MATH 240 STATISTICS PROJECT
SPRING 2014

Overview:
You are being asked to conduct a statistics project over the course of this semester. The purpose of this project is to have you experience and apply, in a hands-on manner, the statistical concepts of this course. Another goal is for you to learn how to communicate statistics verbally and in written form. The project gives you an opportunity to work with other students and to review the work of your peers. Remember, we learn best by doing.

Various assignments, instructions, and tips for this project are explained below. I encourage you to complete a project that interests you to make this more enjoyable and more meaningful.

Things to Keep in Mind:
• You must do this project in groups of 2-3 people. If at any time someone in your group is not contributing to the project, please let that person know. If that does not resolve the problem, let me know so that I can help. Keep in mind, at the end of the project, each of you will evaluate your group members’ contributions to the project, and these evaluations will help determine each person’s individual project grade.

• Your data should not identify any individuals. Confidentiality is crucial in research.

• The collection of your data should not harm or offend anyone.

• If your research involves human subjects, you must obtain informed consent. If you plan to use interviews or questionnaires, you will receive an informed consent form that you must use with all participants of your study. More on this topic later.

• Your project should use good data collection techniques. When this cannot be done as effectively as possible (e.g., the data were not collected in a completely random fashion), it will be a limitation of your research project and its findings; note this issue for your paper. You must keep limitations and unexpected problems in mind as you complete your research, explain the reasons they occurred, and their affects on your research findings and subsequent conclusions in the final report.

• All assignments should be typed when handed in. You will be writing up your report in Word and then pasting in appropriate Minitab printouts or graphs. By having everyone use Word, each person’s files can later be merged to help create the final report.

• A list of titles of previous student projects is on my homepage. I also have student projects in my office you can view. See http://yourspace.minotstateu.edu/laurie.geller

• I will provide additional tips and reminders throughout the semester.
PROJECT ASSIGNMENTS

Assignment 1: Group Selection (5 points)
Determine who will be in your group (2-3 people). Please just hand in a sheet of paper listing those who will be in your group.
Due Thursday, January 23, 2014

Assignment 2: Preliminary Description of Topic and Data Collection Process (5 points)
Determine at least two big questions that you want to answer in your study. Then determine and describe the type of data that you will collect and how you plan to collect these data in order to answer your questions. You will need to collect data on many characteristics of your sample so that these characteristics can later be compared somehow (e.g., before and after data; comparisons by gender, major, type, year, age, etc.) Define the population and the sample that you will be studying. You will have a chance to revise this if necessary. Email or hand-in the assignment during class.
Due Thursday, January 30, 2014

Assignment 3: Revised Description of Topic and Data Collection Process (10 pts)
Revise Assignment 2 where needed. Include all elements of Assignment 2. If your questions and data collection process change over the course of the project, you need to let me know. Email or hand-in the assignment during class.
Due Thursday, February 6, 2014

Assignment 4: Data Collection Preparation (10 points)
Determine your group's data collection methods. If you are using a questionnaire, you must use the consent form I have provided. You must also have the questionnaire and consent form reviewed and approved by me BEFORE you can use them to collect data. If you are not using a questionnaire, indicate where you will get your data. Remember, you need sample, not population data, in order for fulfill the requirements of this project.
Email the following to me: Your questionnaire with the consent statement. If you are not using a questionnaire, hand in a description of where you will get your data; include web sites, organizations, or whatever is relevant to your project.
Due Thursday, February 20, 2014

Assignment 5: Data Collection and Spreadsheet Created (10 pts)
Collect the data. Input the data into a Minitab or Excel spreadsheet. Remember to keep this information confidential. You might try creating a few graphs or making some calculations (e.g., mean, standard deviation) in Minitab. Make sure everyone in the group has a copy of the data file.
Email the following to me: (1) a first rough draft of your final report up through and including the section called Methods in the checklist; and (2) a copy of the Minitab or Excel file of your data.
Due Thursday, March 27, 2014
Assignment 6: Data Summary and Interpretations (10 points)
The types of data summaries you complete will depend on the type of data that you collected — qualitative or quantitative or both.

- If you have qualitative or categorical data, you should use graphs (e.g., pie charts or bar charts with percents) and some type of table or chart (e.g., crosstabulation chart, relative frequency/percentage table) to summarize the proportion and size of each category.
- If you have quantitative data, you should use graphs (e.g., dotplots, histograms, boxplots, etc.), calculate measures of central tendency (e.g., mean, median), calculate measures of spread (e.g., range, standard deviation), and check for and identify outliers (use boxplots to do this).
- Use Minitab for your calculations and graphs. When Minitab’s printouts are cumbersome and hard to read, retype them in Word to make it easier for the reader.
- Make sure you save your Minitab file as a PROJECT file. This format saves all the data, graphs, and calculations together in one file.
- Make sure everyone in the group has a copy of the Minitab project file.

Email the following to me: The second rough draft of your final report up through and including the section called Summary of the Data in the checklist. Remember, you must incorporate computer output, like graphs, into the report. When you do include a graph or table, be sure label it, give it a name, refer to it in the text (e.g., See Figure 1), explain its contents, especially the parts that are most important to your study and the questions you are trying to answer.

Due Thursday, April 10, 2014

Assignment 7: Confidence Intervals, Hypothesis Tests, and Analyses (10 points)
Perform hypothesis tests or analyses on your data in order to answer the questions that you posed. Also create confidence intervals if you are trying to estimate a parameter of the population. You will have to decide the most appropriate tests, confidence intervals, or analyses to perform.

Email the following to me: The third rough draft of your final report up through and including the section called Statistical Inference in the checklist. Again, remember, you must incorporate computer output into the report. You may be pushed for time on this one because we will have discussed relevant content in class not long before this assignment is due. If we need to change the due date we will, or you can just make it a very rough draft of the analyses and tests you plan to perform. We can discuss this more later.

Due Thursday, April 24, 2014

Assignment 8: Rough Draft (optional)
If you’d like me to review a rough draft of your paper or your presentation, please email a copy to me. I will read it, make comments and edits, and return it to you by the end of the week.

Due Monday, May 5, 2014

Final Report (100 points)
Create a final report of your project. You should have most of this report already written in the previous drafts, but you should go through the checklist that I have provided to make sure that you included everything. I will use this checklist when I grade your report! You must include recommended changes from previous drafts/assignments. Reports must be typed and follow the
format of the checklist. Like we have done in lab, incorporate Minitab output and graphs into the body of the paper.

Print and hand in the following: (1) A copy of your final report for me to grade. Note, I will be comparing your final report to earlier drafts. You must have addressed the comments I put on these earlier drafts in your final report. (2) Also hand in as many copies of the report as there are people in your group (in addition to the copy for me). One or more of your peers will use these extra copies to critique your project (see below).

Due no later than 4:00 p.m. Monday, May 12, 2014.
Late papers will not be accepted. Do not email me your final report.

Presentation (50 points)
Each group will give a presentation (10 minutes or so) of their project. Each group member must participate in the presentation in some way. The presentation should provide the audience with an overview of the purpose of the study, methods, findings, conclusions (i.e., the answers to your research questions), drawbacks to the techniques used, and further recommendations. Feel free to be creative, but also be professional! The presentation should be accompanied by some type of visual aid, like transparencies, poster board, PowerPoint, or Prezi. Some of your classmates will critique your presentation as well.

Presentations will be conducted during our final exam time, Tuesday, May 13 from 12:00-1:50 p.m. Attendance is mandatory!! Failure to attend the presentations will result in a reduced project grade or an additional assignment.

Peer Critiques (20 points)
Everyone will critique another group’s project and presentation. I will give you these materials in class.
Due no later than 4:00 p.m. Thursday, May 15, 2014

Evaluations of Your Group Members (10 points)
You will also be asked to evaluate the work and participation of your group members. I will provide forms for these evaluations. The evaluation of your group members may affect each person’s individual project grade, so be honest and fair.
Due no later than 4:00 p.m. Thursday, May 15, 2014

Evaluation of the Project (10 points)
Finally, each of you will get a chance to evaluate the project—describe successes, challenges, rewards, and learning, and include suggestions that would make the project more successful in the future.
Due no later than 4:00 p.m. Thursday, May 15, 2014
Final Report Evaluation
Your final report will be graded based on the following:

- Quality of written report
- All parts of checklist included
- Design of questionnaire/experiment—Was the data collection process adequately explained? Were the appropriate data collected to answer the questions posed?
- Correctness of statistical analysis and checks of technical assumptions—Did you use the appropriate graphs, calculations, tests, confidence intervals, etc.?
- Correctness of interpretations of the results of the statistical calculations and conclusions—Did you come to the correct conclusions based on your analyses?

Overall Evaluation
Individual grades will be determined by the instructor, the evaluations of the group members, the overall group grade, and the completion of the peer critiques, project evaluations, and group member evaluations. Overall group grades will be based on the final report, presentation, and assignments 1-7.

______________________________________________________________________________

PROJECT AND QUESTION IDEAS

To give you an idea of my expectations, you can stop by my office to look at previous years’ class projects. Titles of these projects are posted in the Math 240 Projects area of my home page. Some examples of students’ projects are also posted there.
See http://yourspace.minotstateu.edu/laurie.geller

Check out the projects done by students in statistics classes at California Polytechnic State University: http://statweb.calpoly.edu/chance/stat217/projects.html. Some of these are great!

Links to data sources are listed at: http://yourspace.minotstateu.edu/laurie.geller/240links.html.

______________________________________________________________________________
Checklist and Format of the Final Report

Your final report must follow the format below. You must include the headings in bold. Under each heading in well-written paragraph form, you should include at least the items listed below. Remember to label and title tables and figures. Have someone else (e.g., The Writing Center) proofread it for grammar, clarity, etc. See the projects of previous students for examples.

TITLE

Introduction

In the introduction, you must:
• Tell the reader what you are going to tell him/her. Briefly introduce the reader to the content of the paper. Grab the reader’s attention. This is your chance to have fun and give some background information on your project’s topic.
• Include the purpose of your study and the questions you plan to answer (or answered once the study is complete).
• Explain the significance of your study. Why should the reader should care about it?
• Explain relevant background information that will help the reader understand your study.
• Define any terms that are unclear.
• Include the variables you plan to analyze.
• State your hypotheses about your study. You must hypothesize the answers to your questions before you gather and analyze the data.

Methods

There is no such thing as “too much detail” in this section! You must describe in detail what you did and how you did it in sufficient detail so that readers could reasonably replicate your study. You may want to merge the three subheadings below depending on how much information you have.

Participants
• Identify and describe the sample and the population of your study
  o Explain how your chose your sample
    ▪ Describe the sampling technique (if applicable) that you used.
    ▪ Explain whether the sample was or was not representative of the population.
      If it was not representative, explain why. (Note: Most of you will not be able to collect a representative sample.)
  o Describe who/what and how many participated
  o Include the demographics of your participants—gender, age, race/ethnicity, etc, if appropriate.

Instruments
• Describe the materials/instruments used for the study—questionnaire, interview protocol, observations, scales, other instruments, etc
• Explain the rationale for using these instruments/materials.
• Be sure to include copies of the instruments in an appendix.
Data Collection

- Explain how you executed your study.
  - *Step by step*, take the reader through the data collection process. Include the rationale for your actions.

**END FIRST ROUGH DRAFT**

Results

This section summarizes the data collected and the data analyses used. Mention all relevant results (i.e., those they help you answer your questions), even those that run counter to your hypotheses—they are still relevant.

Summary of the Data

- Your summary of the data should be concise, well-labeled, and easy to read.
- All figures, tables, etc must be labeled and named (e.g., Table 1 Descriptive Statistics for Group 1), explained, and referred to in the text using the table or figure number. For example: “Table 2 includes...”
- If you have qualitative or categorical data:
  - You should use graphs/figures (e.g., pie charts or bar charts with percents) and some type of table or chart (e.g., crosstabulation table, relative frequency/percentage table) to summarize the proportion and size of each category.
- If you have quantitative data:
  - You should use graphs (e.g., dotplots, histograms, boxplots, etc.), calculate measures of central tendency (e.g., mean, median), calculate measures of spread (e.g., range, standard deviation), and check for and identify outliers (use boxplots to do this).
- Use Minitab for your calculations, graphs, and figures. When Minitab’s printouts are cumbersome and hard to read, retype them in in Word to make it easier for the reader.
- Always point out key results of tables and figures, and provide sufficient explanation to make them readily intelligible. Highlight results that are important to your study.

**END SECOND ROUGH DRAFT**

Statistical Inference

This section must include:

- The results of your statistical analyses (i.e., confidence intervals, hypothesis tests).
  - Remember, your null and alternative hypotheses must be stated before you analyze (even collect) the data!!
  - For each test, you must state, in paragraph form: (1) the hypotheses, (2) the type of test (dependent paired t-test, ANOVA, Chi-square test, etc), (3) the level of significance, alpha, (4) the calculated test statistic, (5) the p-value, and (6) your conclusion (reject the null or fail to reject the null hypothesis). You must explain in words the meaning of your conclusion as it relates to your study and the question you are answering.
For each confidence interval (CI), don’t just give the CI without any explanation. You must explain the type of confidence interval and its meaning.

The same is true for a linear regression or correlation. Explain the analysis and its meaning as it relates to your study.

- For quantitative data, you should use some type(s) of the following:
  - confidence intervals for mean(s), hypothesis tests for mean(s), simple linear regression, simple one-way ANOVA
- For categorical data, you should use some type(s) of the following:
  - confidence intervals, hypothesis tests for proportions, Chi-square tests
- Also remember that we never ever prove anything with statistical inference!! You never know for sure whether the sample is like the population, and thus, whether you made the correct decision about the null hypothesis. You just gather evidence to support your decisions.

**NOTE:** You may want to combine the sections, Summary of the Data and Statistical Inference. For example, present the descriptive statistics for female GPA and immediately follow this description with the inferential statistics for female GPA, rather than splitting this information into two separate sections. You do not have to do this for the rough drafts, but you may want to do it for the final report to make the paper read easier. It’s up to you.

**END THIRD ROUGH DRAFT**

**Discussion and Conclusions**

In this section you must:

- Remind the reader of your purpose and/or research questions.
- Give a brief summary of all your main results—provide answers to your initial research questions.
- Indicate the meaning of your results—evaluate and interpret the results and their implications, especially with respect to your original questions/hypotheses and purpose of your study.
- Consider the practical significance of your findings. Just because a result is statistically significant does not mean it is practically significant. Meaning, just because it is $0.20 cheaper to buy cookies at Walmart than Market Place, do I want to spend the extra time and money to make a trip to Walmart if it is farther away than Market Place?
- Use this section to give possible reasons for your findings or observations.
- Give recommendations to improve your study.
  - Discuss limitations of your study—e.g., sample size, poor questions, lack of randomization, etc.
  - Discuss possible sources of bias and their possible effects on the results.
  - Describe ways you could have improved your project. What should you have done differently?
  - Suggest future questions for someone conducting a similar study.
• Close the paper by discussing the importance of your findings. What do your findings mean for those who care about your topic? Meaning, you found something – So what?! What should you/we/whoever do with your findings? Why should the reader/the class/society care?
• Finally, have fun in this section as well.

Appendix

In this section you should include anything else you need to reference in the report or make available for the reader. For example:
• Consent form (see next page)
• Questionnaire
• Interview protocol
• Extra analyses
• PowerPoint slides, etc.

Use good writing skills, like introductory sentences at the beginning of each new section (tell us what you are going to tell us), transition sentences between sections, summaries when necessary, good grammar, spelling, punctuation, and flow.

Remember, the Writing Center, located in the lower level of the library (858-3060 or http://www.minotstateu.edu/writingcenter/), is there to help you!

Be professional, creative, and have fun!

I hope you will learn tons about statistics by completing this project.
INFORMED CONSENT STATEMENT FOR MATH 240 STATISTICS PROJECT

When conducting a study involving human subjects/participants, you must inform the participants of certain things and gain their consent to participate in your study. This is required by law. The information you must include is in the sample consent statement below.

If you use a written questionnaire: You must have each person read and sign the informed consent statement prior to conducting your research.

If you conduct an interview over the phone: You must read this to each participant and verbally gain his or her consent. You must also provide each participant with the necessary contact names and phone numbers in case he or she has questions or concerns.

If you conduct an interview in person: You must have each person read and sign the informed consent statement prior to conducting your research.

A sample consent statement is below. You will need to adapt the statement to fit your topic and questions, but you must use this basic consent statement when doing your research.

Your consent form must be approved by me prior to collecting any data!!

Sample consent statement:

Our names are [students’ names], and we are Minot State University (MSU) students. We are collecting data about [your topic, e.g., the parking situation on campus] for a project in the statistics course that we are currently taking at Minot State University. The purpose of our study is… [Provide further description of your project and its purpose. You want to make sure the participant understands what you are doing and why you are doing it.]

We would like to ask you a few questions about [your topic]. Your participation is strictly voluntary, and you may withdraw consent and discontinue participation by not submitting your questionnaire. Once you submit a completed questionnaire, you cannot withdraw from the study since there will be no way to identify your questionnaire. By participating in this study, you can expect to gain [whatever it is that he or she may gain]. No risks are related to your participation. This questionnaire should only take a minute or two [or whatever amount] of your time. All of your answers will remain anonymous. The results of our study will not be published and will only be used for this class project. No persons will be identified or named in the final report and presentation of the findings.

You are voluntarily making a decision whether or not to participate. By completing the questionnaire you have given your consent, and that having read and understood the information provided above, you have decided to participate.

Thank you for taking the time to answer these questions. If you have concerns or questions about our research, please contact our instructor, Laurie Geller, Dept. of Math & Computer Science, 701-858-3282. If you have any questions about the rights of research subjects, please contact Dr. Bryan Schmidt, Chair of the MSU Institutional Review Board, at 701-858-4250.