

**Deterministic Math Models (550.251)**  
**Homework 2 (Due Thursday, February 14, 2008)**

**General Directions:** You must show all work and document any assumptions to receive full credit. All problems are to be done by hand unless otherwise stated. When formulating linear programs, make sure you define your variables and label all constraints.

Algebraically formulate a linear program to determine the best solution for the situations stated in the problems 1–3 below. Then solve your models using Excel. Make sure you print out your Excel Answer Report.

1. Winston & Albright: Problem 3.11.30(a)
2. Winston & Albright: Problem 4.9.58(a).
3. Winston & Albright: Problem 4.9.64.
4. Exclaim! Jeans is setting up a production schedule for the coming week. Exclaim! can make four jeans products: mens and womens jackets and pants. Although it can make different sizes of each, the variation in material usage and labor between sizes is negligible. Each jacket and pair of pants goes through cutting and stitching operations before being boxed. The following table gives the profit, denim, cutting time, stitching time, and boxing time required per 100 items, as well as the total resource availabilities during the week.

<i>Item</i>	<i>Profit</i>	<i>Denim (yds)</i>	<i>Cutting (hrs)</i>	<i>Stitching (hrs)</i>	<i>Boxing (hrs)</i>
Men's Jackets	\$2000	150	3	4.0	0.75
Women's Jackets	\$2800	125	4	3.0	0.75
Men's Pants	\$1200	200	2	2.0	0.50
Women's Pants	\$1500	150	2	2.5	0.50
Available this week		2500	36	36.0	8

**NOTE:** Parts (b), (c), and (d) are independent of each other.

- (a) Develop and solve (using Excel) a linear programming model for Exclaim! Jeans which will maximize its profit for the week.
- (b) Suppose that, in addition to the existing restrictions, management wishes to produce at least 500 of each item. Add these constraints to your linear program and re-solve the problem using Excel. What is the result? To what do you attribute this result?
- (c) Suppose the minimum production for each item is 300. Use Excel to find an optimal solution.
- (d) Suppose a constraint was added that requires the production of at least 500 mens items. Use Excel to find an optimal solution.

5. Magnolia Homes of Houston, Texas has received a grant from the federal government to build a community of homes on a local 9-acre site geared toward low- to middle-income families. Magnolia is planning to build both 1400-square-foot detached family homes and attached 1100-square-foot townhomes on the site. The total acreage required per house (including the yard and allowances for streets, driveways, etc.) is .40 acre per detached home and .15 acre per townhome. Each detached home is expected to take 1600 man-hours to complete, while each townhome is expected to take 800 man-hours. The contract Magnolia has with the government contains the following clauses:

1. The project must be completed in 4 months.
2. The government will pay Magnolia enough to earn a \$25,000 profit on each detached home and \$12,000 on each townhome.

Magnolia has a skilled labor force of 70 workers, each capable of working 160 hours per month.

- (a) Formulate and solve (using Excel) as a linear programming model.
- (b) Suppose there were a clause in the contract requiring at least as many townhomes be built as detached homes. Why do you not have to re-solve the model in part (a)?
- (c) Suppose the contract included a clause requiring at least as many detached homes be built as townhomes. What is the optimal solution to the linear model? Round this solution so that all variables are integers and all constraints are satisfied.