INSTITUTO SUPERIOR DE ECONOMIA E GESTÃO

OPERACIONAL RESEARCH –Semester 1

Date: 26/01/2012 **Época de Recurso** Duration: **2 hours**

Note: Justify all your answers and present the calculations

1. Consider the following LP problem:

$$\text{Min } Z = 4x_1 + 2x_2$$

$$\text{s.to: } \begin{cases} 2x_1 + 3x_2 \geq 6 \\ x_1 + x_2 \leq 10 \\ 2x_1 - x_2 \geq 0 \\ x_1,\ x_2 \geq 0 \end{cases}$$

a) (1,5 points) Formulate the dual of the given problem.

b) (4,5 points) Solve the given LP graphically, indicate the points that form the Feasible Region and write:

I) The optimal solution of the augmented LP.

II) The optimal solution (decision variables) and optimal value of the dual.

c) (2 points) Determine the sensitivity intervals of the first and the second constraints right hand sides.

d) (1 point) If the coefficient of x_2 in the objective function turns to be null, what is the impact in the values of x_1, x_2 and in the optimal value?

e) (1,5 points) Using an ILP model, formulate the problem that results from the previous by introducing a third variable that, to be considered, must have a minimum value of 4 is incompatible with x_2, and have coefficient 2 in the objective function and coefficients 1, 2, 0 in the three given constraints.

(→)

2. The following simplex tableaux corresponds to a problem of maximizing the gross margin achieved by the production of three products, whose quantities are represented by decision variables, x_1, x_2 and x_3. The conditions for the functioning of the system are due to limited capacity of the processing into three sections (in wh) and written in three functional constraints ($\leq$).

VB	z	x_1	x_2	x_3	x_4	x_5	x_6	T. I.
z	1	0	-3	0	0	2	0	20
x_1	0	1	-1	2	0	1	0	5
x_4	0	0	2	0	1	0	0	6
x_6	0	0	1	1	0	2	1	4

a) (1 point) Write and classify the primal solution associated with the given tableaux.

b) (3 points) Get and write the primal optimal solutions (decision and slack variables) and dual (only decision variables), and the value of the respective objective functions.

c) (1 point) Interpret the meaning of the first shadow price relating it, if possible, with the value of the slack variable of the first primal constraint.

d) (1 point) Considering the given simplex tableaux and without performing calculations explain:

I) What are the implications of introducing variable x_3 in the set of basic variables?

II) What are the implications of replacing x_1 by x_2 in the set of basic variables?

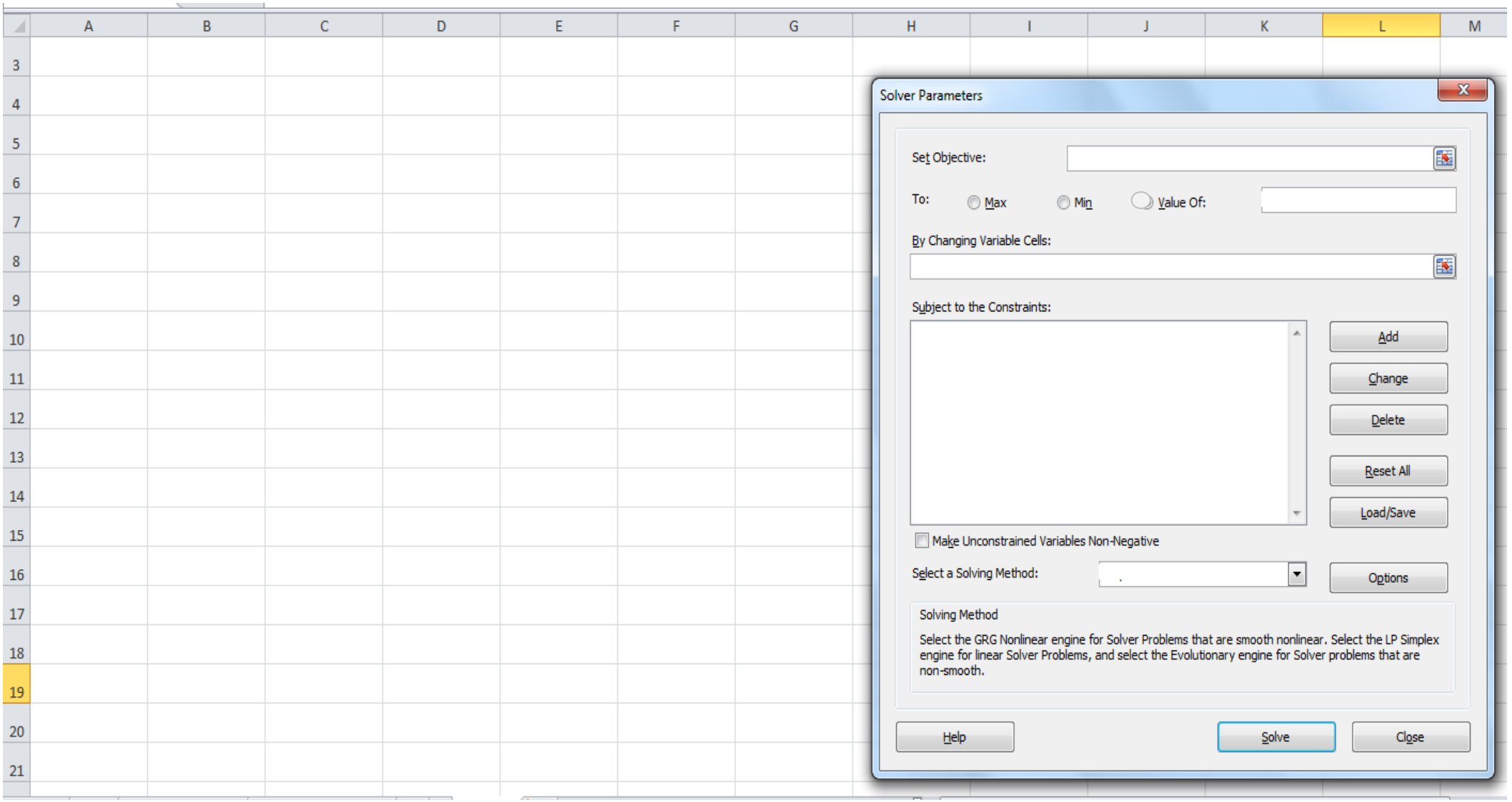
3. The company AEI has two warehouses (**W1** and **W2**) where it stores the products for its shops. The transport of a certain type of perishable products requires speed. Daily, in each warehouse, 60 units of the product can be stored, and the demands are 30, 40 and 20 units in each of three shops (**S1**, **S2** and **S3**). The unit transportation costs between warehouses and shops are displayed in the following table.

	S1	**S2**	**S3**
W1	10	11	14
W2	12	12	12

a) (2,5 points) In the Excel sheet attached formulate the problem to identify the quantities that each shop should order to the warehouses daily to satisfy the demand while minimizing the total cost associated with transportation.

b) (1 point) What changes should be done in the model to ensure that the warehouse **W2** will order the maximum units allowed and they will be fully disposed.

NAME: _____ **N.:** _____


A B C D E F G H I J K L M
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Solver Parameters
Set Objective:
To: Max Min Value Of:
By Changing Variable Cells:
Subject to the Constraints:
Add
Change
Delete
Reset All
Load/Save
Make Unconstrained Variables Non-Negative
Select a Solving Method:
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.
Help
Solve
Close