Introdução MathProg
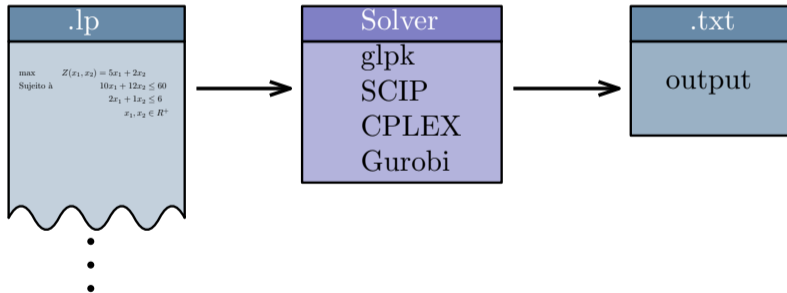
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20/03/2024
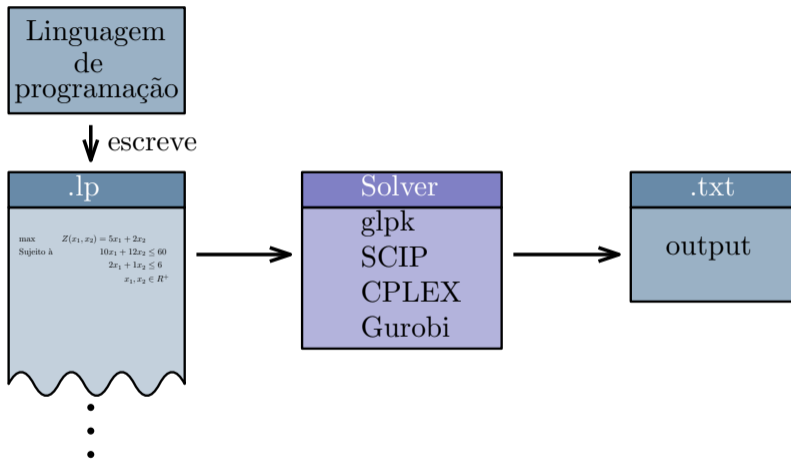
Usando arquivos .lp
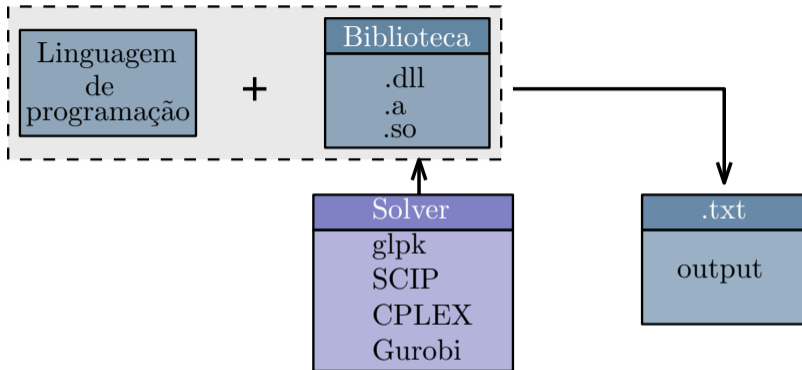
Ficam grandes

.lp

$$\max \quad Z(x_1, x_2) = 5x_1 + 2x_2$$
$$\text{Sujeito à} \quad 10x_1 + 12x_2 \leq 60$$
$$2x_1 + 1x_2 \leq 6$$
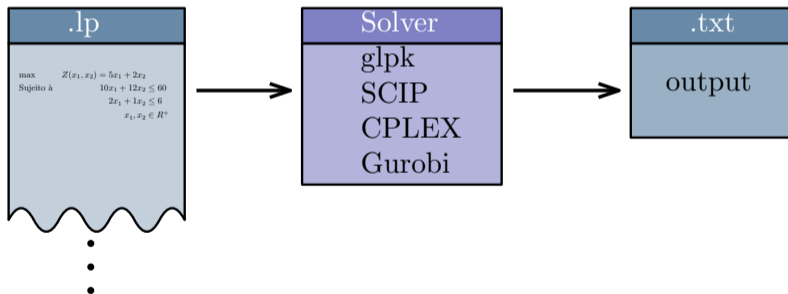$$x_1, x_2 \in R^+$$

Solver
glpk
SCIP
CPLEX
Gurobi

.txt
output

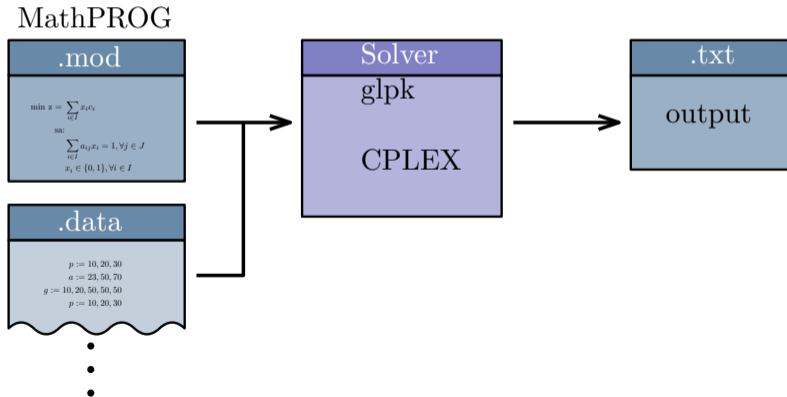# Linguagem de programação para escrita

Linguagem de programação com solver

Ficam grandes

Linguagem de programação matemática

Modelo Simples

$$\begin{aligned}
\max \quad & Z(x_1, x_2) = 100x_1 + 150x_2 \\
\text{Sujeito à} \quad & 2x_1 + 3x_2 \leq 120 \\
& 1x_1 \quad \leq 40 \\
& \quad 1x_2 \leq 30 \\
& x_1, x_2 \in R^+
\end{aligned}$$

Modelo Simples

$$
\begin{aligned}
\text{max} \quad & Z(x_1, x_2) = 100x_1 + 150x_2 \\
\text{Sujeito à} \quad & 2x_1 + 3x_2 \leq 120 \\
& 1x_1 \qquad \leq 40 \\
& \qquad 1x_2 \leq 30 \\
& x_1, x_2 \in R^+
\end{aligned}
$$

Modelo Simples

$$\begin{aligned}
&\text{max} && Z(x_1, x_2) = c_1 x_1 + c_2 x_2 \\
&\text{Sujeito à} && a_{11} x_1 + a_{12} x_2 \leq b_1 \\
& && a_{21} x_1 \qquad\quad \leq b_2 \\
& && \qquad\quad a_{32} x_2 \leq b_3 \\
& && x_1, x_2 \in R^+
\end{aligned}$$

Modelo Simples

$$\begin{aligned} \max \quad & Z(x_1, x_2) = c_1 x_1 + c_2 x_2 \\ \text{Sujeito à} \quad & a_{11} x_1 + a_{12} x_2 \leq b_1 \\ & a_{21} x_1 \qquad \leq b_2 \\ & \qquad a_{32} x_2 \leq b_3 \\ & x_1, x_2 \in R^+ \end{aligned}$$

Parâmetros:

$c_1 = 100, c_2 = 150$
$b_1 = 120, b_2 = 40, b_3 = 30$
$a_{11} = 2, a_{12} = 3, a_{21} = 1, a_{32} = 1$

Modelo Simples

$$\begin{aligned}
\max \quad & Z(x_1, x_2) = c_1 x_1 + c_2 x_2 \\
\text{Sujeito à} \quad & a_{11} x_1 + a_{12} x_2 \leq b_1 \\
& a_{21} x_1 \qquad\quad \leq b_2 \\
& \qquad\quad a_{32} x_2 \leq b_3 \\
& x_1, x_2 \in R^+
\end{aligned}$$

Parâmetros:

$c_1 = 100, c_2 = 150$
$b_1 = 120, b_2 = 40, b_3 = 30$
$a_{11} = 2, a_{12} = 3, a_{21} = 1, a_{32} = 1$

$a = \begin{bmatrix} 2 & 3 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} \quad c = \begin{bmatrix} 100 & 150 \end{bmatrix}$
$b = \begin{bmatrix} 100 & 150 & 120 & 40 & 30 \end{bmatrix}$

Modelo Simples

$$
\begin{aligned}
\text{max} \quad & Z(x_1, x_2) = c[1]x_1 + c[2]x_2 \\
\text{Sujeito à} \quad & a[1,1]x_1 + a[1,2]x_2 \leq b[1] \\
& a[2,1]x_1 + a[2,2]x_2 \leq b[2] \\
& a[3,1]x_2 + a[3,2]x_2 \leq b[3] \\
& x_1, x_2 \in R^+
\end{aligned}
$$

Parâmetros/Variáveis:

$$
a = \begin{bmatrix} 2 & 3 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} \quad c = \begin{bmatrix} 100 & 150 \end{bmatrix}
$$

$$
b = \begin{bmatrix} 100 & 150 & 120 & 40 & 30 \end{bmatrix}
$$

Modelo Simples

$$\begin{aligned}
\text{max} \quad & Z(x_1, x_2) = c[1]x[1] + c[2]x[2] \\
\text{Sujeito à} \quad & a[1,1]x[1] + a[1,2]x[2] \le b[1] \\
& a[2,1]x[1] + a[2,2]x[2] \le b[2] \\
& a[3,1]x[1] + a[3,2]x[2] \le b[3] \\
& x_1, x_2 \in R^+
\end{aligned}$$

Parâmetros/Variáveis:

$$a = \begin{bmatrix} 2 & 3 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} \quad c = \begin{bmatrix} 100 & 150 \end{bmatrix}$$

$$b = \begin{bmatrix} 100 & 150 & 120 & 40 & 30 \end{bmatrix}$$

$$x = \begin{bmatrix} x_1 & x_2 \end{bmatrix}$$

Modelo Simples

max $\quad Z(x_1, x_2) = c[1]x[1] + c[2]x[2]$

Sujeito à $\quad a[1,1]x[1] + a[1,2]x[2] \leq b[1]$

$\qquad\qquad a[2,1]x[1] + a[2,2]x[2] \leq b[2]$

$\qquad\qquad a[3,1]x[1] + a[3,2]x[2] \leq b[3]$

$\qquad\qquad\qquad x_1, x_2 \in R^+$

Parâmetros/Variáveis:

$a = \begin{bmatrix} 2 & 3 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} \ c = \begin{bmatrix} 100 & 150 \end{bmatrix}$

$b = \begin{bmatrix} 100 & 150 & 120 & 40 & 30 \end{bmatrix}$

$x = \begin{bmatrix} x_1 & x_2 \end{bmatrix}$

Modelo Simples

$$\begin{aligned}
\text{max} \quad & Z(x_1, x_2) = c[1]x[1] + c[2]x[2] \\
\text{Sujeito à} \quad & a[1,1]x[1] + a[1,2]x[2] \leq b[1] \\
& a[2,1]x[1] + a[2,2]x[2] \leq b[2] \\
& a[3,1]x[1] + a[3,2]x[2] \leq b[3] \\
& x_1, x_2 \in R^+
\end{aligned}$$

Parâmetros/Variáveis/Conjuntos:

$$a = \begin{bmatrix} 2 & 3 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} \quad c = \begin{bmatrix} 100 & 150 \end{bmatrix}$$
$$b = \begin{bmatrix} 100 & 150 & 120 & 40 & 30 \end{bmatrix}$$

$$x = \begin{bmatrix} x_1 & x_2 \end{bmatrix}$$
$$I = \begin{bmatrix} 1 & 2 & 3 \end{bmatrix}, \quad J = \begin{bmatrix} 1 & 2 \end{bmatrix}$$

Modelo Simples

$$\max \quad Z(x_1, x_2) = \sum_{j \in J} c[j]x[j]$$

$$\text{Sujeito à} \quad a[1,1]x[1] + a[1,2]x[2] \leq b[1]$$

$$a[2,1]x[1] + a[2,2]x[2] \leq b[2]$$

$$a[3,1]x[1] + a[3,2]x[2] \leq b[3]$$

Modelo Simples

$$\max Z(x_1, x_2) = \sum_{j \in J} c[j]x[j]$$

$$\text{Sujeito à} \sum_{j \in J} a[1,j]x[j] \leq b[1]$$

$$a[2,1]x[1] + a[2,2]x[2] \leq b[2]$$

$$a[3,1]x[1] + a[3,2]x[2] \leq b[3]$$

Modelo Simples

$$\max Z(x_1, x_2) = \sum_{j \in J} c[j]x[j]$$

$$\text{Sujeito à } \sum_{j \in J} a[1,j]x[j] \leq b[1]$$

$$\sum_{j \in J} a[2,j]x[j] \leq b[2]$$

$$\sum_{j \in J} a[3,j]x[j] \leq b[3]$$

Modelo Simples

$$\max Z(x_1, x_2) = \sum_{j \in J} c[j]x[j]$$

$$\text{Sujeito à } \sum_{j \in J} a[i,j]x[j] \leq b[i], \quad \forall i \in I$$

Modelo Simples

$$\max Z = \sum_{j \in J} c_j x_j$$

Sujeito à

$$\sum_{j \in J} a_{ij} x_j \leq b_i, \quad \forall i \in I$$

$$a = \begin{bmatrix} 2 & 3 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} \quad c = \begin{bmatrix} 100 & 150 \end{bmatrix}$$

$$b = \begin{bmatrix} 100 & 150 & 120 & 40 & 30 \end{bmatrix}$$

$$x = \begin{bmatrix} x_1 & x_2 \end{bmatrix}$$

$$I = \begin{bmatrix} 1 & 2 & 3 \end{bmatrix}, J = \begin{bmatrix} 1 & 2 \end{bmatrix}$$