MP-2 Tutorial-2

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Question

produce TV sets at two factories sony and LG. Suppose 'x' tv's are produced at sony, 'y' are produced at LG. Suppose the cost is given by $C(x,y) = 6x^2 + 12y^2$

If you must produce 90 tv sets, what is the number of TV sets that must be produced by each factory?

Solution

objective function should be subtracted λ times of constraints.

Constraint $x + y = 90$

$$6x^2 + 12y^2 - \lambda(x+y-90) = F(x,y,\lambda)$$

$$6x^2 + 12y^2 - \lambda x - \lambda y + 90\lambda = F(x,y,\lambda)$$

Partial derivations

$$F_x = 12x - \lambda = 0 \qquad F_y = 24y - \lambda = 0$$

$$F_\lambda = -x - y + 90 = 0$$

$$F_x = 12x - \lambda = 0 \longrightarrow x = \lambda/12$$

$$F_y = 24 - \lambda = 0 \longrightarrow y = \lambda/24$$

$$F_\lambda = -x - y + 90 = 0$$

$$\Rightarrow -\frac{\lambda}{12} - \frac{\lambda}{24} + 90 = 0$$

$$\frac{3\lambda}{24} = 90$$

$$\lambda = 720$$

$$x = \frac{\lambda}{12} = \frac{720}{12} = 60 \qquad (x, y) = (60, 30)$$

$$y = \frac{\lambda}{24} = \frac{720}{24} = 30$$

$$C(x, y) = 6x^2 + 12y^2$$

$$= 6(60)^2 + 12(30)^2$$

$$= 6.3600 + 12.900$$

$$= 21600 + 10800$$

$$= 32400$$

Cost of both to produce 60 tv sets by sony and 30 tv sets by LG is 32,400

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TUTORIAL-2

In [1]:
```
#Langrange Multipliers

import numpy as np

def func(X):
  x=X[0]
  y=X[1]
  L=X[2]
  return 6*x**2+12*y**2-L*(x+y-90)
```

In [6]:
```
def dfunc(X):
  dLambda=np.zeros(len(X))
  h=1e-3
  for i in range(len(X)):
    dX=np.zeros(len(X))
    dX[i]=h
    dLambda[i]=(func(X+dX)-func(X-dX))/(2*h)
  return dLambda
```

In [7]:
```
from scipy.optimize import fsolve
x1=fsolve(dfunc,[1,1,0])
print(x1,func(x1))
x2=fsolve(dfunc,[-1,-1,0])
print(x2,func(x2))
```

```
[ 60.          30.         720.00000001] 32400.0
[ 60.          30.         719.99999999] 32400.0
```

In [11]:
```
pip install pyatom
```

```
Collecting pyatom
  Downloading https://files.pythonhosted.org/packages/e3/1b/ea029151d3ff734277c2adbd20addd9fee8e7105ec8659ffcb0834a29312/pyatom-0.0.10-py3-none-any.whl (https://files.pythonhosted.org/packages/e3/1b/ea029151d3ff734277c2adbd20addd9fee8e7105ec8659ffcb0834a29312/pyatom-0.0.10-py3-none-any.whl)
Installing collected packages: pyatom
Successfully installed pyatom-0.0.10
```

In [8]:
```
pip install -i https://pypi.gurobi.com gurobipy
```

```
Looking in indexes: https://pypi.gurobi.com (https://pypi.gurobi.com)
Collecting gurobipy
  Downloading https://pypi.gurobi.com/gurobipy/gurobipy-9.1.1-cp36-cp36m-manylinux1_x86_64.whl (https://pypi.gurobi.com/gurobipy/gurobipy-9.1.1-cp36-cp36m-manylinux1_x86_64.whl) (11.1MB)
     |████████████████████████████████| 11.1MB 2.1MB/s
Installing collected packages: gurobipy
Successfully installed gurobipy-9.1.1
```

In [9]:
```
pip install rsome
```

```
Collecting rsome
  Downloading https://files.pythonhosted.org/packages/af/89/89da29b18d1aa5d033fc7d01f8e50b87d18a4ccaf88aa82e4a34d8ddb4bf/rsome-0.0.7-py3-none-any.whl (https://files.pythonhosted.org/packages/af/89/89da29b18d1aa5d033fc7d01f8e50b87d18a4ccaf88aa82e4a34d8ddb4bf/rsome-0.0.7-py3-none-any.whl)
Installing collected packages: rsome
Successfully installed rsome-0.0.7
```

In [13]:
```
import pyatom.lp as lp
import pyatom.grb_solver as grb
model=lp.Model()
y1=model.dvar()
y2=model.dvar()
y3=model.dvar()
y4=model.dvar()
model.max(16*y1+22*y2+12*y3+8*y4)
model.st(5*y1+7*y2+4*y3+3*y4<=14)
model.st(y1>=0)
model.st(y1<=1)
model.st(y2>=0)
model.st(y2<=1)
model.st(y3>=0)
model.st(y3<=1)
model.st(y4>=0)
model.st(y4<=1)
model.solve(grb)
```

```
Restricted license - for non-production use only - expires 2022-01-13
Being solved by Gurobi...
Solution status: 2
Running time: 0.0005s
```

In [14]:
```
print(model.get())
print(y1.get())
print(y2.get())
print(y3.get())
print(y4.get())
```

```
44.0
[1.]
[1.]
[0.5]
[0.]
```