Solar Observation Project

*Write-Up*

You ***may not*** work with other students on the write-up for your Solar Observation Project. If two or more students turn in significantly similar copies of their final write-up report, ***all*** will receive grades of zero. Depending on the severity of the plagiarism, further penalties may be assessed. You should not be using any source (books, notes, internet resources, etc.) enough that you would need to cite the source. Reading about seasonality to clarify your understanding of the relationship between the Sun and Earth is fine. Copying and pasting (or even paraphrasing) is not. This report *must* be your own work. If you have questions, please come see me during office hours, make an appointment or send me an e-mail.

No hand-written reports will be accepted. Your final report must be double-spaced and printed on one side of each 8.5x11 inch page of paper. The complete report must be stapled and turned in on or before 9:30 AM on December 8th, 2013. An electronic copy of the report must be submitted to Turnitin on Facebook by that same time and date. Failure to submit both electronic and hard copy by that time and date will result in a grade of zero for the final report. Early submissions are both welcome and recommended. NO LATE WORK WILL BE ACCEPTED FOR ANY REASON!

Over the course of the semester, you have been collecting data to test the following hypothesis:

**H1:**  We expect to observe that shadows cast by objects at midday will grow longer from September 17th to October 29th, indicating that the angle of the Sun above the horizon at midday has decreased over the course of that measurement period.

Your first task is to construct a null hypothesis (**H0**) to compliment this testing hypothesis. Please see the “Scientific Methods” lecture for information about constructing a good null hypothesis. Using the data you collected both individually and as a class, you can now determine whether or not the null hypothesis should be accepted or rejected. If the null hypothesis is rejected, you must also determine whether or not to accept or reject the testing hypothesis.

Your report ***must*** include the following sections, each under its own separate heading (I have attached a sample “framework” for the final report to the end of these instructions to help you with the formatting):

**Cover Page** (one page including the title of the project and your name)

**I. Introduction (minimum length: 300 words)**

In this section, you will introduce the project, including an overview of the physical reason why the angle of the midday Sun above the horizon changes over the course of the year as well as specifically why you expected it to decrease over the time interval you observed the phenomenon. List and explain specific scientific reasons to expect to reject your null hypothesis and accept your testing hypothesis for the time period during which you collected data. Do not use the *results* of the experiment in your explanation - the purpose of the introduction is to explain why you would expect the testing hypothesis to be accurate based on scientific principles such as those you learned about in the “Seasonality” lecture and lab exercise (and lab write-up!). Pay particular attention to the exercise you did on determining the midday sun angle in Rock Hill.

Do ***NOT*** copy from lecture notes, books, the internet, other students or any other source (doing so constitutes plagiarism and thus an automatic grade of zero on the project, at a minimum). Explain why the midday Sun angle changes over the course of those weeks as youunderstand it.

The introduction *must* contain your null and testing hypotheses formatted *exactly* as shown below:

**Ho :** *Your null hypothesis*.

**H1 :** We expect to observe that shadows cast by objects at midday will grow longer from September 17th to October 29th, indicating that the angle of the Sun above the horizon at midday has decreased over the course of that measurement period.

**II. Materials and Methods**

In this section, you will describe the data you and your classmates collected this semester. Assume that your reader has *no idea* what you did, but would like to be able to collect data in the same way. This section must include all information related to the collection and processing of the data, including (but not limited to) details about what measurements you made and the time frame in which the measurements were made. Be sure to include descriptions of any problems you ran into during the data collection process. For mathematical calculations, you must include a description of the calculation and explain why the calculation was necessary (i.e., why you couldn’t just use the raw data). Since you already did these measurements, all verbs should be in the past tense.

**III. Results**

Every write-up must include a properly formatted table with a ***full set of the raw and derived data collected by the class***, including all measurements, dates when measurements were taken and which group made the measurements (I will provide you with a copy of this data). The table ***must*** have a full caption and be introduced and described in the body of the text (see **Tables and Figures** section below). Data that have been mathematically derived from the raw data must also be included in this section.

Analyze the data as it applies to your hypotheses. At a bare minimum, you must analyze the data collected by your own group for this project. You should also analyze the data collected by other groups in this class (either individually, or the class as a whole), particularly if you feel that their data support a different conclusion than that supported by your data. Feel free to include figures or graphs, but only if you include a full caption *and* describe what they illustrate and why in the body of the text. Diagrams and/or tables that are not fully described in the body of the text will be ignored during grading. “See Figure 1” is *NOT* a description of the figure (see **Tables and Figures** section below).

At the end of your data analysis section you must *specifically state* whether or not you can reject your null hypothesis based on the data you collected this semester. You must also specifically state whether or not you must reject your testing hypothesis. You are not “proving” or “showing the hypothesis to be true” – you can only reject at least one hypothesis and perhaps provisionally accept the other.

**IV. Discussion (minimum: 300 words)**

In this section, you will relate your results back the description of the phenomenon in your introduction. If you rejected your testing hypotheses, you must explain in detail why you were unable to confirm one or more of the widely accepted theories for the causes of seasonality on Earth. If you feel that errors were made in data collection, they should be discussed here. If you rejected your null hypothesis and provisionally accepted your testing hypothesis, discuss how your observations relate to the model of the real world that you described in introduction.

For the rest of the discussion, please discuss how this project could be expanded to test other hypothesis about the position of the Sun in Earth's sky over the course of the seasons. For example, predict what you would observe if you observed the midday Sun during spring instead of fall. You could also predict what you would observe over the course of an entire year, instead of just during a six-week period. You could predict what you would observe at different places on the globe on the same day. You could also discuss what other measurements you could use to test this or related hypotheses.

**V. Conclusion**

Summarize the results for the project in a 150+ word paragraph. *There should be nothing new in the conclusion*, it is simply a summary. If your conclusion seems repetitive, you are on the right track.

**Tables and Figures**

Tables (you need at least one of these) and figures (if any) must be specifically described in the body of the text (e.g., “Figure one shows the distribution of….”; “The results of the calculations are summarized in Table two…”). Each table or figure must have a title and caption that describe the contents of the table or figure. Tables and figures lacking specific descriptions, titles and captions will be ignored during grading. You may *not* copy illustrations from other publications, lecture notes, each other or any other source; all figures must be drafted by you.

<Sample report – everything I’ve written inside “<>” marks should be either deleted or replaced with your text before you turn in your report!>

<Your Name Here>

Solar Observation Project

Fall Semester, 2014

Geol 250 – Earth and Space Systems

<Submission Date Here>

**I. Introduction**

<Write your introduction here. At some logical point (usually near the beginning or end, you will need to include the hypotheses, formatted like this:

**Ho :** <your null hypothesis>

**H1 :** We expect to observe that shadows cast by objects at midday will grow longer from September 17th to October 29th, indicating that the angle of the Sun above the horizon at midday has decreased over the course of that measurement period.

Your introduction must be at least 300 words long – use the word count function to check!>

**II. Materials and Methods**

<Write your materials and methods here. Be sure to include an explanation of why you needed to apply the ArcTan function on the H/L data.>

**III. Results**

<Your results go here. Once you have submitted all of your data, I will compile it and supply a properly formatted table for the raw and derived data collected by the class. You must refer to your data table in your text and describe what data are included. This is also a good section to include a figure, such as the midday sun data plotted against collection date.

At the end of the results section, make sure you specifically state whether or not you accept or reject your null hypothesis. If you reject your null hypothesis, you must also specifically state whether or not you accept or reject your testing hypothesis. Remember, you cannot “prove” either hypothesis, only provisionally accept that a hypothesis is supported by the data you collected.>

**IV. Discussion**

<Your discussion goes here. It should be a minimum of 300 words long.>

**V. Conclusion**

<Your conclusion goes here. It should be a minimum of 150 words long, and contain NO new material.>