CPSC 4850/5850/7850 – Algorithms in OR	
Assignment 3, total 10(20) pts	**Due Mar 18**

Instructions: hand in your written or typed answers in class on the due date shown. If you are taking the class as undergraduate, problems marked *(GRAD)* are optional.

Problem 1) **[10 pts]** Using the pivoting function implemented in Assignment 2, write a revised simplex algorithm in Octave (as discussed in class and in Chapter 7 of your text). Your algorithm should solve LP given in standard form. The input is: the cost vector, the coefficient matrix, the right hand side. The output is: status (OPTIMAL, INFEASIBLE, or UNBOUNDED), the value of variables at optimal, the optimal cost, the optimal dual variables, the reduced costs at the optimal solution, and the number of pivot operations in phase 1 and phase 2 of the simplex algorithm.
Using your code, solve the two assignment problems with cost matrices given in Exercise 5.1 in your text. Then solve with Octave's simplex routine, *glpk*, the same two problems and compare results.
Submit:

(a) Send by e-mail, before class on the due date, the required octave source files for your implementation, appropriately commented.

(b) Submit on paper a short documentation for your routine where you describe how to invoke the code and you discuss any assumptions that you made in your code.

(c) Submit on paper the solutions consisting of primal and dual variables, objective function, and reduced costs for the two assignment problems from Exercise 5.1, that you obtained with your routine and with Octave's *glpk* function. Make sure you describe your notation and your decision variables.

Note: Be careful how you carry out comparisons using floating point numbers. A very simple way of guarding against computation errors is to use a small positive value ϵ so that you will consider $a > b$ iff $a - \epsilon > b$ and $a = b$ iff $b - \epsilon \le a \le b + \epsilon$.

Problem 2) **[10 pts]** (GRAD) Find a feasible solution to the following system of linear constraints, using the simplex method. (You may use Octave as an aid in the computations).

x_1	x_2	x_3	x_4	
1	0	1	-1	$= 3$
1	1	2	0	$= 10$
1	1	1	-2	≥ 14

$x_j \geq 0$ for all j

If the system is infeasible, use the information from the final simplex tableau to determine how to modify the original right hand side constraints to make the system feasible.
From your answer, show that every feasible solution to the system

$$x_1 + x_3 - x_4 = 3$$
$$x_1 + x_2 + 2x_3 = 10$$

must satisfy $x_1 + x_2 + x_3 - 2x_4 < 14$.
Submit your answers on paper.