ISYE 6669 Deterministic Optimization

Homework 6

February 25th, 2021

1.

Decision variables for our problem is the following:

z: *total difference in runtime between A and B*
a : *total amount of runtime for creating product A*
b : *total amount of runtime for creating product B*

$min\ |z|$

$s.t.$
$a - 2b \leq z$
$2b - a \leq z$
$a \geq 30$
$a + b \geq 50$
$a \leq 100$
$a \leq 100$
$b \geq 0$

Note: When we simply the objective function we get the following constraints related to the absolute difference between product A and product B
$|(3a + 5b) - (4a + 3b)| = (2b - a, a - 2b)$
We then use this results to form our constraints.

```
import cvxpy as cp
import numpy as np

# declaring variables
z = cp.Variable()
a = cp.Variable()
b = cp.Variable()

# defining objective
objective = cp.Minimize(z)

# defining constraints
constraints = [
a-(2*b) <= z,
```

```
(2*b)-a <= z,
a+b >= 50,
a >= 30,
a <= 100,
b <= 100,
b >= 0
]

myprob = cp.Problem(objective, constraints)
myprob.solve()
# printing outputs
print("\nThe optimal value is", myprob.value)
print("The values of a and b are ", a.value, b.value)

The optimal value is 4.043281386825957e-10
The values of a and b are  57.94946776796661 28.97473388417445
```

2.

Decision variables for our problem is the following:
c_1 : *purchase cost Supplier* 1
c_2 : *purchase cost Supplier* 2
x_1 : *suitcases purchased from both suppliers*

$min\ c_1 + c_2$

$s.t.$
$10x \ \leq c_1$
$1200 \ \leq c_2$
$1200 + 5(400 - x_2) \ \leq c_2$
$x \geq 0$
$x \leq 500$

```
import cvxpy as cp
import numpy as np

# declaring variables
c_1 = cp.Variable()
```

```
c_2 = cp.Variable()
x = cp.Variable()

# defining objective
objective2 = cp.Minimize(c_1+c_2)

# defining constraints
constraints2 = [
x >= 0,
x <= 500,
10*x <= c_1,
1200 <= c_2,
1200 + 5*(400-x) <= c_2,

]

problem2 = cp.Problem(objective2, constraints2)
problem2.solve()
# printing outputs
print("\nThe optimal value is", problem2.value)
print("The values of a and b are ", x.value, 500-x.value)

The optimal value is 3200.000001852015
The values of a and b are  -6.345394058853363e-08
500.00000006345397
```

Based on this output, we can see that all 500 units should be bought from Supplier 2, and will result in a cost of 3200.