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Ex. 2

$\max \; x_1 + 3\delta_1 + \delta_2$

$-0.5\delta_2 - x_1 - \delta_1 \geq -0.5$

$\delta_1, \delta_2 \in \{0,1\}$

$x_1 \leq 0$

Since the simplex requires the positivity of all variables x_1 is replaced by $x_2 = -x_1$

$\max \; -x_2 + 3\delta_1 + \delta_2$

$-0.5\delta_2 + x_2 - \delta_1 \geq -0.5$

$\delta_1, \delta_2 \in \{0,1\}$

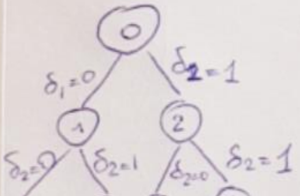
$x_2 \geq 0$

$\max \; -x_2 + 3\delta_1 + \delta_2$

$0.5\delta_2 - x_2 + \delta_1 + s_1 = 0.5$

$\delta_1, \delta_2 \in \{0,1\}$

$x_2 \geq 0$



Relaxation of node 0 - Phase 1

$\min \; y_1 + y_2 + y_3$

$0.5\delta_2 - x_2 + \delta_1 + s_1 + y_1 = 0.5$

$\delta_1 + s_2 + y_2 = 1$

$\delta_2 + s_3 + y_3 = 1$

$x_2, s_1, s_2, s_3, y_1, y_2, y_3 \geq 0$

δ_1, δ_2

		x_2	δ_1	δ_2	s_1	s_2	s_3	y_1	y_2	y_3
	0	0	0	0	0	0	0	1	1	1
s_1	0.5	-1	1	0.5	1	0	0	1	0	0
s_2	1	0	1	0	0	1	0	0	1	0
s_3	1	0	0	1	0	0	1	0	0	1

→ Phase 1 is ok since the first row has coeff ≥ 0 and cost $= 0$ and I have in the basis no y_i variables

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Phase 2

		x_2	δ_1	δ_2	s_1	s_2	s_3	
	0	-1	3	1	0	0	0	$-3AUX$
s_1	0.5	-1	1	0.5	1	0	0	$\to [0.5/1]$
s_2	1	0	1	0	0	1	0	$[1/1]-AUX$
s_3	1	0	0	1	0	0	1	

$AUX = [0.5 \ -1 \ 1 \ 0.5 \ 1 \ 0 \ 0]$

		x_2	δ_1	δ_2	s_1	s_2	s_3	
	-1.5	2	0	-0.5	-3	0	0	$-2AUX$
δ_1	0.5	-1	1	0.5	1	0	0	$+AUX$
s_2	0.5	1	0	-0.5	-1	1	0	
s_3	1	0	0	1	0	0	1	

$AUX = [0.5 \ 1 \ 0 \ -0.5 \ -1 \ 1 \ 0]$

		x_2	δ_1	δ_2	s_1	s_2	s_3	
	-2.5	0	0	0.5	-1	-2	0	$-0.5AUX$
δ_1	1	0	1	0	0	1	0	
x_2	0.5	1	0	-0.5	-1	1	0	$+0.5AUX$
s_3	1	0	0	1	0	0	1	

$AUX = [1 \ 0 \ 0 \ 1 \ 0 \ 0 \ 1]$

		x_2	δ_1	δ_2	s_1	s_2	s_3
	-3	0	0	0	-1	-2	-0.5
δ_1	1	0	1	0	0	1	0
x_2	1	1	0	0	-1	1	0
δ_2	1	0	0	1	0	0	1

Phase 2 is over. $J^* = 3$

$$\bar{x} = \begin{bmatrix} x_2 \\ \delta_1 \\ \delta_2 \\ s_1 \\ s_2 \\ s_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 0 \\ 0 \\ 0 \end{bmatrix} \to \begin{array}{l} x_1 = 1 \\ \delta_1 = 1 \\ \delta_2 = 1 \end{array}$$

Since $\delta_1 = 1$ and $\delta_2 = 1$ the relaxation of node 0 is also the optimal solution of the original MILP with optimal cost 3

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