Linear Programming (Simplex LP) PuLP?

Asked 4 years, 2 months ago Active 4 years, 2 months ago Viewed 4k times

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In Python only, and using data from a Pandas dataframe, how can I use PuLP to solve linear programming problems the same way I can in Excel? How much budget should be allocated to each Channel under the New Budget column so we maximize the total number of estimated successes? I'm really looking for a concrete **example** using data from a dataframe and not really high-level advice.

Problem Data Setup

	Channel	30-day Cost	Trials	Success	Cost Min	Cost Max	New Budget
0	Channel1	1765.21	9865	812	882.61	2647.82	0
1	Channel2	2700.00	15000	900	1350.00	4050.00	0
2	Channel3	2160.00	12000	333	1080.00	3240.00	0

This is a **Maximization** problem.

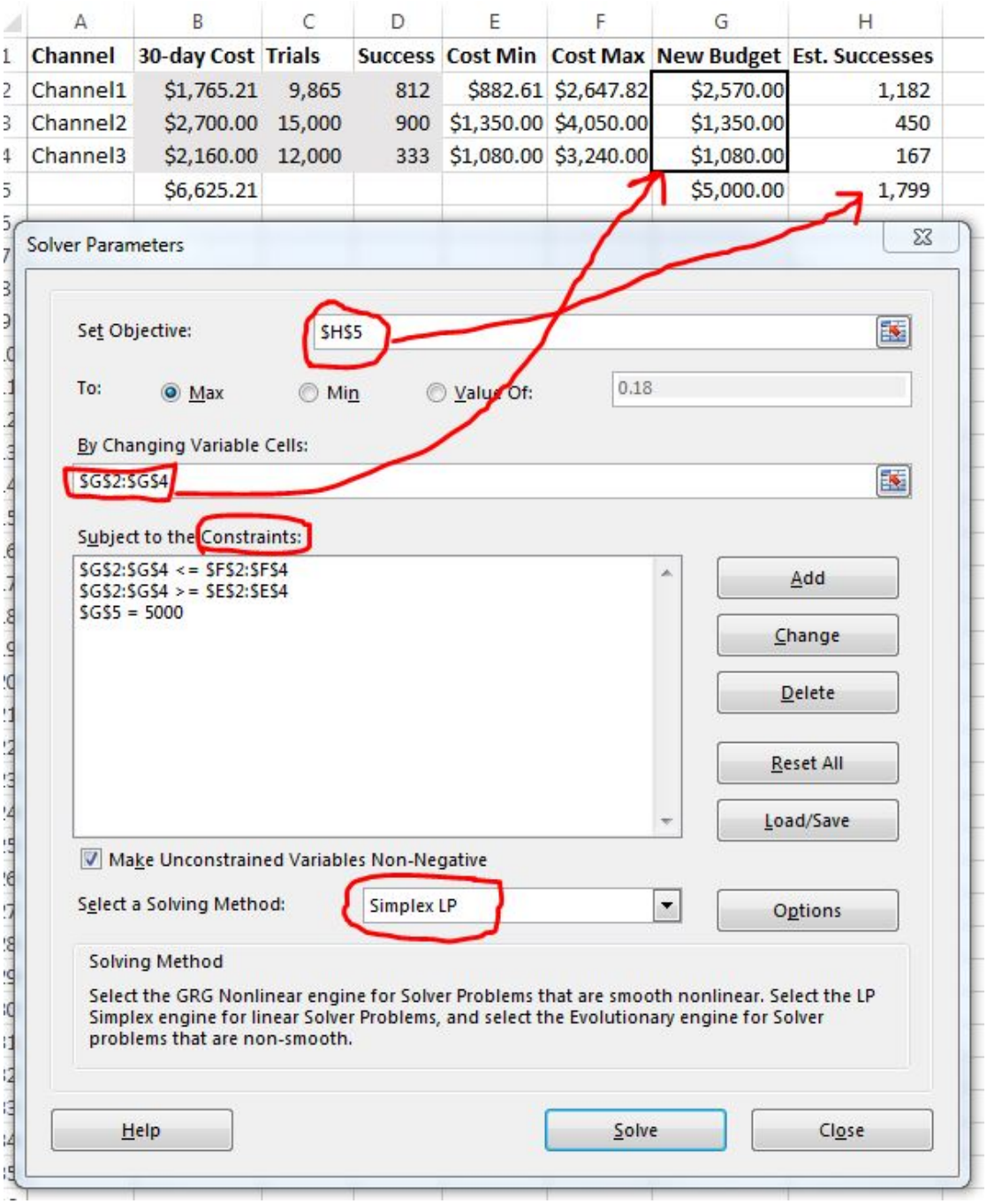
The *objective function* is:

```
objective_function = sum((df['New Budget']/(df['30-day Cost']/df['Trials']))*(df['Success']
```

The *constraints* are:

1. The sum of `df['New Budget']` must equal `5000`
2. The `New Budget` for a given channel can go no *lower* than the `Cost Min`
3. The `New Budget` for a given channel can go no *higher* than the `Cost Max`

Any ideas how to translate this pandas dataframe solver linear problem using PuLP or any other solver approach? The end-result would be what you see in the image below.



python pandas dataframe linear-programming pulp

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edited Oct 15 '15 at 23:59

TigerhawkT3

41.5k ● 5 ● 38 ● 69

asked Oct 15 '15 at 23:36

Jarad

8,072 ● 8 ● 53 ● 80

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1 Answer

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In general you create a dictionary of variables (`x` in this case) and a model variable (`mod` in this case). To create the objective you use `sum` over the variables times some scalars, adding that result to `mod`. You construct constraints by again computing linear combinations of variables, using `>=`, `<=`, or `==`, and adding that constraint to `mod`. Finally you use `mod.solve()` to get the solutions.

```
import pulp

# Create variables and model
x = pulp.LpVariable.dicts("x", df.index, lowBound=0)
mod = pulp.LpProblem("Budget", pulp.LpMaximize)

# Objective function
objvals = {idx: (1.0/(df['30-day Cost'][idx]/df['Trials'][idx]))*(df['Success'][idx]/float(
mod += sum([x[idx]*objvals[idx] for idx in df.index])

# Lower and upper bounds:
for idx in df.index:
    mod += x[idx] >= df['Cost Min'][idx]
    mod += x[idx] <= df['Cost Max'][idx]

# Budget sum
mod += sum([x[idx] for idx in df.index]) == 5000.0

# Solve model
mod.solve()

# Output solution
for idx in df.index:
    print idx, x[idx].value()
# 0 2570.0
# 1 1350.0
# 2 1080.0

print 'Objective', pulp.value(mod.objective)
# Objective 1798.70495012
```

Data:

```
import numpy as np
import pandas as pd
idx = [0, 1, 2]
d = {'channel': pd.Series(['Channel1', 'Channel2', 'Channel3'], index=idx),
     '30-day Cost': pd.Series([1765.21, 2700., 2160.], index=idx),
     'Trials': pd.Series([9865, 1500, 1200], index=idx),
```

```
df = pd.DataFrame(d)
df
#    30-day Cost  Cost Max  Cost Min  Success  Trials   channel

# 0      1765.21   2647.82    882.61      812    9865  Channel1
# 1      2700.00   4050.00   1350.00      900    1500  Channel2
# 2      2160.00   3240.00   1080.00      333    1200  Channel3
```

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edited Oct 16 '15 at 18:24

answered Oct 16 '15 at 1:01

josliber ♦

39.4k ● 11 ● 73 ● 109

In the same example what if I have two variables. For eg: currently, $G$2:$G$4 is there if want something like $G$2:$H$6 as changing the variable in pulp. – Bastin Robin Aug 27 '17 at 10:38

@josliber, I'm curious, why are you using `1.0` in your objective function where OP is using `df['New Budget']`? Is that because `df['New Budget']` are the variable cells? I'm trying to map this to my own problem but can't figure out where to put my variable cells. Thanks! – tmthyjames Nov 1 '17 at 15:15

@tmthyjames I am using `1.0/(df['30-day Cost'][idx]/df['Trials'][idx]))*(df['Success'][idx]/float(df['Trials'][idx])` because this is the OP's objective function from their excel spreadsheet. If you have a different formula then you would use that instead. – josliber ♦ Nov 1 '17 at 15:25

Hi @josliber, is it possible for me to connect with you over mail? I have a similar problem that I want to discuss. Would be really grateful, if you could help me out. Thanks. Kindly, check this out : stackoverflow.com/questions/49194399/… – IndigoChild Mar 10 '18 at 17:19

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