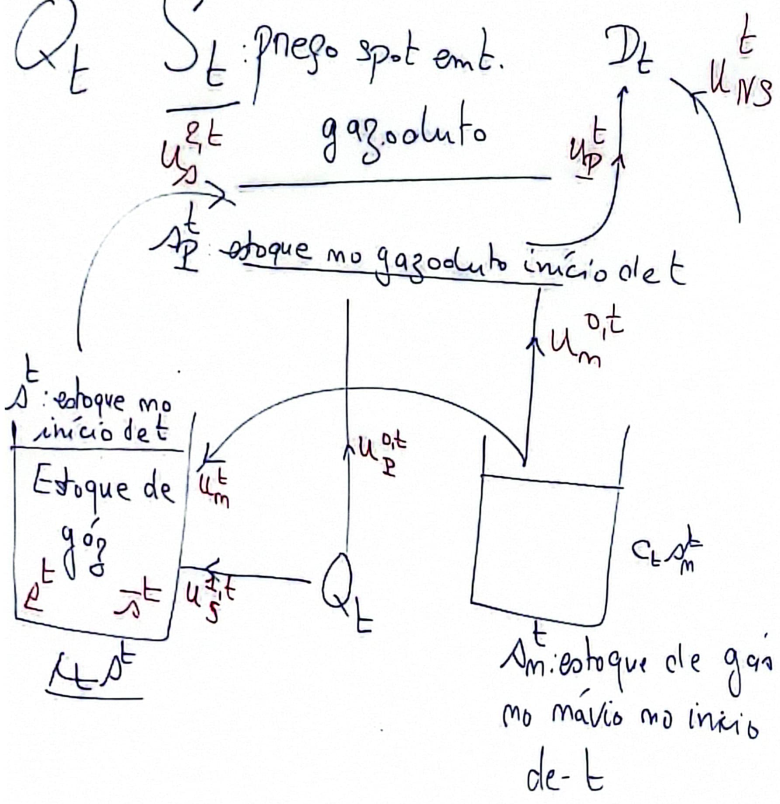
Gurobi, Mosek



13 S_t: preço de venda unitário

contrato m em t_m pode chegar Q_m.

Podemos cancelar o contrato m para $t = 1, \dots, t_m - 1$.

Custo para o contrato m:

1) se eu cancelar em t, $t = 1, \dots, t_m - 1$ pagamos
$$F_m^t = Q_m f_{m,t}$$

2) C.c. pagamos em $t = t_m$:
$$C_m^t = Q_m \hat{S}_t$$

Y_m^t, $m=1,\dots,N$, $t=1,\dots,t_m-1$

$$Y_m^t = \begin{cases} 1 & \text{se cancelamos em } t \text{ ou antes} \\ 0 & \text{c.c.} \end{cases}$$

	1	2	3	4	t_m-1	t_m
m	0	0	1	1	1	cancelamento
	0	0	0	0 0	0	não tem canc

Multa paga para contrato m:

Para $t=1$, $F_m^1 = Q_m f_{m1}(Y_m^1 - Y_m^0)$, $Y_m^0=0$

Para $t=2,\dots,t_m-1$: $F_m^t = Q_m f_{mt}(Y_m^t - Y_m^{t-1})$

Custo da carga para $t=t_m$

$$C_m^t = Q_m S_t (1-Y_m^{t-1}).$$

$$\min \sum_{t=1}^{T} c_t\left[s^t + \sum_m s_m^t\right] + \sum_{m=1}^{N}\left[Q_m S_{t_m}(1-Y_m^{t_m-1})\right]$$
$$+ \sum_{m=1}^{N}\sum_{t=1}^{t_m-1} Q_m f_{mt}\left[Y_m^t - Y_m^{t-1}\right]$$
$$+ \sum_t u_{NS}^t p_t - 1.3\sum_t S_t u_I^t$$

$Y_m^t \geq Y_m^{t-1}$, $m=1,\dots,N$, $t=1,\dots,t_m-1$,

$Y_m^0=0$, $Y_m^t \in \{0,1\}$ $\forall t,m$

$s_m^t = Q_m(1-Y_m^{t-1})$, $t=t_m$, $\forall m$

$s_m^t = s_m^{t-1} - u_m^{0,t} - u_m^t$ $t \geq t_m+1$ $\forall m$

$Q_t = u_P^{0,t} + u_S^{1,t}$

$s_P^t = s_P^{t-1} + \left(\sum_m u_m^{0,t}\right) + u_P^{0,t} + u_S^{2,t} - u_I^t$

$s^t = s^{t-1} + \left(\sum_m u_m^t\right) + u_S^{1,t} - u_S^{2,t}$

$D_t = u_P^t + u_{NS}^t$

$\underline{s}_P^t \leq s_P^t \leq \bar{s}_P^t$

$\underline{s} \leq s^t \leq \bar{s}$

$u_{NS}^t \geq 0$

$u \geq 0$

Mosek. AMPL, Jump

Líquidos:

(L)		Custo	Vender	
A	8000	5.5	6	l_1
B	4250	4.5	6	l_2
C	16 000	7.5	6	l_3
D	2000	11.25	6	l_4

	Preço venda		
E 1	11	400	1
F 2	15	800	2
G 3	14	200	3
P	22	2G	1E
P		$\frac{2}{3}pG$	$\frac{1}{3}pE$

. l_i qtde de líqu. i vendida diretamente

. x_{ij} qtde de líqu. i usado para mistura $j = 1, 2, 3$ (E F G)

. p: qtde de produzida.

$$\max 6\left[l_1 + l_2 + l_3 + l_4\right] + 11\left(\sum_{i=1}^{4} x_{i1} - \frac{p}{3}\right) + 15\sum_{i=1}^{4} x_{i2} + 14\left(\sum_{i=1}^{4} x_{i3} - \frac{2}{3}p\right) + 22p - 5.5\left(l_1 + \sum_i x_{1i}\right) - 4.5\left(l_2 + \sum_i x_{2i}\right) - 7.5\left(l_3 + \sum_i x_{3i}\right) - 11.25\left(l_4 + \sum_i x_{4i}\right)$$

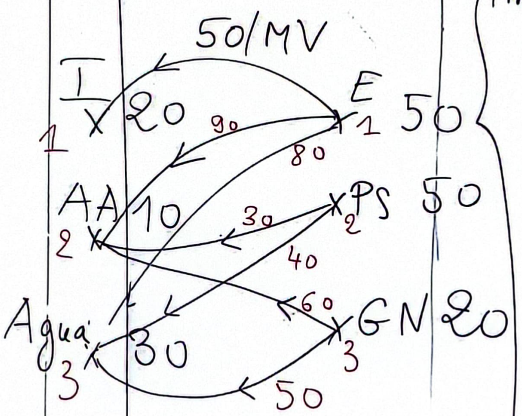
$$l_1 + \sum_i x_{1i} \leq 8000$$

$E \quad \sum_i x_{i1} \geq 400$

$F \quad \sum_i x_{i2} \geq 800$

$G \quad \sum_i x_{i3} \geq 200$

x_{ij} : energia de $i \to j$



$$\min \; 50x_{11} + 90x_{12} + 80x_{13} + 30x_{22} + 40x_{23} + 60x_{32} + 50x_{33}$$

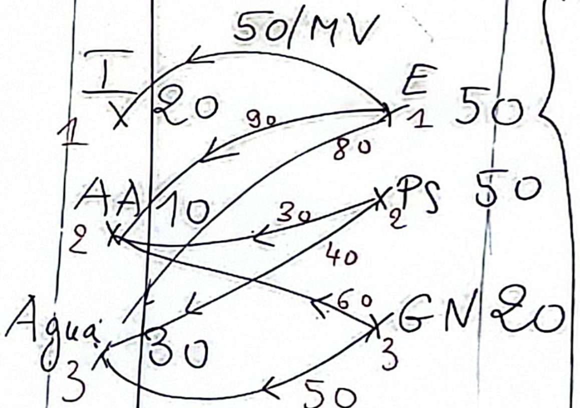
$$\begin{cases} x_{11} = 20 \\ x_{12} + x_{22} + x_{32} = 10 \\ x_{13} + x_{23} + x_{33} = 30 \\ x_{11} + x_{12} + x_{13} \leq 50 \\ x_{22} + x_{23} \leq 50 \\ x_{32} + x_{33} \leq 20 \end{cases} \quad , x_{ij} \geq 0$$

$$X_{11} = 0.3\left[\sum_i X_{i1}\right]$$
$$X_{21} \geq 0.1 \sum_i X_{i1}$$
$$X_{31} = 0.4 \sum_i X_{i1}$$
$$X_{41} \leq 0.05 \sum_i X_{i1}$$
$$X_{12} \geq 0.25 \sum_i X_{i2}$$
$$X_{22} \leq 0.2 \sum_i X_{i2}$$
$$X_{32} = 0.2 \sum_i X_{i2}$$
$$X_{42} \geq 0.1 \sum_i X_{i2}$$
$$X_{13} = 0.2 \sum_i X_{i3}$$
$$X_{23} \geq 0.15 \sum_i X_{i3}$$
$$X_{33} = 0.4 \sum_i X_{i3}$$
$$X_{43} \leq 0.2 \sum_i X_{i3}$$

E $\sum_i x_{i1} \geq 400$

F $\sum_i x_{i2} \geq 800$

G $\sum_i x_{i3} \geq 200$



$$\frac{P}{3} \leq \sum_i x_{i1}$$
$$\frac{2P}{3} \leq \sum_i x_{i3}$$

x_{ij} : energia de $i \to j$

$$\begin{cases} \min\ 50x_{11} + 90x_{12} + 80x_{13} + 30x_{22} + 40x_{23} + 60x_{32} + 50x_{33} \\ X_{11} = 20 \\ X_{12} + X_{22} + X_{32} = 10 \\ X_{13} + X_{23} + X_{33} = 30 \\ X_{11} + X_{12} + X_{13} \leq 50 \\ X_{22} + X_{23} \leq 50 \\ X_{32} + X_{33} \leq 20 \end{cases}, \quad X_{ij} \geq 0$$

H hiperplano $\Leftrightarrow H = \varphi^{-1}(\alpha)$

$H \subset X$

para $\varphi : X \longrightarrow \mathbb{R}$

linear não nula

$\Rightarrow$ $\boxed{H = x_0 + V \text{ com } \dim V = n-1}$

$V = \{x \mid \langle a, x\rangle = a^T x = 0\}$

com $a \neq 0$.

$\varphi(x) = a^T x$, $\varphi(a) = \|a\|^2 \neq 0$

φ não nula, linear.

$\alpha = \varphi(x_0)$

$x \in \varphi^{-1}(\alpha) \Leftrightarrow \varphi(x) = \alpha = \varphi(x_0)$

$\Leftrightarrow a^T(x - x_0) = 0$

$\Leftrightarrow x - x_0 \in V$

$\boxed{\varphi^{-1}(\alpha) = x_0 + V = H}$

$\Leftarrow H = \varphi^{-1}(\alpha)$

$H = \{x \mid \varphi(x) = \alpha\}$

Seja $x_0 \mid \varphi(x_0) = \alpha$

$H = \{x \mid \varphi(x) = \varphi(x_0)\}$

$= \{x \mid x - x_0 \in \ker \varphi\}$

$= x_0 + \ker\varphi$

$= x_0 + V$

$\dim V = \dim \ker \varphi = n - \underbrace{\dim \operatorname{Im} \varphi}_{1} = n-1$

$\Rightarrow H$ hip (e.a dim $n-1$).