IS609 Homework Week 6

Ben Arancibia

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2) A rancher has determined that the minimum weekly nutritional requirements for an average-sized horse include 40lb of protein, 20lb of carbohydrates, and 45lb of roughage. These are obtained from the following sources in varying amounts at the prices indicated:

	Protein (lb)	Carbohydrates (lb)	Roughage (lb)	Cost
Hay (per bale)	0.5	2.0	5.0	\$1.80
Oats (per sack)	1.0	4.0	2.0	3.50
Feeding blocks (per block)	2.0	0.5	1.0	0.40
High-protein concentrate (per sack)	6.0	1.0	2.5	1.00
Requirements per horse (per week)	40.0	20.0	45.0	

Formulate a mathematical model to determine how to meet the minimum nutritional requirements at minimum cost.

Amounts of all the different feed types are paramaters in the model.

Minimize $Cost(H, T, F, P) = 1.8H + 3.5T + 0.4F + 1.0P$

This is subjec to following:

Protein: $0.5H + 1.0T + 2.0F + 6.0P >= 40.0$

Carbs: $2.0H + 4.0T + 0.5F + 1.0P >= 20.0$

Roughage: $5.0H + 2.0T + 1.0F + 2.5P >= 25.0$

$H, T, F, P >= 0$

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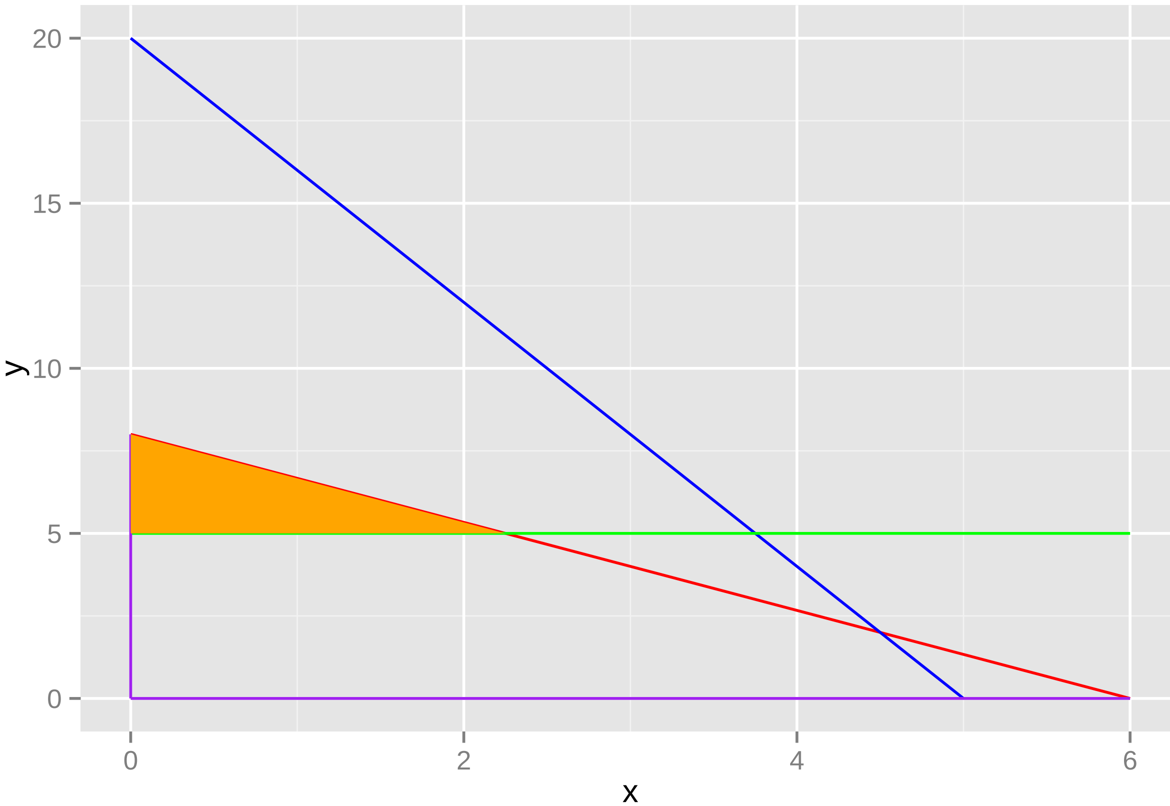
6) Use graphical analysis to Maximize 10x + 35y subject to:

8x + 6y <= 48 (board-feet of lumber)

4x = y <= 20 (hours of carpentry)

y >= 5 (demand)

x,y, >= 0 (nonnegativity)



The extreme points are:

The intersection of constraint 1 and 5 at point (0,8)

The intersection of constraint 1 and 3 at point (2.25, 5)

The intersection of constraint 3 and 5 at point (0,5)

Plug them into the objective equation : $(10 * x) + (35 * y)$ to find the maximum which is *(0,8) with value of 280.0.*

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6) Using the method in section 7.3, Maximize 10x + 35y subject to:

8x + 6y <= 48 (board-feet of lumber)

4x + y <= 20 (hours of carpentry)

y >= 5 (demand)

x,y, >= 0 (nonnegativity)

Decision Variables to format xi

8x1 + 6x2 <= 48 (board-feet of lumber)

4x1 + x2 <= 20 (hours of carpentry)

x2 >= 5 (demand)

x1,x2 >= 0 (nonnegativity)

Add yi variables

8x1 + 6x2 + y1 = 48 (board-feet of lumber)

4x1 + x2 + y2 = 20 (hours of carpentry)

x2 = 5 + y3(demand)

x1,x2, y1, y2, y3 >= 0 (nonnegativity)

Iterate through the variable combinations, set 4x1 + x2 + y2 = 20 to 0.

x1,x2 = 0, x2 violates constraint 3

when x1,y1 = 0

6x2 = 48 (board-feet of lumber)

x2 + y2 = 20 (hours of carpentry)

x2 = 5 + y3 (demand)

Results:

x2 = 8 y2 = 12 y3 = 3

The feasible point at (0,8)

When x1, y2 = 0

6x2 + y1 = 48

x2 = 20

x2 = 5

Results: x2 = 20 y3 =15 y1 = -52.

Solution is not possible, negative

When x1,y3=0

6x2 + y1 = 48

x2 + y2 = 20

x2 = 5

Results:

x2 = 5 y2 = 15 y1 = 18

Feasible points at (0,5)

x2,y1 = 0, constraint 3 is violated

y1,y2 = 0. consraint 3 is violated

When y1,y3 = 0

8x1 + 6x2 = 48

4x1 + x2 + y2 =20

x2 = 5

Results:

x2= 5 x1 = 2.25 y2=6

Feasible points at (2.25,5)

When y2,y3 = 0

8x1 + 6x2 + y1 = 48

4x1 + x2 = 20

x2 = 5

Results:

x2 = 5 x1 = 3.75 y1 = -12

Solution is not possible, negative

Enter three possible solutions into $(10 * x) + (35 * y)$

Get the same answer, find the maximum which is *(0,8) with value of 280.0.*