Simplex

Operations Research

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Tecnológico de Costa Rica
Semester 1, 2018
May 24, 2018

Simplex Algorithm

The simplex is a method to solve lineal programming problems. This is a mechanical method that search for the best or optimal solution for a lineal programming(LP) problem. It was invented by George Danzig in 1947. It uses operations over a matrix to search for the optimal solution. It begin from a feasible region and it starts to do some operations, depending if you are maximizing or minimizing that search for the candidate column and the pivot, and after all the numbers are positive or negative, depends if maximizing or minimizing, that it give you the best solution.

Original Problem

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Maximize

- $Z = -10000x1 - 3000x2$

Constraints

1. $1x1 + 1x2 \leq 4$
2. $10x1 + 4x2 \leq 10$
3. $0x1 + 1x2 \geq 3$

Initial Table

Initial Table

Z	x1	x2	s_1	s_2	e_1	a_1	•
1	-10000	-3000	0	0	0	1M	0
0	1	1	1	0	0	0	4
0	10	4	0	1	0	0	10
0	0	1	0	0	-1	1	3

Table 1: Initial Table.

Intermediates Tables

Intermediate Table 1

Z	x1	x2	s_1	s_2	e_1	•
1	-10000	-3000-1M	0	0	1M	-3M
0	1	1	1	0	0	4
0	10	4	0	1	0	10
0	0	1	0	0	-1	3

Table 2: Intermediate Table 1, with the column a_1 canonized.

Intermediate Table #1

Z	x1	x2	s_1	s_2	e_1	•
1	-10000	-3000-1M	0	0	1M	-3M
0	1	1	1	0	0	4
0	10	**4**	0	1	0	10
0	0	1	0	0	-1	3

Table 3: Intermediate Table 1, during the pivoteo.

Calculations: 4/1 = 4 | **10/4 = 2,5** | 3/1 = 3

Intermediate Table #2

Z	x1	x2	s_1	s_2	e_1	•
1	-2500+2,5M	0	0	750+0,2M	1M	7500+-0,5M
0	-1,5	0	1	-0,2	0	1,5
0	2,5	1	0	0,2	0	2,5
0	-2,5	0	0	-0,2	-1	0,5

Table 4: Intermediate Table 2, with the column 3 canonized.

Final Table

Final Table

Z	x1	x2	s_1	s_2	e_1	a_1	•
1	-2500+2,5M	0	0	750+0,2M	1M	0	7500+-0,5M
0	-1,5	0	1	-0,2	0	0	1,5
0	2,5	1	0	0,2	0	0	2,5
0	-2,5	0	0	-0,2	-1	1	0,5

Table 5: Final Table.

Solution

Solution

Optimal solution

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- $Z = 7500$
- $x_2 = 2,5$

Especial Cases

The problem had the following special cases:

1. Not Feasible Problem

In the following slides this will be explained.

Not Feasible Problem

The problem became not feasible when making a tour of the first row of the final table and found Ms.

- final slide -