CS231: Topics in Combinatorial Algorithms **Prof. Suri**

Homework Assignment 4

Handed Out: Nov. 23 *Due: Dec. 2*

1. Modern Furniture Inc. produces two types of wooden chairs. Manufacturing chair A requires 2 hours of assembly time and 4 hours of finishing time. Chair B requires 3 hours to assemble and 3 hours to finish. Modern estimates that next week 72 hours will be available for assembly and 108 hours for the finishing operations. The unit profits for Chairs A and B are \$10 and \$9, respectively. If it is estimated that the maximum demand for Chair B is 16, what is the optimal product mix? Formulate a linear programming model and solve it using the graphical method.

2. Suppose you wish to acquire unit quantity of each of the n products, $i = 1, 2, \ldots, n$. In the market, these are m *package* deals, $j = 1, 2, \ldots, m$, that bundle these products in various combinations. For instance, one such package might contain one unit each of products $3, 7$ and 15, and cost \$50. Such a package can be specified as the tuple $\langle (3, 7, 15), \$50 \rangle$. Given the list of n products you desire, and the m packages that the market offers, formulate a linear program that models the problem of acquiring unit quantity of all n products at the *minimum possible total cost*. Your solutions may accept *fractional* packages.

   (You don't have to solve the linear program; just formulate it.)

3. An automotive firm produces 3 types of cars: luxury, midsize, compact. These three types have gasoline mileage of 18, 29, and 38 miles/gallon, respectively. They generate profits of \$600, \$460, and \$320 per car, resp. The estimated demands are 600,00 units for luxury, 800,000 for midsize, and 700,000 for compact. Government regulations require that the *average* gasoline mileage for the company's entire line of cars should be at least 30 miles/gallon. Formulate the linear programming model for this problem to maximize the company's profit.

   (You do not have to solve the problem; just describe the LP formulation.)