

QR 26: Choice and Chance
The Mathematics of Decision Making

Unit III Study Guide: Optimization

Synopsis: To optimize means to make the most of a given situation. In each kind of optimization problem, there are things we can vary to change the value of the desired output. But usually we cannot vary these infinitely far; rather we bump into certain restrictions imposed by the real world. These *constraints* make the problem harder to solve. However, when the objective and the constraints are linear functions of the things we can change, there is an important and widely used solution method known as linear programming.

References: Reading from the first two are in the sourcebook. The last two are handouts also available on the course webpage.

- [HH] Harnett and Horrell, *Data, Statistics, and Decision Models with Excel*.
- [DSS] Dorfman, Samuelson, and Solow, *Linear Programming and Economic Analysis*.
- [R1] Rosenberg, N. UMAP Module 453: "Linear Programming in Two Dimensions: I"
- [R2] Rosenberg, N. UMAP Module 454: "Linear Programming in Two Dimensions: II"

For Class III.1 on March 2, 2000

Topics: Examples of optimization problems. Anatomy of such problems: objective function, choice variables, and constraints. Feasibility sets.

Due: Unit III Activity

For Class III.2 on March 7, 2000

Topics: Pareto Frontier in Choice Space. Graphical solution of Linear Programming problems. The corner principle. Key assumptions in this method.

Read: Sections 12.1--12.3 of [HH] and as much of [DSS], Chapter 2, as you can.

For Sections II.1 on March 7-8, 2000

Topics: More discussion and examples of Linear Programming, with and without Excel.

For Class III.3 on March 9, 2000

Topics: Using Excel for Linear Programming. Solver. Solver Reports and their interpretations. Slack and binding constraints. Shadow prices. Sensitivity.

Read: Section 12.4--12.7 of [HH].

For Class III.4 on March 14, 2000

Topics: McDonald's Case Discussion (see below). Examples of nonlinear, integer, and other kinds of optimization problems.

Due: Unit III Exercises. Case Preparation.

Unit III Case Assignment

[HH, Short Case 12.1] Your task is to design a list of *all* the foods a person will eat during one day at McDonald's. All three meals (breakfast, lunch, and dinner) are to be eaten there. This diet must be nutritional—that is, it must provide at least 100% of the U.S. required daily allowance of calcium, iron, and the major vitamins. In addition, the diet should supply at least 55 grams of protein, contain at most 3 grams of sodium, and obtain at most 30% of its calories from fat. The diet must be at least moderately appealing; for example, eating three salads in a day might be nutritional, but hardly appealing to most people. Finally, the diet must be a least-cost diet. Nutritional facts can be found on the Web: http://www.mcdonalds.com/food/nutrition_facts/. Prices you will have to find from a local McDonald's franchise since these vary from location to location.