QRMS Project 2: The Stars in the Sky (Due November 14, 2011)

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, structured paper of between one and three pages length that meets the normal expectations for formal writing.

Part 1: Data Gathering

In this part, you will design your method and gather your data. However, nothing described in this part will appear directly in your paper (which is 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 choose a sample that is likely to 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 the New Moon is October 26th, so it'd probably be best to do this portion of the project as early as possible 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

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?

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 expect that your answer will be higher or lower than that of your classmates? Why do you think this?

7. If someone at a different spot on the Earth repeated your method, would they get a different answer? On what kind of spots on the Earth would an observer would be likely to get a higher number as an answer? What about a lower number?