ESCOLA POLITÉCNICA DA UNIVERSIDADE DE SÃO PAULO
DEPARTAMENTO DE ENGENHARIA DE TRANSPORTES
PTR 5744 - PESQUISA OPERACIONAL APLICADA AO PLANEJAMENTO DE TRANSPORTES

**1ª SÉRIE DE PROBLEMAS - 1º Período de 2018**

# Problema 1

Resolva, através do método gráfico, o seguinte problema de programação linear:

Maximize $z = 3x_1 + 4x_2$,

subject to:

$$x_1 - 2x_2 \geq 4,$$
$$x_1 + x_2 \leq 3,$$
$$x_1 \geq 0, \qquad x_2 \geq 0.$$

# Problema 2

[1.17] A 10–acre slum in New York City is to be cleared. The officials of the city must decide on the redevelopment plan. Two housing plans are to be considered: low–income housing and middle–income housing. These types of housing can be developed at 20 and 15 units per acre, respectively. The unit costs of the low– and middle–income housing are $17,000 and $25,000. The lower and upper limits set by the officials on the number of low–income housing units are 80 and 120. Similarly, the number of middle–income housing units must lie between 40 and 90. The combined maximum housing market potential is estimated to be 190 (which is less than the sum of the individual market limits due to the overlap between the two markets). The total mortgage committed to the renewal plan is not to exceed $2.5 million. Finally, it was suggested by the architectural adviser that the number of low–income housing units be at least 50 units greater than one–half the number of the middle–income housing units.

    a.    Formulate the minimum cost renewal planning problem as a linear program and solve it graphically.
    b.    Resolve the problem if the objective is to maximize the number of houses to be constructed.

# Problema 3

Resolva através do Método Simplex o seguinte problema de programação linear:

$$
\begin{aligned}
\text{minimize} \quad & 2x_1 + 4x_2 + x_3 + x_4 \\
\text{subject to} \quad & x_1 + 3x_2 \qquad\; + x_4 \leqslant 4 \\
& 2x_1 + x_2 \qquad\qquad \leqslant 3 \\
& \qquad\; x_2 + 4x_3 + x_4 \leqslant 3 \\
& x_1 \geqslant 0 \qquad i = 1, 2, 3, 4.
\end{aligned}
$$

# Problema 4

Resolva através do Método Simplex, utilizando os métodos do M-grande e das duas fases, o seguinte problema de programação linear:

$$
\begin{aligned}
\text{Maximize} \quad & 4x_1 + 5x_2 - 3x_3 \\
\text{subject to} \quad & x_1 + 2x_2 + x_3 = 10 \\
& x_1 - x_2 \qquad\quad \geq 6 \\
& x_1 + 3x_2 + x_3 \leq 14 \\
& x_1, \quad x_2, \quad x_3 \geq 0.
\end{aligned}
$$