CS635 – Problem Set #4

Due Date: February 20, 2009

Instructions for Handing In Homework

Formulate the following problems in GAMS and solve them. Submit this assignment electronically using the instructions on the course web page. You should hand in exactly 6 files with the following names: `hw4-1.gms, hw4-1.txt, hw4-2.gms, hw4-2.txt, hw4-3.gms, hw4-3.txt`.

Use an editor to extract the required lines of output to the "txt" file, namely the model and solution status, the optimal values for the variables and the optimal value of the objective function. Ensure you use self-explanatory variable names.

1 Sugar Cane Production

The harvest of cane sugar in Australia is highly mechanized. The sugar cane is immediately transported to a sugar house in wagons that run on a network of small rail tracks. The sugar content of a wagon load depends on the field it has been harvested from and on the maturity of the sugar cane. Once harvested, the sugar content decreases rapidly through fermentation and the wagon load will entirely lose its value after a certain time. At this moment, eleven wagons all loaded with the same quantity have arrived at the sugar house. They have been examined to find out the hourly loss and the remaining life span (in hours) of every wagon; these data are summarized below:

Lot	1	2	3	4	5	6	7	8	9	10	11
Loss(kg/h)	43	26	37	38	13	54	62	49	19	28	30
Life span (h)	8	8	2	8	4	8	8	8	8	8	8

Every lot may be processed by any of the three, fully equivalent production lines of the sugar house. The processing of a lot takes two hours. It must be finished at the latest at the end of the life span of the wagon load.

1.1 Problem

The manager of the sugar house wishes to determine a production schedule for the currently available lots that minimizes the total loss of sugar. Write a GAMS model to do this. Ensure that you display only when each wagon is unloaded and the loss of product from each wagon in each unloading period.

2 File Storage

Currently, the State University can store 200 files on hard disk, 100 files in computer memory, and 300 files on tape. Users want to store 300 word-processing files, 100 packaged-program files, and 100 data files. Each month a typical word-processing file is accessed 8

times, a typical packaged-program file 4 times, and a typical data file 2 times. When a file is accessed, the time is takes for the file to be retrieved depends on the type of file and the storage medium:

	Word-Proc	Package-Prog	Data
Hard Disk	5	4	4
Memory	2	1	1
Tape	10	8	6

2.1 Problem

The goal is to minimize the total time per month that users spend accessing their files. Determine where files should be stored.

3 Steel Erectors

A construction company's work schedule on a certain site requires the following number of skilled personnel, called *steel erectors*, in the months of March through August:

Month	mar	apr	may	jun	jul	aug	sep
Personnel	4	6	7	4	6	2	3

Personnel work at the site on the monthly basis. Suppose that three steel erectors are on the site in February and three steel erectors must be on site in September. The problem is to determine how many workers to have on site in each month in order to minimize costs, subject to the following conditions:

Transfer costs: Adding a worker to this site costs $100 per worker and redeploying a worker to another site costs $160.

Transfer rules: The company can transfer no more than three workers at the start of any month, and under a union agreement, it can redeploy no more than one-third of the current workers in any trade from a site at the end of any month.

Shortage time and overtime: The company incurs a cost of $200 per worker per month for having a surplus of steel erectors on site and a cost of $200 per worker per month for having a shortage of workers at the site (which must be made up in overtime). Overtime cannot exceed 25 percent of the regular work time.

3.1 Problem

Formulate this problem as a shortest path problem and solve it. Ensure that you print out how many workers are working in each month. Furthermore, ensure that your model uses an option file for cplex that extracts the network problem from the model, and solves the model using the network simplex method.