

# Convex Optimization

## Tutorial 3

Tanmay Garg CS20BTECH11063

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In [ ]: #Importing required Libraries
import numpy as np
import matplotlib.pyplot as plt
import cvxpy as cp
```

```
In [ ]: #Importing data from python file
from expense_stream_data import *
```

```
In [ ]: # Given to us in file are the variables
# m, n, P, e, rho
# to find b, w, x
b = cp.Variable((n, 1))
w = cp.Variable((n, 1))
x = cp.Variable((m, 1))
```

```
In [ ]: sum_with_invest = w + cp.matmul(P, x)
```

```
In [ ]: MyObjective = cp.Minimize(b[0] + np.ones(m)@x)
# MyObjective = cp.Minimize(b[0] + cp.sum(x))

#The constraints given in the question
MyConstraint = [
    b >= 0,      #given in question
    x >= 0,      #given in question
    w >= 0,
    sum_with_invest >= e
]
```

```
In [ ]: # Constraint for b vector given in question
for t in range(n-1):
    MyConstraint += [
        b[t + 1] - (1 + rho)*b[t] + w[t] == 0
    ]
```

```
In [ ]: # # Solving the Convex Optimization
# prob = cp.Problem(MyObjective, MyConstraint)
# value = prob.solve()
# print("Total amount we invest: ",value)
```

```
In [ ]: MyConstraint += [x == 0]
prob = cp.Problem(MyObjective, MyConstraint)
value = prob.solve()
print("Total amount we invest: ",value)
```

Total amount we invest: 336.54540310163355