation	quality of weld
brand, mess type, liquid amount, amount of towels used	quality of paper towel clean up
type of OS, amount of RAM available, language used, parallel or serial processing	Computation Speed
oven temp, baking time	Quality of cake
brand of pop/soda, type of candy	volume of displaced foam
species of Wisconsin Fast Plant, fertilizer type, light conditions	height of plant
Minecraft Character Handedness, Shooting Hand, Type of Bow	Shot power