# Learning Opportunity 1-5

AIMS-ZA Advanced Linear Algebra with Sage

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February 2, 2018

**1-5-1** Attempt to find the optimal production schedule (maximum profit) for OilCo by hand. See the problem description and production schedule in the `lo` directory of the course repository. (This problem has a due date of *Friday, in-class*).

**1-5-2** This exercise will help you become familiar with Sage's linear solvers.

You wish to design a daily diet for AIMS students which has the absolute minimum cost. But you are not heartless and want to provide some nutrition and variety. The optimal diet should:

1. Provide at least 2000 Calories.
2. Provide at least 55 grams of protein.
3. Provide at least 800 milligrams of calcium.
4. To ensure variety, there is a daily maximum limit on the number of portions of each food.
5. The table below provides additional required information.

| Food | Portion Size | Calories | Protein (g) | Calcium (mg) | Rand/Portion | Max Portions |
|---|---|---|---|---|---|---|
| Oats | 28 g | 110 | 4 | 2 | 3 | 4 |
| Chicken | 100 g | 205 | 32 | 12 | 24 | 3 |
| Eggs | 2 large | 160 | 13 | 54 | 13 | 2 |
| Milk | 250 ml | 160 | 8 | 285 | 9 | 8 |
| Cake | 170 g | 420 | 4 | 22 | 20 | 2 |
| Beans | 260 g | 260 | 14 | 80 | 6 | 2 |

**Table 1:** Food Specifications

1. Design and implement a model using Sage's linear programming solver. Solve the model to compute the minimum daily cost. Notice that this will assume the portions are divisible.
2. Read the Sage documentation (link to *Thematic Tutorial* on Course Calendar) to learn how to restrict your decision variables to integers, reflecting practicalities such as it may be hard to serve half of a soft-boiled egg. Solve this model.
3. Comment on the different values for the two different models. Explain this difference in general terms. For example, which model is more constrained?

Full marks for two solutions and a well-written commentary.