This is not a book on Linear Programming (LP). This is a book on decision making. It is a book on behavior, specifically resource-allocation behavior. But just as people’s decision making under choice cannot be studied in the absence of an understanding of Bayesian math, neither can people’s decisions about the allocation of resources be understood without an understanding of LP. LP is the mathematical model used in Operations Research and Management Science to find the optimal solution to resource-allocation problems when certain variables are known. This chapter will provide the reader with a very fundamental introduction to LP but it is far beyond the scope of this book (and the ability of the authors) to provide a comprehensive tutorial on all aspects of LP. Hundreds of books have been written on the topic since Dantzig’s 1963 Linear Programming and Extensions. But if the reader wishes to explore the topic in depth, one very authoritative place to start would be *Linear Programming* (Dantzig & Thapa, 1997).

LP is used in industry, economics, and government to find the optimal solution to complex problems involving the mixture of ingredients, scheduling, transportation, and other high-capital applications. The annual savings in the U.S. attributable to LP have estimated in the billions of dollars. George B. Dantzig was awarded the National Medal of Sciences from the President of the United States “for inventing Linear Programming and for discovering the Simplex Algorithm that led to wide-scale scientific and technical applications to important problems in logistics, scheduling, and network optimization.”
An Illustration: The Hungry Busy Student

By way of introduction to LP, let us consider the college student with a limited weekly budget for food and a limited amount of time. This same example will be used in Chapter 8 but is introduced here in additional detail to serve as a more general discussion of LP.

Our student has two choices from which to obtain meals. The student may shop at a supermarket for low-cost food in its unprepared state, take it home to cook it, eat it, and clean up afterwards. This is an economical choice in terms of dollars, but it is also a choice that consumes a considerable amount of time. Our student can also obtain meals from a restaurant. Restaurant meals are convenient and do not require the time to be spent in shopping, preparation, and clean-up. But restaurant meals are more expensive.

In this problem, our busy student must subsist on a weekly food allowance of $75 and is only able to devote 15 hours per week to meals. This food allowance and time limitation applies to all aspects of food and eating and includes eating in a restaurant as well as shopping, cooking, eating at home, and clean-up. Our student estimates that home-cooked meals will average $2.50 each and take one hour of time when shopping, cooking, eating, and clean-up are included, while restaurant meals will average $5.00 and take only a half hour. So our student constructs the following matrix of resources to be allocated:

<table>
<thead>
<tr>
<th></th>
<th>Home-Cooked Meals</th>
<th>Restaurant Meals</th>
<th>Resources Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Money</td>
<td>$2.50</td>
<td>$5.00</td>
<td>$75</td>
</tr>
<tr>
<td>Time</td>
<td>60 Minutes</td>
<td>30 Minutes</td>
<td>15 Hours</td>
</tr>
</tbody>
</table>

Formulating the Problem as Linear Programming

Of course students have proven to be skilled at subsisting on such limited resources for years without knowing LP. But here we will attempt to formulate the problem as an LP problem and determine what the single optimum solution