**Multiple Regression Analysis Project**

**Overview**

The total project counts for about 50% of your final grade. The 180 point cumulative project total is 10 points (proposal), 50 points (presentation), 100 points (paper), 15 points (appendix for paper), and 5 points (data). All assignments will be completed and turned by your group, not individually. At the end of the project each group member will give feedback on the group and communicate whether they agree that everyone in the group should receive the same grade.

**Minimum requirements for project**

The **minimum** requirements for the project are:

* Use a multiple regression approach on experimental data to test a research question(s) of interest
* Groups of 2-3 students.
* Parameters
  + Run single predictor tests learned in 311
  + Response: Quantitative or binary categorical
    - Could have different response variables
  + Explanatory: At least three factors
  + Use model building to come up with final model(s)

\*\*Please note: If you strive to do the minimal possible on this project (e.g. meeting the minimum requirements), even if you do these well, will likely not receive an “A” on this project. For example, if you do 3 single predictor tests and one multiple regression model, with a weak literature review, even if all done correctly, you likely will not receive an A. Aspire for more and your grade will reflect that. A larger-scale project that is done well, even if there are a few minor mistakes, will likely end up with a higher grade.

**Timeline of due dates for the project**

On or before Friday, April 10: Your group submits your project proposal for review.

Wednesday April 22 or Friday April 24: Your group gives a presentation to the class on your project

Wednesday April 29: Your group submits your final report write-up with appendix and data set.

**Project Ideas**

* Instron: rope braid, rope length, knot type predicting strength of rope
* Instron: nail type, nail depth into 2x4, nailed into knot(y/n) predicting holding strength of nail
* Strawberries: organic or not, storage container type, storage place predicting days til spoil
* Bananas: organic or not, store in bags/not, fridge/counter, wrap ends/not, hang/not
* Coffee pH: brand, flavor, creamer, artificial creamer
* Easter eggs: thickness of rubber band, how far pulled back, amount of weights in egg predicting distance launched
* OJ: fresh/frozen, name brand/off brand, temp stored at predicting amount of vitamin C
* Frisbee accuracy: type of throw, male/female, on ultimate or not predicting accuracy of throw
* Frisbee distance: type of throw, type of disk, weight of disc predicting distance and accuracy
* Baking healthy: flour type, baked good type, gender of taster, predicting taste score
* Baking pre-made cookies: brand, temp of dough, temp of oven, time in oven predicting rating score (appearance and taste), pan type
* Pizza rolls: brand, cooking apparatus, temp of cooking apparatus, time in cooking apparatus predicting rating (temp & appearance)
* Laundry: stain remover, stain type, scrub/no scrub predicting stain rating
* Flame retardant baby clothes: detergent type, dryer/line dry, number of washes predicting time to incinerate
* Paper towel strength: brand, type of liquid, amount of liquid predicting amount of weight before rips
* Paper towel absorption: brand, type of liquid, time to absorb predicting weight of liquid absorbed
* Sponge bacteria: type of water, level of dampness, microwave (y/n) predicting bacteria count in number of colonies
* Reading comprehension: font type, genre, difficulty level, gender of reader predicting comprehension score

**Project Proposal Guidelines**

As a first step to conducting your experiment you should write up a ***one page project proposal*** which outlines your research question(s), your experimental design, your proposed data analysis techniques (both descriptive and inferential), anticipated conclusions and limitations.

The outline for each *one page* proposal should be:

1. Research question(s)—1-2 sentences
2. Background/significance of the research- 2-4 sentences. You will need a reference here as well.
3. Experimental plan: What is your response variable, what are your factors & how many levels does each one have, do you have any blocking variables. How many treatments will you be testing and how many experimental units will be in each treatment.
4. Analytic plan: (what statistical methods (be specific) do you plan to use to analyze the data; both descriptive and analytic methods); ANOVA, logistic regression, multiple regression, which variables will be explanatory in the model and which the response, which variables will you interact with each other.- 2-3 sentences
5. Anticipated conclusions/findings – 2-4 sentences
6. Limitations – 2-4 sentences

*Note: I realize that this is a lot to put on one page, but it will force you to write concisely but clearly, and to think carefully about the key points of your research.*

\*\*\* You should have at least 3 factors/blocks in your experiment.\*\*\*

**Presentation Guidelines**

Your group will give a short presentation about your group project. All group members should participate in giving a part of the presentation. The presentation should be about ten minutes. After your presentation, there will be a brief time of Q+A with the class and your professor.

Note: Your presentation should cover the entire project (background, methods, results and conclusions) and thus your entire project, except for perhaps some editing of the paper, should be completed by the time you give your presentation. Hearing your presentation is a way for your professor and class to give you feedback on any major errors/problems with your project before you submit your final paper.

**Details:**

Presentation days are Wednesday, April 22 and Friday, April 24. You must submit your PowerPoint slides at least 30 minutes before class time through Moodle

**Things that will be looked for in your presentation**

|  |
| --- |
| 1. Title- Accurate preview, informative, specific, precise |
| 2. Background- logical organization, general to specific, sufficient background to understand paper, put in context of larger body of scientific work, why research is important/relevant, ends with hypotheses/goals of paper |
| 3. Methods—could the study be repeated based on information given, but information is not too detailed? Logical organization (data collection, variable creation, analytic methods) |
| 4. Results- appropriate content for a results section, appropriate analyses used, good/clear presentation, no extraneous information, figures/tables labeled and clear, |
| 5. Discussion/conclusions- clear statements of conclusions to research questions, specific references to results to justify conclusions, understanding of the limitation of the research, placed in context of larger body of scientific work |
| 6. References—appropriate and of adequate quality, cited when appropriate |
| 7. Overall presentation---well spoken and organized, grammar, etc. |

**Paper Guidelines**

Your final papers are due, via Moodle submission, by ***11:59pm on Wednesday, April 29.*** Your paper should consist of no more than 6 pages of concisely written single-spaced text (tables and graphs *are* included in the 6 page limit; however the appendix and database are not). Some research write-ups will need more room than others***. I do realize that many of your chosen topics are not of a serious scientific nature, but the paper should be organized and written as if they were.***

Please organize into sections as follows:

**1. Title and Authors**

**2. Abstract**

**3. Background and Significance**

**4. Methods**

**5. Results**

**6. Discussion/Conclusions**

**7. References**

**8. Appendix (a separate file submission and thus not included in the 6 page limit)**

**9. Data (a separate file submission as an SPSS data file)**

You should use times new roman, 12 pt font, single spaced. Each section (or subsection) should receive a heading similar to what is below.

**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 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. Background and significance**

In this section you are providing the background of the research area and arguing why it is interesting and significant. This section relies heavily on literature review (prior research done in this area and facts that argue why the research is important). This whole section should provide the necessary background leading up to a presentation (in the last few sentences of this section) of the research hypotheses that you will be testing in your study. Well-accepted facts and/or referenced statements should serve as the majority of content of this section. Typically, the background and significance section starts very broad and moves towards the specific area/hypotheses you are testing.

*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? How does this work relate to other work in the scientific literature?*

*- Has a reasonable explanation been given for why the research was done? Why is the work important? Why is it relevant?*

*- Is the final paragraph a brief description of the hypothesis/goals of the paper?*

**4. Methods**

a. *Data collection*. Explain how the data was collected/experiment was conducted. Additionally, you should provide information on the individuals/experimental units in the study to assess representativeness. Non-response rates, equipment failure and other relevant data collection details should be mentioned here if they are an issue. However, you should not discuss the impact of these issues here---save that for the limitations section (in with discussion/conclusions).

b. *Variable creation*. Detail the variables/factors in your analysis and how they are defined (if necessary). For example, if you created a combined (frequency times quantity) drinking variable you should describe how. If you are talking about gender no further explanation is needed.

c. *Analytic Methods*. Explain the statistical procedures that will be used to analyze your data. E.g. Boxplots are used to illustrate differences in absorption times across brands and types of substances absorbed. ANOVA is used to assess the differences in mean absorption time for different brands. Multiple regression is used to assess impact of brand and substance on absorption time.

*Assessment: Could the study be repeated based on the information given here? Is the material organized into logical categories?*

**5. Results**

Typically, results sections start with descriptive statistics, e.g. what percent of the sample is male/female, what is the mean GPA overall, in the different groups, etc. Figures can be nice to illustrate these differences; however, information presented must be relevant in helping to answer the research question(s) of interest. Typically, inferential statistics (i.e. hypothesis tests) come next. Tables can often be helpful for results from multiple regression. DO NOT GIVE SPSS OUTPUT HERE! This should look like a peer-reviewed journal article results section. Tables and figures should be labeled, embedded in the text, and referenced appropriately. The results section typically makes for fairly dry reading. It does not explain the impact of findings, it merely highlights and reports statistical information.

*Assessment:*

*- Is the content appropriate for a results section? Is there a clear description of the results?*

*- 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?*

*-Here is where you could have a table of CIs for beta coefficients from your mult regression.*

**5. 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. Place these all in the larger scope of previous research on your topic (i.e. what you found from the literature review), that is, how do your findings help the field move forward? Talk about generalizability and cause/effect. 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:*

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

**6. References**

*Assessment: Are the references appropriate and of adequate quality? Are the references citied properly (both in the text and at the end of the paper)?*

**7. Appendix (separate file submission)**

In this section you should give a detailed step-by-step description of what you did (statistically) and how you did it. NOTE: This section is NOT included in the 6 page limit; it is a separate file submission. Describe how you used SPSS 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. SPSS output 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.

**8. Database**

You should also upload a copy of your final analysis database (as an SPSS data file) to Moodle that contains the variables and observations that were in your analysis.