Lesson 6. Blending Models

Example 1 (Problem 2.3 in Rader). A film packaging plant can manufacture four different thicknesses (1, 3, 5, and 0.5 mm) in any combination. Each thickness requires time on each of the three machines in minutes per square yard of film, as shown in the table below. Each machine is available 60 hours per week. The table also gives revenue and cost per square yard for each thickness. Variable labor costs are $25 per hour for machines 1 and 2, and $35 per hour for machine 3. Formulate and solve a profit-maximizing LP model for this problem, given the maximum demands for each thickness.

Thickness	Time (min) 1	2	3	Max Demand	Revenue	Cost
1 mm	5	8	9	400	110	30
3 mm	4	7	5	250	90	10
5 mm	4	5	4	200	60	10
0.5mm	6	10	6	450	100	20

Example 2. The Hoosier Gasoline Company produces two blends of gasoline, regular and premium, by mixing three different types of oil. Each type of oil comes in barrels and has its own costs and octane ratings, which are given below:

Type	Cost/Barrel	Octane Rating
1	45	93
2	35	90
3	20	87

Premium gasoline must consist of at least 30% Type 1 oil. In addition, the minimum average octane rating and minimum production requirements for each blend are as follows:

Blend	Average Octane Rating	Demand
Regular	89	15,000 barrels
Premium	91	12,500 barrels

Formulate a linear program that determines how to meet the demand for each blend of gasoline at minimum cost.

Example 3. You are a portfolio manager in charge of a bank portfolio with $10 million to invest. There are 5 different securities available:

Bond name	Bond type	Years to maturity	Rate of return at maturity
1	Municipal	9	4.3%
2	Agency	15	2.7
3	Government	4	2.5
4	Government	3	2.2

The bank has some policies that limit how you can construct your portfolio:

1. Municipal and agency bonds must total at least $4 million
2. The average years to maturity of the portfolio must not exceed 5 years
3. Bonds cannot be "shorted" (cannot buy negative amounts of bonds)

Write a linear program that determines a portfolio of the above securities that maximizes earnings.