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WDI PUBLISHING

note 1-429-307
November 16, 2012

Note on Linear Programming: A Brief Overview

This note is intended to be used with *Note on the Use of Solver in Excel* (WDI Publishing #1429308)

In some situations, the available resources are adequate to carry out the alternative operating plan selected. In others, however, this is not true. For example, a machine only has a certain amount of capacity. If that capacity is entirely used by one product, it cannot be used for another. Similarly, a factory building has room for only so many machines. In these situations, there are constraints on the uses of resources.

Linear programming provides a model for solving problems that involve several constraints. In it, a series of linear mathematical relationships is developed. The first, called the objective function, is the quantity to be optimized. This is usually a formula for differential costs, which the model will minimize, or one for differential income, which is to be maximized. The other statements express the constraints of the situation.

Example. A company makes two products, each of which is worked on in two departments. Department 1 has a capacity of 500 labor-hours per week; Department 2 has 600 labor hours. The labor requirements of each product in each department are:

	Labor Hours per Unit	
	Product A	Product B
Department 1	5.0	2.5
Department 2	3.0	5.0

As many units of B as can be made also can be sold, but a maximum of 90 units of A can be sold per week. The unit contribution (i.e., unit price minus unit variable costs) is $2 for A and $2.50 for B. How many units of each should be made in order to maximize total contribution?

The problem can be expressed mathematically as follows:

Maximize:	$C = 2A + 2.5B$	(maximize contribution, the objective function)
Subject to:	$5A + 2.5B \leq 500$	(Department 1 capacity constraint)
	$3A + 5B \leq 600$	(Department 2 capacity constraint)
	$A \leq 90$	(Product A sales constraint)
	$A \geq 0, B \geq 0$	(A negative number of units cannot be made)

Published by WDI Publishing, a division of the William Davidson Institute (WDI) at the University of Michigan.