This is hw3, the last one. It is due in class on April 30, 2018. You can talk with others about the problems, but I want to insist that you write up solutions **ENTIRELY** on your own. If you use a source like a book, a paper, or something taken from the web, carefully cite the sources, along with your solution. If you did discuss with others, please cite **THEM** in your solutions (maybe different people for different problems). Finally, when you hand in your solutions, write the pledge “I followed the rules for this assignment” and then sign your name. If you do not do this we will not grade your HW.

1. One formulation (standard?) for the Linear Programming (LP) problem in $R^2$ seeks a point $P^* = (x, y) \in R^2$ with minimum $y –$ coordinate that satisfies each of the following conditions:

   - $y \geq A_i x + B_i$, all $i \in I^+$
   - $y \leq A_i x + B_i$, all $i \in I^-$
   - and for each $i \in I^0$ either $-\infty \leq L_i \leq x$ or else $x \leq R_i \leq \infty$.

Taking $I^+, I^-, I^0$ as disjoint subsets of the first $n$ positive integers for which $|I^+| + |I^-| + |I^0| = n$, this version of LP seeks the “lowest point” ($\text{min } y$) in the intersection of $n$ halfspaces in $R^2$.

N. Megiddo reformulated it taking $L = \max(L_i)$ and $R = \min(R_i)$ and stopping if $L > R$. Otherwise he defined

$L(x) = \max_{i \in I^+} A_i x + B_i$, and

$U(x) = \min_{i \in I^-} A_i x + B_i$,

and rephrased the LP problem to seek $\text{min } L(x)$ subject to the conditions that $L(x) \leq U(x)$, and $x \in [L, R]$.

(a) (5 pts) Argue that Megiddo’s formulation is equivalent to the standard one because it will give the same answers as the standard one: (i) ’NO SOLUTION’ when the $n$ inequalities are inconsistent (“infeasible”) or because there is no lowest point (“unbounded below”); (ii) “no unique solution” when the min $y$ is on a horizontal line in $I^+$ with $A_i = 0$; or (iii) the unique lowest feasible point,

(b) (10 pts) coming

=================================