Spring 2015

Assignment 3: Excel Functions and Linear Programming

Solution

Date Due: February 12, 2015

Instructor: Trani

Problem 1

<u>Task 1</u>

Public Function RailNoise(SELref, Ncars, S, V) 'Function used to estimate the noise generated by a rail vehicle
'Programmer: Moises Bobadilla ' Date: Februrary 10, 2015 '
'Inputs: 'SELref = equivalent noise level (dBA) 'Ncars = number of cars in the train 'S = train speed (mph) 'V = hourly average train volume (trains/hr)
RailNoise = SELref + 10 * (Log(Ncars) / Log(10)) + 20 * (Log(S / 50) / Log(10)) + 10 * (Log(V) / Log(10)) - 31.4
End Function

NOTE: Taking the natural log in VBA can be done using two methods: a) as shown in the solution to Task 1 (divide Log(x)/log(10)) or b) sing the Excel function (Application.WorksheetFunction.In). This last statement used Excel to do the computation of In.

<u>Task 2</u>

Inputs								
SELref	73	dBA						
Ncars 8 # of cars								
S 49 mph								
V	28	cars/hr						
Output								
Leq	64.9270	dBA						

Train Speed (mph)	Leq (dBA)
0	0
5	45.102
6	46.686
9	50.208
12	52.707
15	54.645
18	56.229
21	57.567
24	58.727
27	59.750
30	60.666
33	61.493
36	62.249
39	62.944
42	63.588
45	64.187
48	64.748
51	65.274
54	65.771
57	66.241
60	66.686
63	67.110
66	67.514
69	67.900

NOTE: Sanity check. The higher the train speed, the higher the noise.

<u>Task 4</u>

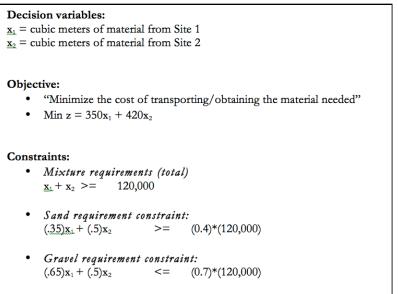
Leq (dBA)
Leq (ubA)
58.906
60.667
61.917
62.886
63.678
64.347
64.927

NOTE: Sanity check. The larger the train size (i.e., transit unit), the more noise is produced.

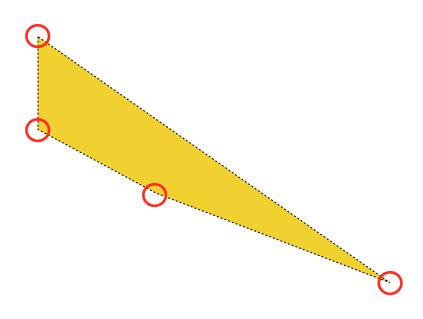
<u>Task 3</u>

Problem 2

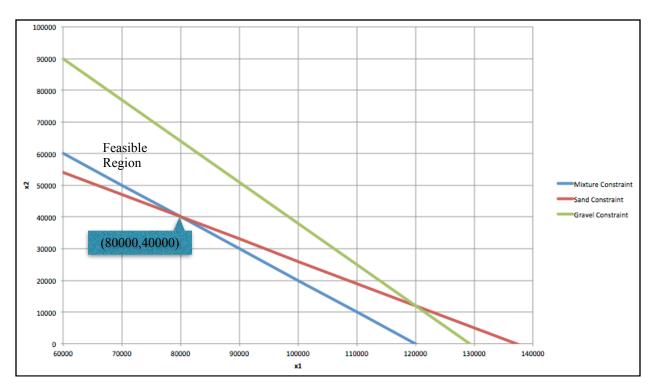
a) Formulate the problem as a Linear programming problem



• Non-negativity



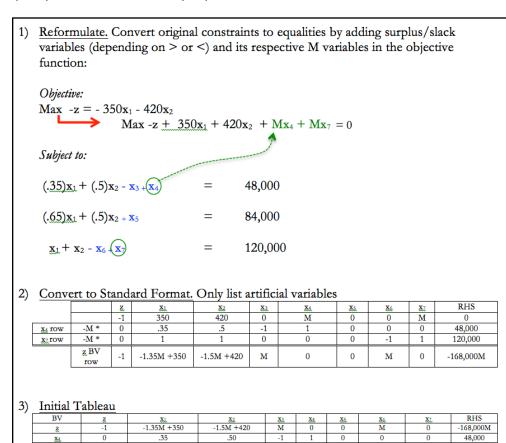
b) Solve the problem graphically



c) Solve the problem using Solver

1 Solver Parameters 3 Solver Parameters 4 Solver Parameters 5 Solver Parameters 6 Solver Parameters 7 Decision Variables 8 X1 80000 X2 40000 Cubic meters of material from Site 1 10 Solver Parameters 12 Solver Parameters 13 Objective Function 14 Min z = 350x1 + 420x2 16 Solver Parameters 17 Constraints 18 Constraints 19 x1+x2x=120000 24 Solver Parameters 25 Solver Parameters 26 Solver Parameters 27 Solver Parameters 28 Solver Parameters 29 Solver Parameters 30 Solver Parameters 31 Solver Parameters 32 Solver Parameters 33 Solver 34 Solver 35 Solver 36 Solver		Α	В	С	D	E	F	G	Н		J	K	L
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34 35 36 Close Solve								smo	oth.				
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d) Setup the first tableau of the Simplex procedure



0

0

1

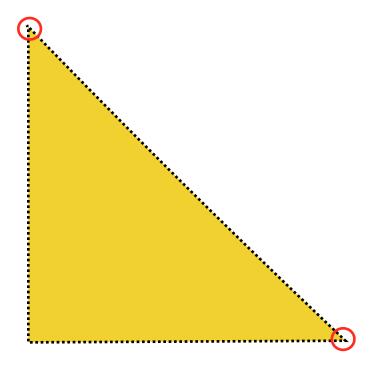
0

0

84,000

120,000

Problem 3



85

X7

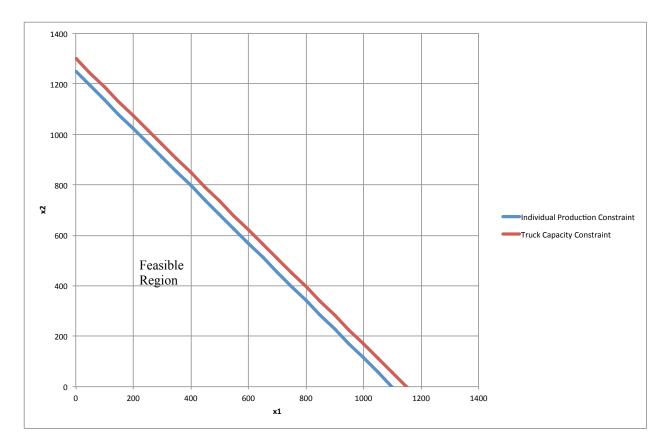
0

.65

a) Formulate the problem as a linear programming problem

$\underline{\mathbf{x}}_{1} = \mathbf{A}$	ion variables: amount of product A produced/day amount of product B produced/day
Objec •	etive: "Maximize revenue" Max $z = 120x_1 + 97x_2$
Const •	traints: Individual production constraint
•	Truck capacity constraint: $\frac{x_1}{1100} + \frac{x_2}{1250} \le 1$ $\frac{x_1}{1150} + \frac{x_2}{1300} \le 1$
•	Non-negativity

b) Solve the problem graphically

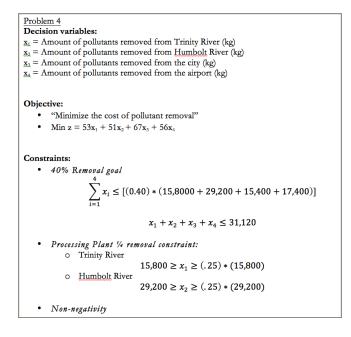


c) Solve the problem using Solver

					Solver Parameters
	De	cision Variab	les		Set Objective: \$D\$19
X1	1100	Cubic M	eters of Pro	duct A/day	
X2	0	Cubic M	eters of Pro	duct B/day	To: 💽 Max 🔿 Min 🔿 Value Of: 🛛 0
					By Changing Variable Cells:
	01		1	_	SC\$8:SC\$9
ax Z: 120X1		jective Funct 132000			Cubicat to the Constraints
ax 2. 120AI	. + 3/ \2	132000			Subject to the Constraints:
					\$D\$19 <= 1 Add \$D\$20 <= 1
		Constraints			
					Change
1/1110 + X	2/1250 <=1	1	<=		Delete
1/1150 + X	2/1300 <=1	0.95652174	<=	1	Delete
					Reset All
					Level (Cruze
					Load/Save
					Make Unconstrained Variables Non-Negative
					Select a Solving Method: Simplex LP 💌 Options
					Solving Method
					Select the GRG Nonlinear engine for Solver Problems that are smooth
					nonlinear. Select the LP Simplex engine for linear Solver Problems, and select the Evolutionary engine for Solver problems that are non-
					smooth.
					Close Solve

Problem 4

a) Formulate the problem as a linear programming problem



b) Solve the problem using Excel Solver

		Decision Va	riables				
X1	3950	Amount of po	ollutants removed	from Trinity River			
X2	27170	Amount of pol	lutants removed f	rom Humbolt River	Solver Results		
X3	0	Amount of	pollutants remov	ed from the city			
X4	0	Amount of p	ollutants removed	d from the airport	Solver found a solution. All constraints and optimality conditions are satisfied.		
					C Keep Solv	ver Solution Original Values	Reports Answer Sensitivity Limits
		Objective F	unction				
Min z = 53x1+51x2+67x3+56x4 1595			1595020		Return to Solver Parameters Dialog Outline Re		
					Save Scenario	Cano	cel OK
		Constra	ints				
Σ(xi) <= (.40)*77800	31120	>=	31120			
15800>=x1		15800	>=	3950			
x1>=(.25*15800)		3950	>=	3950			
2920	00>=x2	29200	>=	27170			
0. 10	5*29200)	27170	-	7300			