

ISyE 6669 A & Q HW Assignment 2

Due: 9/6/2002.

Consider the linear programming formulation for the diet problem discussed in class. The following notation will be used to describe the model:

- i Index for food item ($i = 1, \dots, I$).
- j Index for nutrient ($j = 1, \dots, J$).
- a_{ij} A parameter indicating amount of nutrient j in one serving of food item i .
- l_j A parameter indicating the minimum amount of nutrient j required in the diet.
- u_j A parameter indicating the maximum amount of nutrient j allowed in the diet.
- c_i A parameter indicating the cost per serving of food i .
- x_i The decision variable indicating the number of servings of food i in the diet.

The LP model of the diet problem is as follows

$$\begin{aligned} \min \quad & \sum_{i=1}^I c_i x_i \\ \text{s.t.} \quad & \sum_{i=1}^I a_{ij} x_i \geq l_j \quad \text{for all } j = 1, \dots, J, \\ & \sum_{i=1}^I a_{ij} x_i \leq u_j \quad \text{for all } j = 1, \dots, J, \\ & x_i \geq 0 \quad \text{for all } i = 1, \dots, I. \end{aligned}$$

1. Download the diet problem data from the class website <http://www.isye.gatech.edu/~sahmed/isye6669>, and solve the problem with your favorite linear programming solver. You can change the bounds (l_j and u_j) on the nutrient requirements (within some realistic values) if you do not like the menu. State the nutrient levels that you chose, the optimal solution and your comments on the optimal diet.
2. Provide a “taste” ranking between 0 and 10 for each of the food items in the data set. Reformulate the problem so as to maximize the taste of the diet with the additional constraint that the cost of the diet does not exceed the optimal cost that you got in part 1 by more than 10%. Solve the problem, state your taste ranking, the corresponding optimal solution and comment on the new diet plan.