IFT-2245 | General notes

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1 Simplex algorithm: example with two iterations

- We stop when no independant variable is negative, if not, we continue

If there's a solution that is optimal in a linear problem, then there is a solution that has a form with some variables that are equal to zero and there is a finite number of solution.

We ask ourselves if there is an independant variable that is negative -> why?

n variables, m constrainsts (n > m)

n - m variables fixed at 0.3

$$\binom{n}{n-m} = \frac{n!}{n!n-m!} \tag{1.1}$$

This is an algebric representation of the simplex algorithm, but there is also a table representation.

1.1 problem

$$\text{Max } 8x + 6y \tag{1.2}$$

- $x + 3y \leq 30$ oursins
- $2x + 3y \leq 24$ crevettes
- $x + 3y \leq 18$ huitres
- $x, y \geq 0$

Min $z = -8x - 6y$

- $5x + 3y + u = 30$
- $2x + 3y + p = 24$
- $x + 3y + h = 18$
- $x, y, p, h \geq 0$

1.2 First iteration

$$u = 30 - 5x - 3y \tag{1.3}$$

$$p = 24 - 2x - 3y \tag{1.4}$$

$$h = 18 - x - 3y \tag{1.5}$$

$$\text{---------} \tag{1.6}$$

$$0 - 8x - 6y \tag{1.7}$$

$$x = 0, y = 0, u = 30, p = 24, h = 18, z = 0 \tag{1.8}$$

a) Input variable: x

- $$u = 30 - 5x \rightarrow u \geq \iff x \leq 6 \tag{1.9}$$

b) Output variable: u

- $$p = 24 - 2x \rightarrow \ p \geq 0 \iff \ x \leq 12 \tag{1.10}$$

c) pivot

$$h = 18 - x \ \rightarrow h \geq 0 \iff \ u \leq 18 \tag{1.11}$$

1.3 Second iteration

$$x = 6 - \frac{3}{5}y - \frac{1}{5}u \tag{1.12}$$

$$p = 12 - \frac{9}{5}y + \frac{2}{5} \tag{1.13}$$

$$h = 12 - \tag{1.14}$$

$$\text{---------------} \tag{1.15}$$

$$z = -48 - \frac{6}{5} + \frac{8}{5} \tag{1.16}$$

a) Input variable: y b) Output variable: x c) pivot

With:

$$x = 6, y = 0, u = 0, p = 12, h = 12, z = -48 \tag{1.17}$$

$$\text{---------------} \tag{1.18}$$

$$x = 6 - \frac{3}{5}y \ \rightarrow \ x \geq 0 \iff \ y \leq 10 \tag{1.19}$$

$$p = 12 - \frac{9}{5}y \ \rightarrow p \geq 0 \iff \ y \leq \frac{20}{3} \tag{1.20}$$

$$h = 12 - \frac{12}{5}y \ \rightarrow h \geq 0 \iff \ y \leq 5 \tag{1.21}$$

1.4 Solve and see if we keep iterating

System of equation where we express x,y,y in function of u and h.

$$x = 3 - \frac{1}{4}u + \frac{1}{4}h \tag{1.22}$$

$$p = 3 + \frac{1}{4}u + \frac{3}{4}h \tag{1.23}$$

$$y = 5 + \frac{1}{12}u - \frac{5}{12}h \tag{1.24}$$

$$\text{---------------} \tag{1.25}$$

$$z = -54 + \frac{3}{2}u + \frac{1}{2}h \tag{1.26}$$

With:

$$x = 3, y = 5, u = 0, p = 3, h = 0, z = -54 \tag{1.27}$$

$$x = 6 - \frac{3}{5}\left(5 + \frac{1}{12}u - \frac{5}{12}h\right) - \frac{1}{5}u \tag{1.28}$$

$$p = 12 - \frac{9}{5}\left(5 + \frac{1}{12}u - \frac{5}{12}h\right) + \frac{2}{5}u \tag{1.29}$$

$$z = -48 - \frac{6}{5}\left(5 + \frac{1}{12}u - \frac{5}{12}h\right) + \frac{8}{5}u \tag{1.30}$$

2 Table form