CHAPTER 2
LINEAR PROGRAMMING: BASIC CONCEPTS

Review Questions

2.1-1 Ponderosa Industrial uses linear programming monthly to guide the product-mix decision.

2.1-2 Overall profitability has increased by 20%. Better utilization of raw material, capital equipment, and personnel also resulted.

2.1-3 The goal was to improve the utilization of reservation personnel by matching work schedules to customer needs.

2.1-4 United Airlines saved more than $6 million annually in direct salary and benefit costs. Customer service also improved and workloads were reduced for support staff.

2.1-5 The SDM system is used to coordinate the supply, distribution and marketing of each of Citgo's major products throughout the United States.

2.1-6 Citgo saved about $14 million annually in interest expenses. Improvements in coordination, pricing, and purchasing decisions added at least $2.5 million more to annual profits.

2.2-1 They provide the highest quality available in the industry for the most discriminating buyers.

2.2-2 1) Should the company launch the two new products?

2) What should be the product mix for the two new products?

2.2-3 The group was asked to analyze product mix.

2.2-4 Which combination of production rates for the two new products would maximize the total profit from both of them.

2.2-5 1) available production capacity in each of the plants

2) how much of the production capacity in each plant would be needed by each product

3) profitability of each product

2.3-1 1) What are the decisions to be made?

2) What are the constraints on these decisions?

3) What is the overall measure of performance for these decisions?

2.3-2 When formulating a linear programming model on a spreadsheet, the cells showing the data for the problem are called the data cells. The changing cells are the cells that contain the decisions to be made. The output cells are the cells that provide output that depends on the changing cells. The target cell is a special kind of output cell that shows the overall measure of performance of the decision to be made.

2.3-3 The Excel equation for each output cell can be expressed as a SUMPRODUCT function, where each term in the sum is the product of a data cell and a changing cell.

2.4-1 1) Gather the relevant data.

2) Identify the decisions to be made.

3) Identify the constraints on these decisions.

4) Identify the overall measure of performance for these decisions.

5) Convert the verbal description of the constraints and measure of performance into quantitative expressions in terms of the data and decisions

2.4-2 Algebraic symbols need to be introduced to represents the measure of performance and the decisions.

2.4-3 A decision variable is an algebraic variable that represents a decision regarding the level of a particular activity. The objective function is the part of a linear programming model that expresses what needs to be either maximized or minimized, depending on the objective for the problem. A nonnegativity constraint is a constraint that express the restriction that a particular decision variable must be greater than or equal to zero. All constraints that are not nonnegativity constraints are referred to as functional constraints.

2.4-4 A feasible solution is one that satisfies all the constraints of the problem. The best feasible solution is called the optimal solution.

2.5-1 Two.

2.5-2 The axes represent production rates for product 1 and product 2.

2.5-3 The line forming the boundary of what is permitted by a constraint is called a constraint boundary line. Its equation is called a constraint boundary equation.

2.5-4 The coefficient of x_1 gives the slope of the constraint boundary line. The constant term gives the value where the line intercepts the x_2-axis.

2.5-5 The easiest way to determine which side of the line is permitted is to check whether the origin (0,0) satisfies the constraint. If it does, then the permissible region lies on the side of the constraint where the origin is. Otherwise it lies on the other side.

2.6-1　The Solver dialogue box.

2.6-2　The Add Constraint dialogue box.

2.6-3　The Assume Linear Model option and the Assume Non-Negative option.

2.7-1　Cleaning products for home use.

2.7-2　Television and print media.

2.7-3　Determine how much to advertise in each medium to meet the market share goals at a minimum total cost.

2.7-4　The changing cells are in the column for the corresponding advertising medium.

2.7-5　The objective is to minimize total cost rather than maximize profit. The functional constraints contain $\geq$ rather than $\leq$.

2.7-6　No.

2.7-7　Closer to the origin.

2.8-1　No.

2.8-2　The graphical method helps a manager develop a good intuitive feeling for the linear programming is.

2.8-3　1)　where linear programming is applicable

2)　where it should not be applied

3)　distinguish between competent and shoddy studies using linear programming.

4)　how to interpret the results of a linear programming study.

Problems

2.1　a)　The two factors that often hinder the use of optimization models by managers are cultural differences and response time. Cultural differences cause managers and model developers to often have a hard time understanding each other. Response time is often slow due to the time to translate, formulate, and solve the manger's problem using optimization systems.

b)　The company shifted from an emphasis on the manufacture of thicker plywoods to thinner plywoods.

c)　Ponderosa plans to use optimization in the use of timber for other products also. In addition, optimization may be used for raw material and inventory management and for financial planning.