The following is part of an old M.S. exam from Purdue University

A researcher in Food Science wants to investigate the effect of dietary fat and muscle atrophy on bone loss. To do this, he has formulated three dietary fat regimen (in addition to a control diet) and plans to feed these diets to mice that are either weight-bearing or non-weight-bearing (Note: the researcher has devised a special apparatus that suspends a mouse in a cage so it is non-weight bearing). Since a non-weight-bearing mouse will not use its muscles in the usual way, it is known that muscle atrophy (and potentially bone loss) will occur. It is unknown whether dietary fat alters this relationship.

The researcher would like help with the design. He has access to a lab room containing 40 cages and 14 suspension apparatuses for 8 weeks. Since a dietary regimen lasts two weeks, this would allow him up to four phases of the experiment. However, a mouse cannot switch diets immediately and thus cannot be used in consecutive phases.

Each mouse will have its bone density measured by X-ray machine at the beginning and end of a dietary regimen. The researcher is interested in the percent change in bone mineral density (BMD) over the two week period and would like to detect differences between treatments greater than 0.10%. A pilot study using the control diet/non-weight-bearing treatment resulted in a standard deviation in the percent change over a two week period of 0.15%.

Based on this information, your task is to describe how you would design the study (in a report no more than 5 pages). Make sure to describe all the design details (e.g., response, sample size) and how you plan to do the analysis. Also carry out any randomizations needed for your design.

On March 1st, we will exchange reports and critique them. To simplify this process for me, please turn in three copies of your report on March 1st. One will be for me and two will be handed out to other students. My copy should include your name. The other two copies can be anonymous if you prefer.

In addition, a few of you (3-4 students) will be selected to do a oral presentation of your report on March 1st. I will contact you before the end of the week if you are one of them. This report can be no longer than 10 minutes and should highlight the key aspects of your proposed experimental design.

Finally, you may have questions you’d like to ask the client prior to proposing a design. Please send these questions to me via email no later than Thur 2/23 at noon. I will respond to you with answers by Thur 2/23 at 2:30.