ISyE/CS635 – Problem Set #5

Due Date: March 7, 2014

Formulate the following problems in GAMS and solve them. Please follow the instructions given in the problems closely. Submit this assignment electronically to the drop box. You should hand in exactly 3 files with the following names: hw5-1.gms, hw5-2.gms, hw5-3.gms

1 Electric Power

The following network represents an electrical power distribution network connecting power generating points with power consuming points.



The arcs are undirected; that is, power may flow in either direction. Points 1,4 and 7 are generating points with generating capacities and unit costs given by the following

	1	4	7
Capacity (in thousands of kilowatt hours)	100	60	80
Unit cost (\$ per thousand KWH)	15.0	13.5	21.0

Points 2, 5 and 6 are consuming points with demands of 35,000, 50,000, and 60,000 KWH respectively. There is no upper bound on transmission line capacity and the unit cost of transmission on each line segment is \$11.00 per 1000 KWH.

1.1 Problem

Set up this problem as a minimum cost network flow problem, using a carefully labeled diagram. Make sure you have directed arcs in your formulation and the sum of the divergences is zero.

1.2 Problem

Write down a solution to the resulting problem and verify its optimality.

2 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.

2.1 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.

3 Construction

During the next 4 months a construction firm must complete three projects. Project 1 must be completed no later than 3 months from now and requires 8 worker-months of labor. Project 2 must be completed no later than 4 months from now and requires 10 workermonths of labor. Project 3 must be completed no later than 2 months from now and requires 12 worker-months of labor. Each month 8 workers are available. During a given month, no more than 6 workers can work on a single job.

3.1 Problem

Determine whether all three projects can be completed on time.