Mila University Center — Academic year 2025/2026

Subject: Linear programming — 3rd year computer science

Material 1(Graphical resolution of LPs)

Exercice 1. Solve the LP problem of exercise 1 using the graphical method.

Exercice 2. Determine the solution to the following linear programme using the graphical method.

Min Z= X+Y

$$\begin{cases} X+4Y\geq 8 \\ 4X+Y\geq 8 \\ X\geq 0, Y\geq 0 \end{cases}$$

Exercice 3. Solve using the graphical method:

Max z $=3x_1+x_2$

$$\begin{cases} x_1-x_2\leq 4 \\ -x_1-x_2\leq -3 \\ 2x_1+x_2\leq 2 \\ x1, x2\geq 0 \end{cases}$$

Exercice 4 Determine the solution to the following linear programme using the graphical method.

$$\begin{cases} 10x_1+8x_2=100 \\ x_1\geq 3 \\ x_2\leq 4 \\ x_1\geq 0 \wedge x_2\geq 0 \\ Min\, Z=10x_1+20x_2 \end{cases}$$

Exercice 5. Consider a company producing two products in quantities x_1 and x_2 respectively, subject to production capacity constraints relating to two production workshops. The linear programme corresponding to margin maximisation is as follows:

Max Z= $3x_1+5x_2$

$$\begin{cases} 2X_2\leq 12 \\ 3X_1+2X_2\leq 18 \\ X_1\geq 0, X_2\geq 0 \end{cases}$$

a) Determine Graphically the optimal vertex and give its coordinates.

b) Express the problem as an equality by adding deviation variables.

c) At the optimum, which variables are basic and which are non-basic?

(d) Significant improvements in work organisation would reduce the machining time for the second item in the first workshop. The first constraint therefore becomes $\alpha x2\leq 12$, where α, the new machining time, is a parameter less than 2. To what value can α be reduced so that the same basis (i.e. the same basic variables) remains optimal?

(e) Below this value, what is the optimal peak (give its coordinates) and what is the new basis (i.e. what are the new basis variables)?