EE5121 - CVX Assignment

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1 Details of the Files

- All files are .m files
- Each question has a separate file with name as Q(question no.).m
- Screenshot of the figure is also in the same file with the question no. as the name.

2 Question 1

The problem can be formulated as follows:

$$\begin{aligned} \min_{x} \quad & min||y-x||^2 \\ \text{subject to} \quad & ||Ax|| \leq b \end{aligned} \tag{1}$$

In standard SOCP form:

$$\begin{aligned} \min_{t} \quad & t \\ \text{subject to} \quad & ||y-x||^2 \leq t^2, \\ & \sum_{i=1}^{n-1} t_i \leq b, \\ & ||a_j^T x||_1 \leq t_i, \forall i \in 1,2,\ldots,n-1 \end{aligned} \tag{2}$$

We take information from the data provided and formulate the problem in MATLAB as given above. Here, A is the matrix as suggested in the question. We choose b such that 20 jumps are observed in the plot. The plot of estimated x and abrupt y is shown below.

The optimal value is +131.077.

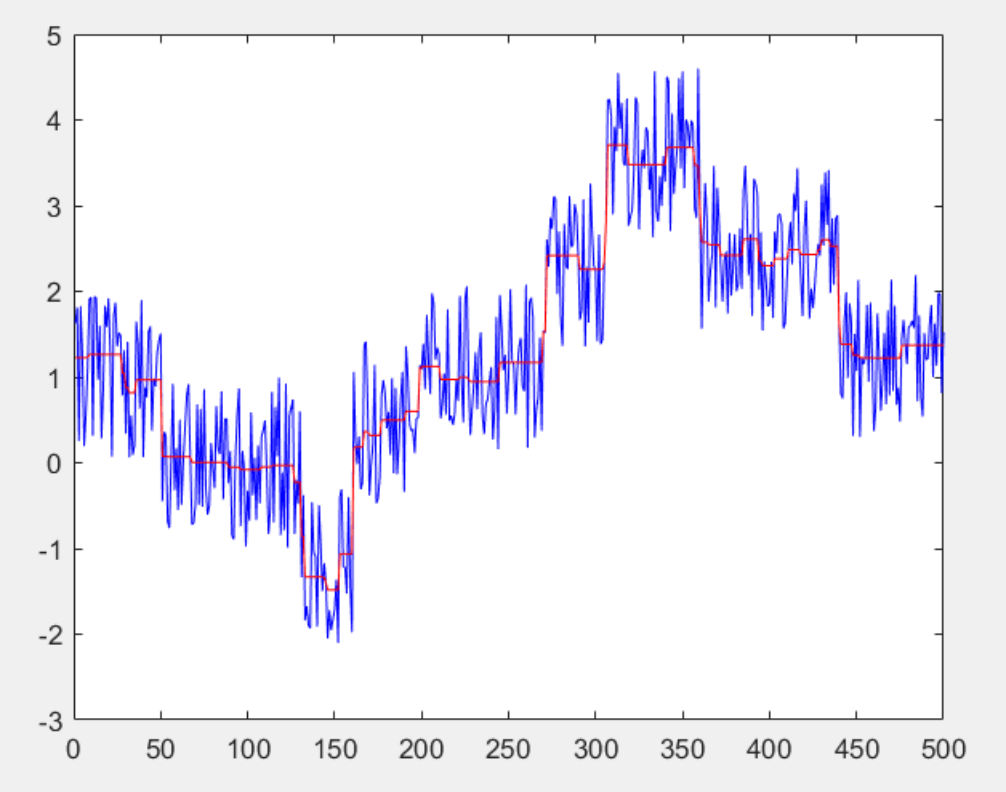

Figure 1: Plot of estimated x and y

3 Question 2

The problem can be formulated as follows:

$$\begin{aligned} \max_{t,x} \quad & 1^T t \\ \text{subject to} \quad & t_j \leq p_j * x_j, \\ & t_j \leq p_j * q_j + p_{disc} * (x_j - q_j), \\ & Ax \leq c_{max}, \\ & 0 \leq x \end{aligned} \tag{3}$$

We obtain the optimal values for various parameters:

- Revenue: 192.5
- Activity Levels: 4, 22.5, 31, 1.5
- Revenue components: 12, 32.5, 139, 9
- Activity levels cross threshold for $x_{2,3}$.
- Revenue component is max for $x_{2,3}$.

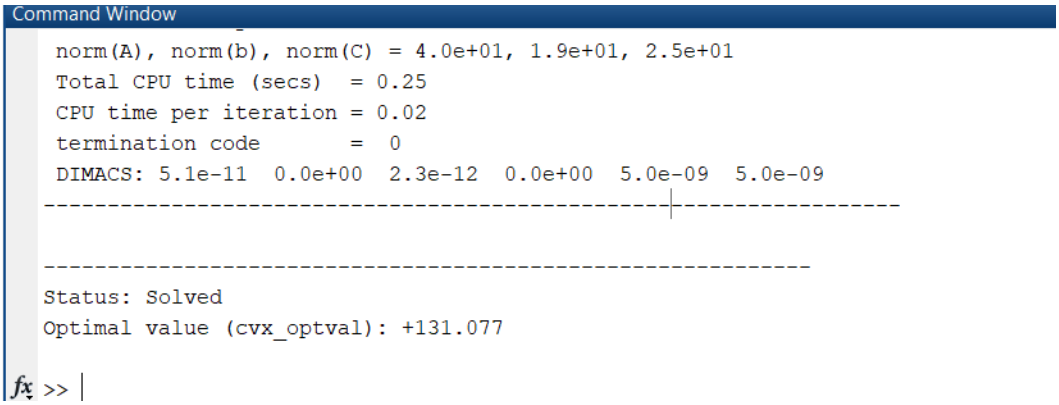

Figure 2: Optimal value for the problem 1

4 Question 3

The problem can be formulated as follows:

$$\begin{aligned} \min_{A,Y,Z} \quad & tr(Y) + tr(Z) \\ \text{subject to} \quad & A_{i,j} = X_{i,j}, \\ & \begin{pmatrix} Y & X \\ X^T & Z \end{pmatrix} \geq 0, \\ & Y \geq 0, \\ & Z \geq 0 \end{aligned} \tag{4}$$

The optimal value is +186.302.

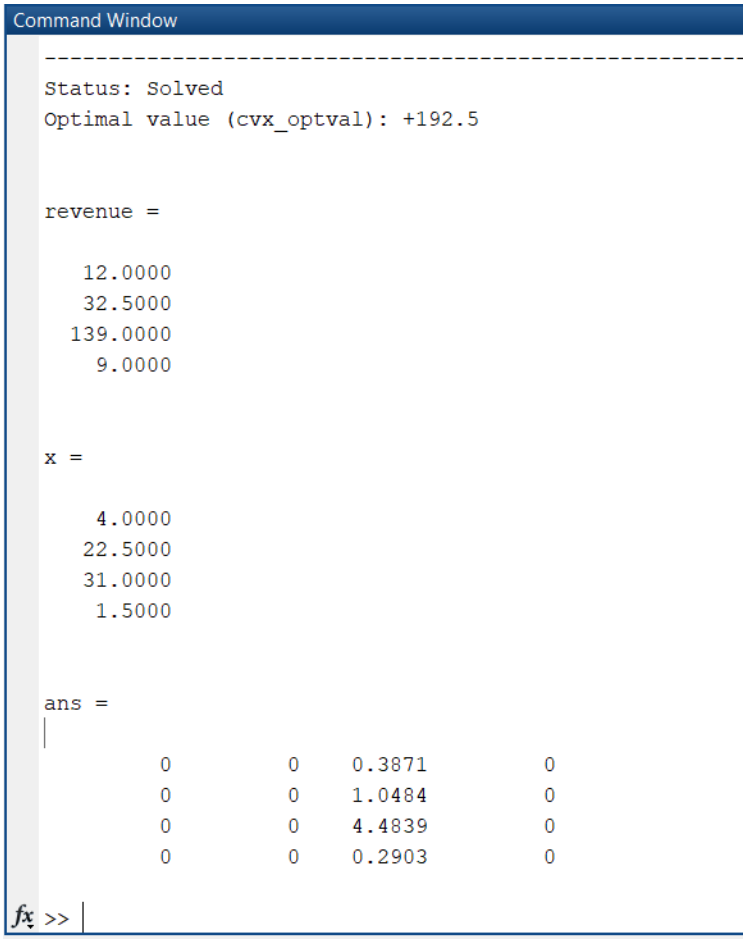

Figure 3: Optimal value for the problem 2

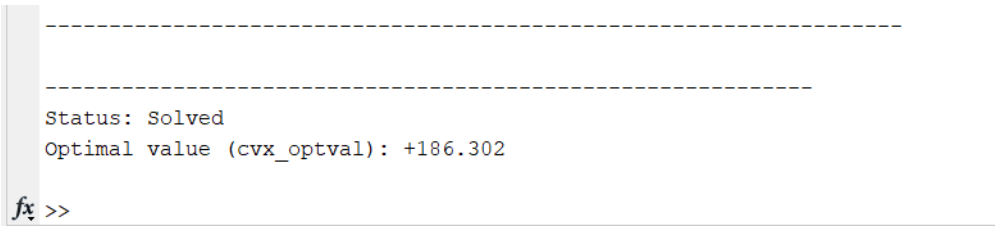

Figure 4: Optimal value for the problem 3