CS635 – Problem Set #1

Due Date: January 30, 2015 **11AM**

Instructions for Handing In Homework

- You should turn in (via dropbox on learn@uw) 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 Soft Suds

The Soft Suds Brewing and Bottling Company, because of faulty planning, was not prepared for the UW Comp Sci Department. There was to be a big party in Madison and Gus Guzzler, the manager, knew that Soft Suds would be called upon to supply the refreshments. However the raw materials required had not been ordered and could not be obtained before the party. Gus took an inventory of the available supplies and found the following:

```
Malt    90 units
Hops    40 units
Yeast   80 units
```

Soft Suds produces two types of pick-me-ups: light beer and dark beer, with the following specifications:

	Malt	Hops	Yeast
Light Beer	2	3	2
Dark Beer	3	1	5/3

Note that fractions (such as 5/3) may not be entered directly but must be approximated, or calculated in an assignment. The light beer brings $2.00/gallon profit, the dark beer $1.00/gallon profit.

3.1 Problem

Assuming that Comp Sci students will buy whatever is made, formulate the linear program Gus must solve to maximize profits, and solve it using GAMS.