MA2210 - D term 2016
Homework II
Show all work.

ONE

Consider the following problem:

$$\begin{aligned} \text{maximize} \quad & z = 3x_1 + 2x_2 \\ \text{subject to} \quad & -x_1 + 3x_2 \leq 12 \\ & x_1 + x_2 \leq 8 \\ & 2x_1 - x_2 \leq 10 \\ & x_1, x_2 \geq 0 \end{aligned}$$

a) Graph the feasible region of the problem labelling clearly.
b) Find the optimal solution to this problem using the graphical method.
c) List each corner point feasible (CPF) solution and the pair of constraint boundary equations that each one satisfies.
d) Write the augmented form of this LP.
e) List the basic feasible solutions (BFS) associated with each CPF and, for each BFS, identify the basic variables and the non-basic variables.

TWO

Weecare Nursing Home in Elderlee, Arizona has the following staffing demands for nursing assistants during each 24-hour period:

Hours	**Staff Needed**
12 a.m. to 6 a.m.	4
6 a.m. to 10 a.m.	8
10 a.m. to noon	5
noon to 2 p.m.	8
2 p.m. to 5 p.m.	4
5 p.m. to 8 p.m.	7
8 p.m. to 10 p.m.	5
10 p.m. to midnight	3

Each nursing assistant works 4 hours, is off one hour, and then works another 4 hours. An assistant can be scheduled to start work at any hour. Formulate the appropriate linear program to minimize the number of nursing assistants that should be hired.

THREE

Consider the following problem.

$$\begin{array}{llllllll} \text{maximize} & 5x_1 & + & 4x_2 & + & 3x_3 & & \\ & & & & & & & \\ \text{subject to} & 2x_1 & + & 3x_2 & + & x_3 & \leq & 6 \\ & 4x_1 & + & x_2 & + & 2x_3 & \leq & 14 \\ & 3x_1 & + & 4x_2 & + & 2x_3 & \leq & 10 \\ & 0 & \leq & x_1, & x_2, & x_3. & & \end{array}$$

a) Work through 3 tableaux of the simplex method. That is, after getting the first tableau, go through two pivot steps. Clearly state the 3 basic feasible solutions and corresponding objective values that are associated with each tableau.
b) Use the Excel Simplex Solver to solve the problem. Record the intermediate solutions and include them in your write-up. Email your Excel file to the TA.

FOUR

Suppose that the following constraints have been provided for a linear programming model with decision variables x_1 and x_2:

$$\begin{aligned} 2x_1 - x_2 &\leq 20 \\ x_1 - 2x_2 &\leq 20 \\ x_1, x_2 &\geq 0. \end{aligned}$$

a) Demonstrate graphically that the feasible region is unbounded.
b) If the objective is to maximize $z = -x_1 + x_2$, does the model have an optimal solution? If so, find it. If not, explain why not.
c) Repeat *b)* when the objective is to maximize $z = x_1 - x_2$.
d) For objective functions where this model has no optimal solution, does this mean that there are no good solutions according to the model? Explain. What probably went wrong when formulating the model?