Department of Computer and Systems Engineering

Optimization and Decision Support Methodologies
1st Assessment Test

Date: November 26, 2020 Duration: 1h 30m

Note: Present all the calculations you carry out, as well as any comments, justifications or conclusions you deem appropriate.

1. Consider the following linear programming problem:

Maximize z = 2x1 - x2

subject to

x1 + 2x2 ≥ 4 **(1)**

3x1 + x2≤ 3 **(2)**

x1≥ 0, x2 ≥ 0

Considering x3 and x4 the surplus and artificial variables of the functional constraint (1), and x5 the slack variable of the functional constraint (2), the Simplex optimal tableau is:

	ci	2	-1	0	-M	0	
xB	cB\ xi	**x1**	**x2**	**x3**	**x4**	**x5**	**b**
x2	-1	0	1	-3/5	3/5	-1/5	9/5
x1	2	1	0	1/5	-1/5	2/5	2/5
	zj-cj	0	0	1	M-1	1	-1

a) For each of the following changes in the initial problem, determine, by carrying out a post-optimization study, what are the implications for the optimal solution presented (in the value of x*, in the value of z* and in the optimal basis), arising from:

[1.75 points] **1)** Changing the objective function to Maximize z = 3x1 + x2;

[1.50 points] **2)** Alteration in the vector of the coefficients of variable x1 in the constraints from $\begin{bmatrix}1\\3\end{bmatrix}$ to $\begin{bmatrix}1\\1\end{bmatrix}$.

[1.75 points] **b)** Determine, by carrying out a sensitivity analysis study, for which interval of b2 (independent term of the 2nd constraint) the optimal basis presented above will remain optimal.

2. Consider the following mixed integer linear programming problem:

Maximize z = x1 + 2x2 + x3 + x4

subject to

x1 + 2x2 + x3 - x4 ≤ 6 **(1)**

2x1 - x2 + 2x3 + x4≤ 6 **(2)**

x1 ≥ 0, x2 ≥ 0, x3 ≥ 0, x4 ≥ 0

x2 and x3 integers

Considering x5 and x6 the slack variables of constraints (1) and (2), respectively, suppose that the Gomory algorithm for MILP was applied to this same problem and that at the end of the 1st step, the following optimal tableau was obtained:

	ci	1	2	1	1	0	0	
xB	cB \ xi	**x1**	**x2**	**x3**	**x4**	**x5**	**x6**	**b**
x2	2	3	1	3	0	1	1	23/2
X4	1	5	0	5	1	1	2	17
	zj-cj	10	0	10	0	3	4	40

[3.00 points] **a)** Withdraw your conclusions and if you find it necessary, proceed with the 2nd step of the referred algorithm, in order to solve the presented problem;

[0.50 points] **b)** Do you think the rounding method would work on this problem? Justify.