QRMS Project 2: The Stars in the Sky (Due December 7, 2012)

In this project, you'll come up with an answer to the question of how many stars are visible to the naked eye in Boulder. This entire project may be completed in a group of up to three and should be presented in a typed double-spaced paper of about two pages in length (and not much more than three, please) that meets the normal expectations for formal writing.

Part 1: Data Gathering (0 pts)

In this part, you will design your method and gather your data. **This data will not appear in your final paper. This section is intended only to prepare you to write the paper as described in part 2.**

1. You should begin by deciding how you plan to estimate the number of stars that are visible. Simply trying to count all of stars that are visible will be incredibly error prone and so is not a good idea. Instead, think about how you can approach this question using statistics (see Unit 5A). You'll want to consider the following questions:
   - What sampling method will you use?
   - How can you ensure that your sample is likely to be representative? (The first method you think of may not be representative, so if necessary think about how you can modify it so that it will be representative.)
   - What percentage of the sky did you choose as your sample? How can you be sure of this?
     - You'll probably need either to create some apparatus to block out part of the sky or to use certain stars that are a known distance apart (for example, by using a star map as a guide). If you make an apparatus, note that "naked eye" means "without magnification," so you should only use a very simple apparatus and not (for example) a telescope. If you use a star map, note that it may list stars that are not visible to the naked eye in Boulder, so merely counting the stars on the map is not an acceptable way to approach this project.
     - This question may require you to use a bit of geometry. The formulas on pages 557 and 559 in your book may be useful. I'm also willing to help if you have questions.
   - How does knowing this percentage help you answer the main question? (see Unit 3A.)
2. Once you've figured out the method you're going to use, you should follow that method to perform your count.
   - This will be impossible (or at least really hard) on a cloudy night, so be sure to plan around the weather. Note also that there will be new moons on November 13 and on December 13 (which is after the due date), so it'd probably be best to do this portion of the project as close to one of those dates as you can since it will be easier to count the stars without light pollution from the moon.
   - Similarly, you'll get more accurate results if you can find a relatively dark place to do your observations and if you wait for your eyes to adjust to the dark before starting.
   - Be sure to record all pertinent conditions that might bias your answer (such as cloud cover, the time of day, the phase of the moon, etc.).

3. After you finish taking your sample, do it a second time. (You will use this below to discuss how certain your answer is.) You can do this directly following your first set of observations, or if you're feeling ambitious you can do to second observation on a different night to see how different sky conditions affect your answer.

Part 2: Analysis (100 pts)

You will present your results in the form of a paper that addresses the following questions. Please follow the guidelines for formal writing: don't just make a list.

1. What question are you trying to answer (or, in statistical language, what is the goal of your study)? What were your population, sample, population parameters, and sample statistics? How did you chose your sample (that is, what sampling method did you use)? Why do you think that your sample is likely to be representative?

2. Briefly describe the method you used in Part 1 in enough detail so that a person reading your description could duplicate your method.

3. Describe the pertinent sky conditions that you recorded when you were making your observations. How do you think that these conditions affected your answer? Were they likely to bias it in a particular direction (that is, were they likely to make you see more or fewer stars)?

4. How did you infer the population parameters from the sample statistics? (If you used any formulas from geometry or other facts/assumptions, state what they were and how you got them.) What answers did you reach to the overall question of the number of stars visible to the naked eye?

5. How much did your answers from steps 2 and 3 of Part 1 differ? Based on this, how accurate do you think your method was? Explain why you think this.

6. Based on all of the above, do you think that your answer is higher or lower than average for an observer in Boulder? Why do you think this? (This is possibly related to your answer to question #3.)

7. If someone at a different spot on the Earth repeated your method, would they get a different answer? What conditions would lead some to get a higher answer? What about a lower answer?