**Quantitative Experiment Project Description**

All assignments will be completed and turned by your group (*of up to three people*), not individually. You may work on this individually if you would like, but I don’t encourage it.

**Minimum requirements for project**

The minimum requirements for the project are:

1. You conduct at least one test of significance and one confidence interval. You may use applets and/or calculators to check your work, but you must also show all formulas with correct values.
2. You must gather **Quantitative** data yourself using a proper experimental design: randomized comparative, block or matched pairs.
3. You should NOT collect data using a survey. You MUST do an experiment. You need to have your subjects actively involved in something. I have listed a number of project ideas in this document.
4. Project report will be graded according to the rubric below.

**Timeline of due dates for the project**

**Beginning of class on Monday, Jan. 28 :** Submit a project proposal via email using guidelines below.

**Week of Jan. 28 – Feb. 1:** You should run your experiment and collect your data.

**Monday, Feb. 4 – Data Due at the beginning of class.**

**Monday, Feb. 4 & Wed, Feb. 6:** Project Write Ups during class. **DUE Wed., Feb. 6 end of period.**

**In your project proposal you should include:**

1. The names of everyone in your group
2. Your research questions
3. Who/what are your experimental units and how will you select them
4. How you plan to gather your data/Your experimental design
5. What variables will you collect
6. What sample size will you try to obtain
7. What statistical tests will you run

**Before you run your experiment and collect your data:**

As a first step to conducting your project you should write up an outline of what you plan to do. This should include your research question(s), your data gathering methods (how you plan to conduct the study, your proposed data analysis techniques (both descriptive and inferential), anticipated conclusions and limitations.

*Practical Hint: A VERY common mistake on student final projects is to not clearly understand the connection between the data being gathered and the tests being run. For example, what type of data you collect (quantitative or categorical) impacts what analysis you will do. It is better to collect too much than too little.*

**Paper Guidelines**

Your paper should be typed with the following sections clearly labeled. The text should be organized as follows:

**1. Title and Authors**

**2. Abstract**

**3. Introduction to the Study**

**4. Methods**

**5. Results and Conclusions**

**6. Appendix (This is the section with all your calculations and analyses.)**

**7. Database**

You should use a 11 pt font, single spaced. Each section should receive a heading.

**1. Title and authors**

Give an informative title to your research project and provide your group members names.

*Assessment: Does the title give an accurate preview of what the paper is about? Is it informative, specific and precise?*

**2. Abstract**

The abstract provides a brief, concise summary of the entire paper (background, methods, results and conclusions) in *no more than 200 words*. This allows you approximately 1 sentence (and likely no more than two sentences) summarizing each of the following sections. Typically, abstracts are the last thing you write.

*Assessment: Are the main points of the paper described clearly and succinctly?*

**3. Introduction to the Study**

In this section you are providing a brief introduction to the topic of your research. Explain why this topic is interesting and important/worth studying. Provide the necessary background information or definitions needed to understand the hypotheses that you will be testing in your experiment. Well-accepted facts and/or referenced statements can be included to help the reader understand. Typically, the introduction starts very broad and ends with the specific hypotheses you are testing. Cite any sources used. For example, *Roadrunners are known for their speed and ability to avoid allurements (Coyote, W. E. 1967).*

*Assessment:*

*-Does the background and significance have a logical organization? Does it move from the general to the specific?*

*- Has sufficient background been provided to understand the paper?*

*- Does the section end with a brief description of the hypothesis/goals of the paper?*

**4. Methods**

a. *Data collection*. Explain how the sample(s) were selected, how the experiment was conducted, and how the data was collected. Provide information on the individuals who participated in order to assess (in the results section) how well they represent the population(s) being studied. Non-response rates and other relevant data collection details should be mentioned here if they are any issues. However, you should not discuss the impact of these issues here---save that for the limitations section. **Make sure you are clear and include enough information in this section so the exact experiment could be replicated (repeated).**

b. *Variable creation*. Detail the variables in your analysis and how they are defined (if necessary). For example, if you combined items to create a variable you should describe how. If you are talking about gender no further explanation is really needed.

c. *Analytic Methods*. Explain the statistical procedures that will be used to analyze your data, e.g. parallel dotplots were used (and included in this section) to access normality in the sampling distribution of difference of means. Include the names and purposes of the statistical tests and confidence intervals used.

*Assessment: Could the study be replicated based on the information given here? Is the material organized into logical categories (like the ones above)?*

1. **Results and Conclusions**
2. *Descriptive Statistics:* Include sample statistics and any other descriptive values of your variables that is relevant in helping to answer the research questions. Data can be presented in a table or graph that clearly communicates the results of your experiment.
3. *Test and Interval Results:* Use correct vocabulary and interpretation of results in context. Use complete sentences. Use correct units. Make it sound professional. DO NOT GIVE SOFTWARE OUTPUT OR APPLET SCREENSHOTS HERE. THEY BELONG IN THE APPENDIX.
4. *Discussion/Conclusions:* Restate your objective and draw connections between your analyses and objective. In other words, how did (or didn’t) you answer/address your objective. Make connections between what you found and any previous background provided in the introduction. Talk about the limitations of your findings and possible areas for future research to better investigate your research question. End with a concluding sentence or two that summarizes your key findings and impact on the field.

*Assessment:*

*- Are the results/data analyzed well? Given the data in each figure/table is the interpretation accurate and logical? Is the analysis of the data thorough (anything ignored?)*

*- Are the figures/tables appropriate for the data being discussed? Are the figure legends and titles clear and concise?*

*- Does the author clearly state whether the results answer the question (support or disprove the hypothesis)?*

*- Were specific data cited from the results to support each interpretation? Does the author clearly articulate the basis for supporting or rejecting each hypothesis?*

*- Does the author clearly interpret the confidence interval and relate it to the context of the study? Is the relationship between the confidence interval and hypothesis test explained?*

*- Does the author adequately relate the results of the current work to previous research?*

**6. Appendix: a.k.a The Math Section**

In this section you should give a detailed description of what you did (statistically) and how you did it. Give your formal null and alternative hypotheses here and not in the body of the paper. (Your paper should have your research question and a conclusion which is essentially your alternative hypothesis.) Describe how you used your software or applets to do the analysis, the details of variable creation and any other information about how you conducted the study that may be important that isn’t already in the paper. Software output or applet screenshots and/or formulas and calculated results will make up a significant portion of this section. THIS (Not the body of the report) IS THE SECTION WHERE YOU CANNOT HAVE TOO MUCH DETAIL! Explain and show me why you did what you did. I should be able to recreate your analysis exactly based on what I see in this section.

**7. Database**

Include a copy of the data at the end of your paper.

**GRADING**

Overall, you will be assessed on the areas outlined above listed as “Assessment”. Additionally, you will be assessed on the following areas with regards to writing quality:

1. Is the paper well-organized? (Paragraphs organized in a logical manner)
2. Is each paragraph well-written? (Clear topic sentence, single major point)
3. Is the paper generally well-written? (Good use of language, sentence structure)
4. Are tables/figures labeled correctly and referenced accordingly
5. Does the entire paper flow and answer the research question(s) sufficiently? Is there extraneous information presented?

Don’t gloss over the descriptive statistics and the methods of your data collection. They are an important part of telling the story. **Pictures of your data collection would be nice to see!**

**Project Ideas:**

**\*\*Remember You are Performing an Experiment with a Response Variable that is Quantitative!! Some of these ideas may be more useful than others for this project.**

Your project idea should be one that is academic in nature and one you can find prior research about. It can be a replication of a previous study or something totally original. Most likely it should be one that answers a small part of some bigger question.

***I have some links to apps on our statmix webpage that you could use in your study. There are some reaction time apps, memorization apps, and a brain test.***

* Can people memorize better while moving than sitting still?
* Can people memorize better while chewing gum (particularly mint gum) than when not.
* What is associated with brain lateralization? Gender, handiness, math ability, etc.
* Can people memorize objects better if they are shown the objects in pictures or in words?
* Did you just cut me off? See if a person reacts to being cut in line by a specific gender and whether males and females respond differently.
* Do age, gender, major, distraction, etc. affect memory?
* I need to make a call. Find out if male or female students are more likely to lend a phone to a stranger. Does saying “please” help?
* Does listening to different types of music affect a person’s reaction time.
* Do Energy Drinks give you energy? Does consumption of an energy drink allow students to complete more sit ups?
* Does what one considers a serving size differ with gender, age, or athlete/non-athlete.
* Can people accurately estimate the length of a short event like a song snippet?
* Size estimates. Do people estimate the amount of a food item differently if they are given a small spoon or a large spoon, a small bowl or a large bowl, etc.?
* Do people like the taste of water better if they think it costs more?
* Does the amount of candy in a bowl effect whether or not people obey the sign that says take only one?
* Do men and women differ on whether or not they tell someone they have some food on their face?
* Is age related to the time needed to complete and the number wrong in a test to investigate **the Stroop effect** (color and words)?
* What factors are related to people being able to follow directions when given a short quiz?
* Do reaction times differ depending on the time of day? With distraction? Amount of sleep?
* Do reaction times differ depending on whether they use their dominant or non-dominant hand on the computer mouse?
* Does exercising help one’s ability to memorize?
* Is there a relationship between the time of day and whether or not someone yawns when yawned at?
* Will watching certain videos affect someone’s emotional state?
* Is there an association between gender, handiness, major on whether or not they see the spinning dancer illusion spin clockwise or counterclockwise?
* Can people memorize pictures of objects easier when the pictures are in color versus black and white?
* Do people prefer a name brand cereal over a store brand in a non-blind taste test and then also in a blind taste test?
* Do gamers have a faster reaction time than non-gamers?
* Will offering an incentive increase the likelihood someone will complete a survey?
* Does the room condition light/dark, alone/with others affect how scared someone is when watching a scary video?
* Is yawning contagious?
* Is recall affected by whether or not you take notes on a computer or by hand?

When deciding on a project topic, think of one that is of interest to you and will be something that could contribute to some broader topic.

**Bad:** *Is the average number of female customers larger at JPs or LJs (two coffee shops close to campus)?* Would anyone really care about this? Does this add to some broader topic? Would this ever be published in a national journal?

**A bit better:** *Will regular coffee drinkers complete a puzzle faster than non-coffee drinkers?* This, as you might guess, be loaded with confounding variables.

**Perhaps a bit better:** *Do gamers have a faster reaction time than non-gamers?* While this one will also have confounding variables, it would seem that gamers should have a better reaction time since that is probably a big part of what they do when playing games. To make this even better you could control for other variables, like a person’s sex.

**Even better:** *Does bowl size affect how much cereal someone will serve themselves?* Now we have a randomized experiment and have the potential to determine cause and effect---this is, of course, assuming it is a nicely controlled randomized experiment.

Power Calculator and Various Apps for Project Data Collection (see statmix page on website for links)

* [Word Memorization App](http://www.braingle.com/mind/test_words.php)
* [Reaction Time App](https://faculty.washington.edu/chudler/java/redgreen.html)
* [Baseball Reaction Time App](https://www.exploratorium.edu/baseball/reactiontime.html)
* [Reaction Time, Number Memorization, Word Memorization, and Shape Memorization](http://www.humanbenchmark.com/)
* [30-second Brain Test](http://braintest.sommer-sommer.com/en/)