Math 20580: reverse engineering nutrition info
Due in class: Friday, September 24

Ground rules: You may (and I'd encourage you to) team up with one or two of your classmates to carry out the instructions below. The point here is analysis and conclusion rather than computation. Please don't show us any actual solving of linear systems. We want to know only the results of your computation and what you make of them. Write everything up in one or two pages, in nice clear complete sentences and paragraphs as if your grader is an actual human being who values good prose over core dumps from unexecutable computer programs. Graders will be encouraged to channel frustration in this regard through point totals.

Following is some nutrition information gleaned from various snack wrappers. Fat, carbohydrates, and protein are all given in grams.

#	**Snack**	**Calories**	**Fat**	**Carbs**	**Protein**
1	Cereal bar	140	3.5	27	2
2	Clif bar	240	5	44	10
3	Fruity Snacks	200	0	47.5	2.5
4	Granola bar	190	6	29	4
5	KitKat	280	15	37	4
6	M&M's	240	10	31	2
7	M&M's cookies	250	12	33	3
8	Power bar	240	4.5	42	10
9	Poptart	400	10	73	6
10	Take 5	200	11	25	4
11	Three Musketeers	260	8	46	2
12	Twix	250	12	33	2

Assuming that all the calories in these foods come from fat, carbs and protein and that the calorie content (i.e. Cals/g) is relatively constant across e.g. different types of protein, one can use any three rows in this table to set up and solve a linear system whose solution tells (or at least should tell) us the individual calorie content of each nutrient. Of course, one can also look this info up online. The first website I checked today gives 9 Cal/g for fat and 4 Cal/g for both carbs and protein. Having now blown the obvious punchline, I ask you to do the following:

(1) Try to verify the content info that I found by using various sets of three rows in the table to set up and solve linear systems. Find several sets where the answers are (relatively) better and several where they're worse. Try to make the sets as different as possible. Describe the results. Please *do* use Matlab or a calculator to help out.
(2) Give some possible non-linear algebra explanations for discrepancies between solutions and reality and among the solutions themselves.
(3) Keeping in mind that real-world data is always approximate, can you think of linear algebra explanations for the discrepancies. (Hint: try varying calorie numbers just a bit in your systems.)