Lista 1 - Exercício 2

INF2912 - Otimização Combinatória

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BigData / **Globo.com**

Transport Problem

- A - conjunto de centros de produção $|A| = m$
- B - conjunto de centros de consumo $|B| = n$
- c_{ij} - custo unitário de desolocamento da produção i para o consumo j
- $a \in \mathbb{R}^m$ - vetor da quantidade produzida por centro
- $b \in \mathbb{R}^n$ - vetor da quantidade consumida por centro
- $\sum^m a_i = \sum^n b_j$

Objetivo:

custo total de transporte mínimo

Modelo LP

$$
\begin{aligned}
\text{minimize} \quad & \sum_{i=1}^{m} \sum_{j=1}^{n} c_{ij} x_{ij} \\
\text{subject to} \quad & \sum_{j=1}^{n} x_{ij} = a_j && i = 1, \ldots, m \\
& \sum_{i=1}^{m} x_{ij} = b_j && j = 1, \ldots, n \\
& x_{ij} \geq 0 && i = 1, \ldots, m; j = 1, \ldots, n
\end{aligned}
$$

JuMP

http://www.juliaopt.org/ (http://www.juliaopt.org/)

http://jump.readthedocs.org/en/stable/ (http://jump.readthedocs.org/en/stable/)

Modeling language for Mathematical Programming (linear, mixed-integer, conic, nonlinear)

In [1]:
```
using JuMP
```

In [2]:
```
m = 2
n = 3

a = [15, 25]
b = [15, 15, 10]
c = [5 10 7
     8 9 6]
```

Out[2]: 2x3 Array{Int64,2}:
```
 5  10  7
 8   9  6
```

In [3]:
```
mtp = Model()

@defVar(mtp, x[1:m,1:n] ≥ 0)

for i=1:m
    @addConstraint(mtp, sum{x[i,j], j=1:n} == a[i])
end

for j=1:n
    @addConstraint(mtp, sum{x[i,j], i=1:m} == b[j])
end

@setObjective(mtp, Min, sum{c[i,j] * x[i,j], i=1:m, j=1:n})

mtp
```

Out[3]:

$$\begin{aligned} \min \quad & 5x_{1,1} + 10x_{1,2} + 7x_{1,3} + 8x_{2,1} + 9x_{2,2} + 6x_{2,3} \\ \text{Subject to} \quad & x_{1,1} + x_{1,2} + x_{1,3} = 15 \\ & x_{2,1} + x_{2,2} + x_{2,3} = 25 \\ & x_{1,1} + x_{2,1} = 15 \\ & x_{1,2} + x_{2,2} = 15 \\ & x_{1,3} + x_{2,3} = 10 \\ & x_{i,j} \geq 0 \quad \forall i \in \{1,2\}, j \in \{1,2,3\} \end{aligned}$$

In [4]:
```
solve(mtp)
```

Out[4]: :Optimal

In [5]:
```
typeof(getInternalModel(mtp))
```

Out[5]: Clp.ClpMathProgSolverInterface.ClpMathProgModel

In [6]:
```
getObjectiveValue(mtp)
```

Out[6]: 270.0

In [7]:
```
getValue(x)
```

Out[7]: 2x3 Array{Float64,2}:
```
 15.0   0.0   0.0
  0.0  15.0  10.0
```

```
In [8]:  getDual(x)

Out[8]:  2x3 Array{Float64,2}:
          0.0  1.0  1.0
          3.0  0.0  0.0
```