Astr 150 Assignment 1: Some methods of science
due Thurs Jan 22, 2009

1. Use the "define" function in the google search engine (www.google.com) to list definitions of the word "postulate" (type the following in google - define: postulate). Consider only the noun form of the word. Read through the definitions and construct your own definition (25 words max).

2. A syllogism is an example of a proof. It consists of two postulates followed by a conclusion. An example of a syllogism would be:

   i All women are mortal.
   ii Marie Curie is a women.
   iii Therefore, Marie Curie is mortal.

The first two statements, (i) and (ii), are postulates. Statement (iii) is a conclusion. This grouping of three statements constitutes a formal proof.

Make up your own syllogism, labelling the two postulates and the conclusion (no word limit).

3. An experiment is an example of a demonstration. For example, when you release a basketball it will drop to the floor. You have demonstrated that gravity pulls objects together. When you pick up the basketball and release it again, then again it drops to the floor. You have demonstrated the action of gravity again. In no way have you shown that gravity always works to pull objects together for all time, and thus you have not "proven" how gravity works.

Write a paragraph on the difference between a "proof" and a "demonstration" (100 words max).

4. Meteorology is purely an observational science. We cannot build a planet and give it an atmosphere and then run experiments on it. All we can do is observe the weather, note any patterns or repetitions in the changes over time, and try to derive rules that enable us to make predictions.

Metallurgy is an experimental science. We can mix together two or more metals to produce a new metal. We can apply pressure to this metal to see if it bends or breaks. We can heat up the new metal to see if it melts at a low or high temperature. We can attach wires to it to see if it does or does not conduct electricity.

Of the two sciences, meteorology and metallurgy, which is astronomy most like? Defend your answer.

5. Imagine that two people, Yasmine and Zenia, are playing a game of cards. The cards are marked from 1 to 10, and are one of two colors, red or black. In the first round, Yasmine plays first. The first several rounds of the game go as follows:

   Round 6: Zenia plays a red 7. Yasmine plays a red 5. Zenia wins.
   Round 7: Yasmine plays a black 8. Zenia plays a red 5. Yasmine wins.
(a) What are the rules to the game? List at least TWO sets of rules that could account for all of the above observations.

(b) What play of cards would you need (you can give a specific example if you wish) to be able to say that one of your sets of rules was incorrect and one was correct?

(c) Is any information irrelevant to predicting the winner of each round?

(d) Suppose that Zenia told you that there was an invisible magician named Drac sitting at the card table. Drac decides the outcome of every round without any explanation, and communicates the outcome only to Zenia. Zenia now invites you to play the game with her for a wager of lots and lots of money. Would you accept her invitation? Why or why not?

The process of science works much like trying to find the rules to this card game. Whenever we find a rule, we call it a "law of science". We can never know if our laws are complete, or apply to every situation, or even if they are correct. We assume that the universe obeys laws, and is not whimsical and arbitrary like Drac the magician. We assume that results repeat, like round 1 and round 10 in the game above. We use controlled experiments to distinguish between multiple rule sets, like in question (b).

Requirements for a good assignment

- The assignment will be graded strictly, as expected for a university-level course. The assignment is graded out of 30 points.
- Have your name, SID, and a word count at the top of the paper. Use question-and-answer format when writing your assignment, do NOT hand in a run-on paragraph (50% penalty).
- Be typed, double-spaced, of maximum length 250 words. Assignments longer than 250 words will receive zero credit.
- Use quotations only to illustrate your point, not to make it. If you are unclear about this requirement, then speak with the instructor.
- Show completeness of information, conciseness of expression, have a logical development of ideas, and evidence of thought regarding the content.
- Be professional of presentation, e.g., no ragged ends, creases, or ink blobs on the paper.
- In all ways, the author should show pride in his/her work.