CS635 – Problem Set #1

Due Date: January 31, 2014 **11AM**

Instructions for Handing In Homework

- You should turn in one GAMS file for each problem. The files should be named `hw1-1.gms`, `hw1-2.gms` and `hw1-3.gms`. In the gams file you should display *exactly* the information specified in the problem. Please follow the directions carefully.

1 Warm-Up Problem

1.1 Problem

Enter and solve the following linear program in GAMS

$$\begin{array}{ll} \min_{x_1,x_2,x_3} & 3x_1 + 2x_2 - 33x_3 \\ \text{subject to} & x_1 - 4x_2 + x_3 \leq 15 \\ & 9x_1 + 6x_3 = 12 \\ & -5x_1 + 9x_2 \geq 3 \\ & x_1, x_2, x_3 \geq 0 \end{array}$$

Use the statement "option limrow=0, limcol=0;" to suppress some of the compiler output (not needed in this exercise) from the "lst" file. Also use the expression "positive variables" to get the lower bounds on the variables instead on setting the lower bounds with "lo". You should have your gams file display the solution. You should create parameters `objval`, `x1val`, `x2val`, and `x3val` to do this as follows.

Assuming that you call your (GAMS) decision variables `x1`, `x2`, and `x3`, and your objective variable is `obj`, your code will look like:

```
parameter x1val, x2val, x3val, objval;
objval = obj.l ;
x1val = x1.l ;
x2val = x2.l ;
x3val = x3.l ;
display objval, x1val, x2val, x3val ;
```

2 Index sets and bounds

2.1 Problem

Use an appropriate set J and declare variables $x(J)$ along with upper and lower bound statements to formulate and solve:

$$\begin{array}{ll} \max_{x_1,x_2,x_3} & 5(x_1 + 2x_2) - 11(x_2 - x_3) \\ \text{subject to} & 3x_1 \geq x_1 + x_2 + x_3 \\ & 0 \leq x_j \leq 3, j = 1, \ldots, 3 \end{array}$$

You should enter the problem as written above - there is no need to do arithmetic to simplify the objective or constraints. Ensure the model is called `prob2`.

Look through the solution report in the listing file to ensure that you understand where all the relevant pieces of information are stored. Use a display statement to print out the level values of the variables, their lower and upper bounds, and the value of the objective function:

```
display x.l, x.lo, x.up, prob2.objval;
```

3 Pig Valve Production

U.S. labs manufactures mechanical heart valves from the heart valves of pigs. Different heart operations require valves of different sizes. U.S. Labs purchases pig valves from three different suppliers. The cost and size mix of the valves purchased from each supplier are given as:

Supplier	Cost ($)	% large	% medium	% small
1	5	40	40	20
2	4	30	35	35
3	3	20	20	60

Each month, U.S. Labs places an order with each supplier. At least 500 large, 300 medium and 300 small valves must be purchased each month. Due to limited availability of pig valves, at most 700 valves per month can be purchased from each supplier.

3.1 Problem

Write a GAMS model to determine how you should acquire the needed pig valves while minimizing cost? You should use a set `suppliers` in your model, and determine a variable `aquire` that you display in the listing file using:

```
display acquire.l;
```