

Simplex Calculator

User's Guide v1.3



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Changelog

- 1.3 English language support added. A splash-screen has been added to the program.
- 1.2 Fixed: Wrong choice of pivot, when both the **b**- and **c**-vector were negative.
- 1.1 Fixed: Wrong choice of pivot, when applying case 2 of the minimum problem.
- 1.0 Initial publishing.

1 Installation

No installation is required. On Windows systems, the .jar file is usually executed by double-clicking, whereas the `java -jar` command should be used on Linux platforms. Both require a *Java Runtime Engine* (JRE) of version 7 or higher to be installed on the system.

2 Using the program

2.1 Basics

The **Simplex Calculator** program can be used to solve linear programming problems via the simplex method. After you have typed in the objective function and the constraints, the program will automatically convert it to the standard form

$$\begin{aligned} &\text{Maximize} && c_1x_1 + c_2x_2 + \dots + c_nx_n \\ &\text{subject to the constraints} \\ & && a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n \leq b_1 \\ & && \vdots \\ & && a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mn}x_n \leq b_m \end{aligned}$$

or

$$\begin{aligned} &\text{Minimize} && b_1y_1 + b_2y_2 + \dots + b_my_m \\ &\text{subject to the constraints} \\ & && a_{11}y_1 + a_{21}y_2 + \dots + a_{m1}y_m \geq c_1 \\ & && \vdots \\ & && a_{1n}y_1 + a_{2n}y_2 + \dots + a_{mn}y_m \geq c_n \end{aligned}$$

This happens by multiplying the 'misoriented' inequalities by -1 , and converting equalities to two inequalities. The problem is subsequently represented in a simplex tableau.

The program accepts both integers, fractions of the form a/b , and decimal numbers with full stop as the decimal mark. It is, however, recommended to use fractions instead of decimal numbers, due to the inaccurate binary representation of the latter.

Three output options are available

- **Show result only:** Calculates the simplex tableau automatically, but shows the result only.
- **Show intermediate steps:** Calculates the simplex tableau automatically, shows each intermediate step, and indicates which case from [Ferguson] was applied.
- **Choose pivot manually:** The user chooses where the program should pivot. In this mode, the program will not check if the chosen pivot agrees with the rules of the simplex method, nor if the problem has been solved.

2.2 Step limit

By default, the program will terminate after 1,000,000 steps. To run the program without this limit, it should be run from a command line with the optional argument `-noLimit`. The program would thus be executed with

```
java -jar SimplexUdregner.jar -noLimit
```

if the current working directory of the command line is the directory where `SimplexUdregner.jar` is stored.

2.3 Selecting language

The default language is Danish, but can be changed to English with the `-lang=english` command line argument.

On Windows platforms, the language can be changed permanently by creating a shortcut and adding `-lang=english` to the Destination.

3 Reporting bugs

If you discover a bug in the program, please send a short description of the bug to `bugs@rene-bc.dk`. If possible, the bug will be corrected for future versions.

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The inverse error function implementation in the Erf class is based on CUDA code developed by Mike Giles, Oxford-Man Institute of Quantitative Finance, and published in GPU Computing Gems, volume 2, 2010.

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The creation of the package "o.a.c.m.analysis.integration.gauss" was inspired by an original code donated by Sébastien Brisard.

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References

[Ferguson] Thomas S. Ferguson. *Linear Programming: A Concise Introduction*. URL: <http://www.math.ucla.edu/~tom/LP.pdf>.