

## IMSE 500: Models of Operations Research

### HW#1

#### Problem 1.

We begin with a few problems to acquaint you with the AMPL software that will be used in this course.

- Download AMPL software (demo version) on <http://ampl.com/products/ampl/ampl-for-students/>.
- Read the Introduction and Chapter 1 ("Production Models: Maximizing Profits") of *AMPL: A Modeling Language for Mathematical Programming* on <http://www.ampl.com/BOOK/download.html>.
- From the canvas site (<http://canvas.umd.umich.edu/>) download files **steel4.mod** and **steel4.dat** corresponding to the contents of Figure 1–6 (on pages 16 and 17).
- Use the AMPL system to translate and solve the optimization problem represented by your two files. The listing that starts at the bottom of page 16 shows how to do this.
- Check that you get the same results as shown in the page 16 listing; in particular, the optimal objective value should be reported as 190071.4286. If not, correct your files before proceeding.

#### Problem 2.

In the file steel4.dat, profit per ton of coils is set at 30. To try another value — say, 31 — you need only type the command:

```
let profit["coils"] := 31;
```

Then you just type solve as before to re-solve with this modified data. By repeating this procedure, you can easily try a series of profit values.

- In the optimal solution from page 17, coils are produced only at the lowest possible level, 500 tons. How much would the profit per ton on coils have to increase, in order that it would be optimal to produce more than 500 tons? By experimenting with different possibilities, answer this question to the nearest dollar per ton. Write (on paper) a very brief summary of your findings.
- Draw an approximate graph of profits versus profit per ton of coils, where the profit per ton ranges from 30 to 40. Draw a similar graph of production of coils versus profit per ton of coils.

### Problem 3.

An advertising company wishes to plan an advertising campaign in three different media: television, radio, and magazines. The purpose of the advertising program is to reach as many potential customers as possible. The results of a market study are given below:

	Television		Radio	Magazines
	Daytime	Prime time		
Cost of advertising unit	\$40,000	\$75,000	\$30,000	\$15,000
# of potential customers	400,000	900,000	500,000	200,000
# of women customers	300,000	400,000	200,000	100,000

The company does not want to spend more than \$800,000 on advertising. It further requires that (1) at least 2 million exposures take place among women; (2) advertising on television be limited to \$500,000; (3) at least three advertising units be bought on daytime television, and two units during prime time; and (4) the number of advertising units on radio and magazines should each be between 5 and 10. Formulate the LP model for this problem and solve it using AMPL. Be sure to state precisely the definitions of your decision variables, and explain in a few words the purpose of each type of constraint. The complete AMPL model and data should be submitted in the files adsplan.mod and adsplan.dat.