MATH 484 2020-21 Fa Exam 1

Work alone. If you get stuck on a coding and/or mathematica issue, if you can't figure it out in 1/2 hour, email me your notebook before you spend hours and hours debugging.

Save your work every 5 minutes! Then a crash only costs you 5 extra minutes!

LP1

Max $z(x,y) = -14x + 2y + 10$

Subject to

$$\begin{aligned} 2x + 7y &\geq 28 \\ -2x - 5y &\leq -30 \\ 4x + 4y &\geq 28 \\ 7x - 1y &\geq -35 \\ x + 2y &\leq 28 \\ 4x - 5y &\geq -75 \\ 5x + 3y &\leq 60 \\ 3x - 2y &\leq 18 \end{aligned}$$

All submitted work to be done in Mathematica. When you are finished, upload your Mathematica notebook to the assignment dropbox for your section.

Name your file GivenName FamilyName Exam 1.nb

1. LP1 is given above.
   a. Plot all the constraint boundaries and label each constraint boundary s1 through s8 according to which slack variable is zero on the boundary, <u>putting the label on the feasible side of each line</u>. Shade the feasible region with a polygon.
   b. Put LP1 in a tableau. Do not drop any constraints or use any shortcuts based on analysis of your graph or preprocessing of any kind. Put all 8 constraints in your tableau <u>in the order given (do not switch rows.)</u>
   c. Execute a succession of pivots according to the simplex algorithm, using Bland's rule with the natural ordering (the ordering we have always use in class) to break all ties.
   d. For each tableau resulting from your sequence of pivots, label the corresponding point in your graph. Call the starting tableau "a", the 2nd tableau "b", and so on.
   e. When you reach an optimal tableau, determine the full solution in the original x-y plane. Document the solution on your graph, using a text-box for the optimal value and solution set, and also graphically highlighting argmax(z) on your plot, whether a point or a line-segment. If you believe the solution set is more than a single point, document the solution set as the convex hull of its extreme points, and find the extreme points with extra pivoting as demonstrated in class.
2. Let LP2 refer to the problem of minimizing the same objective z(x,y) subject to the same constraints. Solve LP2 in the MINIMAL number of pivots **<u>s</u>tarting from your final LP1 tableau,** with the condition that every tableau in your sequence remains a feasible tableau (b >= 0). DO NOT USE SIMPLEX FOR THIS. Instead, analyze LP2 graphically to find argmin(z) in your graph and choose your path of pivots in advance. Continue naming your tableaux with the next letters of the alphabet following your final LP1 tableau. As you pivot to argmin(z), for each tableau, label the corresponding point in your graph as you did for LP1, and document the solution of LP2 in the same manner you documented the solution to LP1.