**Assignment Specifications : Centroid Lab**

Minimum Assignment :

Prepare a brief (approximately one page) report on the activities assigned on Thursday, March 11th. Describe the method (what did we do?), the goals (why did we do what we did?), the results (what did this tell us?), and comments (statement of degree of success/failure, improvements to lab design, important conceptual points, etc.)

This report should be type-written (word processed) and well written (grammatically correct). It is due promptly at the beginning of lab on Thursday, April 1st.

Additional Possible Assignments/Extensions on a Theme

I Research Paper

Write an essay explaining the concepts: centroid/center of mass/center of gravity.

This essay should be type-written (word processed) and well written (grammatically correct). Generally, I do not like to assign page lengths to essays because I believe it is counterproductive to the purpose of an essay. I feel the purpose of an essay is to express in writing something that you would like to communicate to others (classmates/co-workers/the press/society/etc.), and only you can judge how much/how little should or can be said about the subject. On the other hand I do have an idea of what I expect, an estimate of the "intellectual weight" of the essay. As a rough guideline, I would suggest a paper about four to six pages in length.

The essay should cover the following important points:

a) What is the difference between centroid, center of mass, and center of gravity? When are they the same and when are they different? What assumptions are made for each calculation?

b) How do you calculate these definitions? What is the difference between the linear case (dimension one), the planar case (dimension two), and the volume case (dimension three)? How does variable density occur in these formulas? This part might be filled in with some example calculations which could easily run 2-3 pages (adding on to the length as indicated above!).

c) Who really uses these definitions? Is this just silly math stuff to keep Adam employed, or do engineers/physicists REALLY use these calculations? In other words, what are some instances in which variable density and 1-, 2-, and 3-D calculations are necessary?

d) Etc. Make the essay your own. What do you want to say about this topic? Have you ever thought about a problem (a car sliding out of control, ice skater twirling around,....) that might relate to center of mass/center of gravity?

Due date is no later than Monday, May 3rd. If you wish to complete a rough draft, then it should be turned in to allow plenty of time for remarks. The Writing Center (in the basement of Dearlove) is an available resource.

II Oral Presentation

Singly or in groups, students may prepare an oral presentation about the lab. Students should consider including facets about the above issues (at a less information-intensive level than in a research paper). At the very least, students should generate one object of their own, demonstrate how to calculate the center of mass, and then demonstrate how well the object balances at the specified point. This object should not be simple (like a square), but should be unusual in some fashion. Ideas discussed during previous labs were (1) to draw any shape whatsoever (freehand sketch/random curves) and then use Riemann sums to approximate the center of mass, or (2) a combined shape (snow cone as a triangle plus a semicircle, an area in the plane, maybe between $x^3$ and $x^{1/2}$ , or some such , but definitely not too symmetric.)