Homework 7

Problem 2

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & 1 \\ 0 & 1 & 2 \end{bmatrix}$$ **as form of** $O\Lambda O^\top$

O =

-0.5000	0.7071	0.5000
-0.7071	-0.0000	-0.7071
0.5000	0.7071	-0.5000

D =

0.5858	0	0
0	2.0000	0
0	0	3.4142

Problem 6

If Matrix A is positive definite or semi-positive definite, then A =

Part a:

A = [1 3
3 9]

O_a = -0.9487 0.3162
0.3162 0.9487

D_a = 0 0

0 10

The matrix is Semi-Positive Definite by observing the eigenvalues.

A_root = 0 0
1 3

Part b:

B = [6 10 11
10 19 19
11 19 21]

O_b =

-0.8745 0.3270 0.3583
-0.0244 -0.7674 0.6407
0.4845 0.5515 0.6791

D_b =

0.1856 0 0
0 1.0842 0
0 0 44.7302

The matrix is Positive Definite by observing the eigenvalues.

B_root =

-0.3767 -0.0105 0.2087
0.3405 -0.7991 0.5743
2.3963 4.2850 4.5417

Part c:

C = [2 6 10
6 10 14
10 14 18]

O_c =

0.8424	0.4082	0.3516
0.1647	-0.8165	0.5534
-0.5130	0.4082	0.7551

D_c =

-2.9165	0	0
0	0.0000	0
0	0	32.9165

The matrix is **neither** Positive Definite **nor** Semi-Positive Definite by observing the eigenvalues.

Problem 3

$O^\top AO$

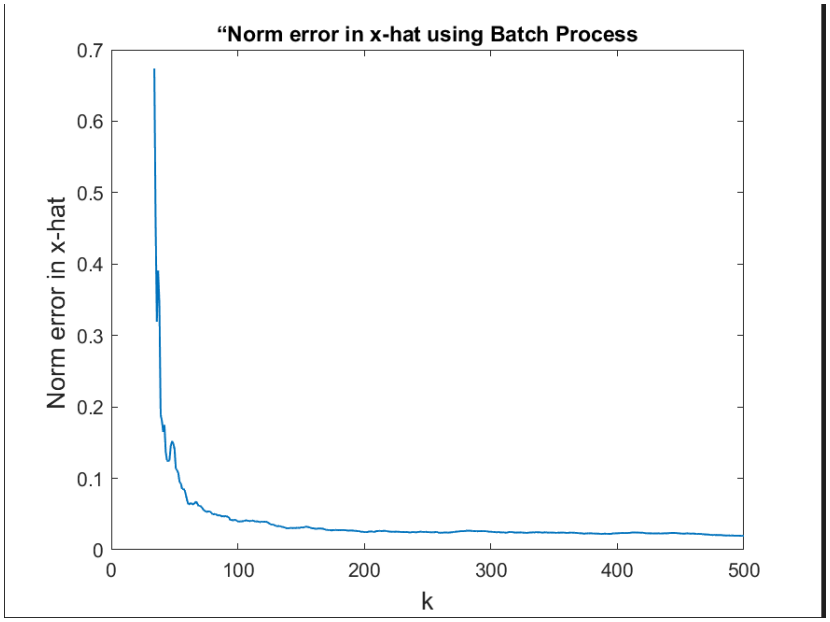
final_matrix =

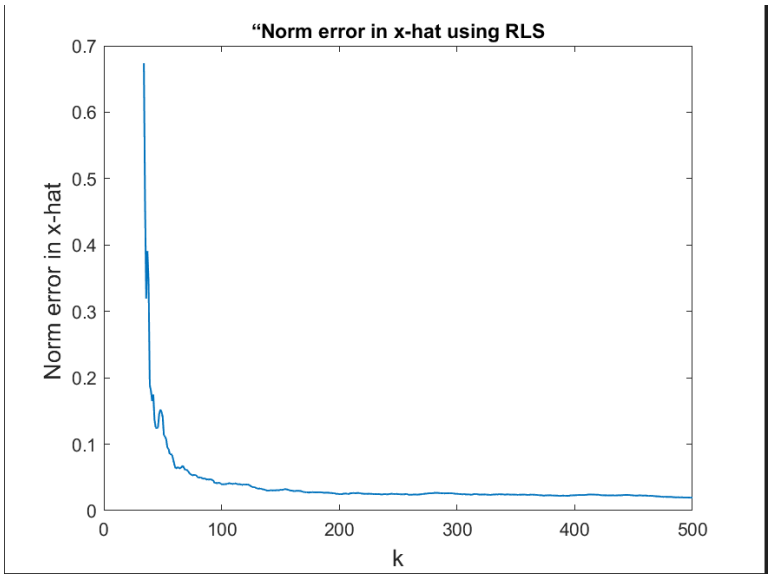
-1	**0**	**0**
0	**2**	**0**
0	**0**	**2**

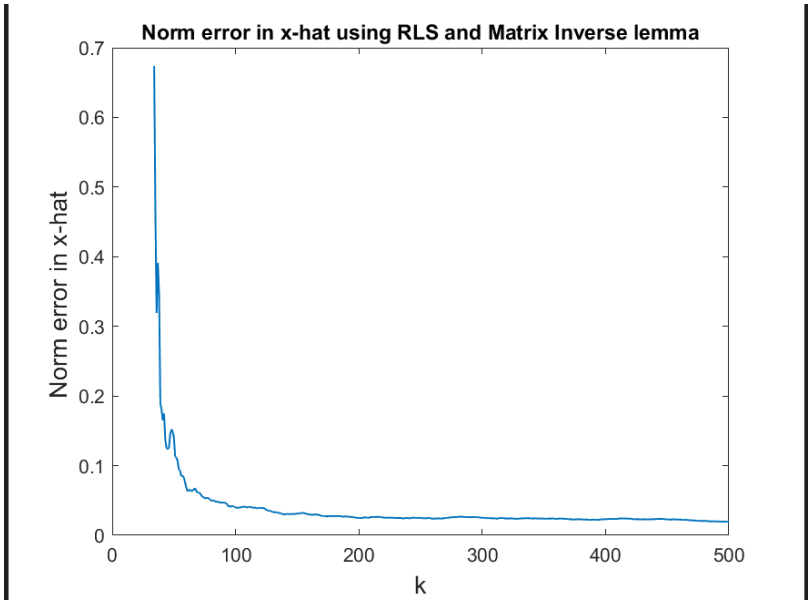
Problem 4

Step (a): n = 34

Total_time for batch process = 3.1442 sec
Total_time for RLS without Matrix Inversion lemma = 0.4463 sec
Total_time for RLS with Matrix Inversion lemma = 0.2729 sec

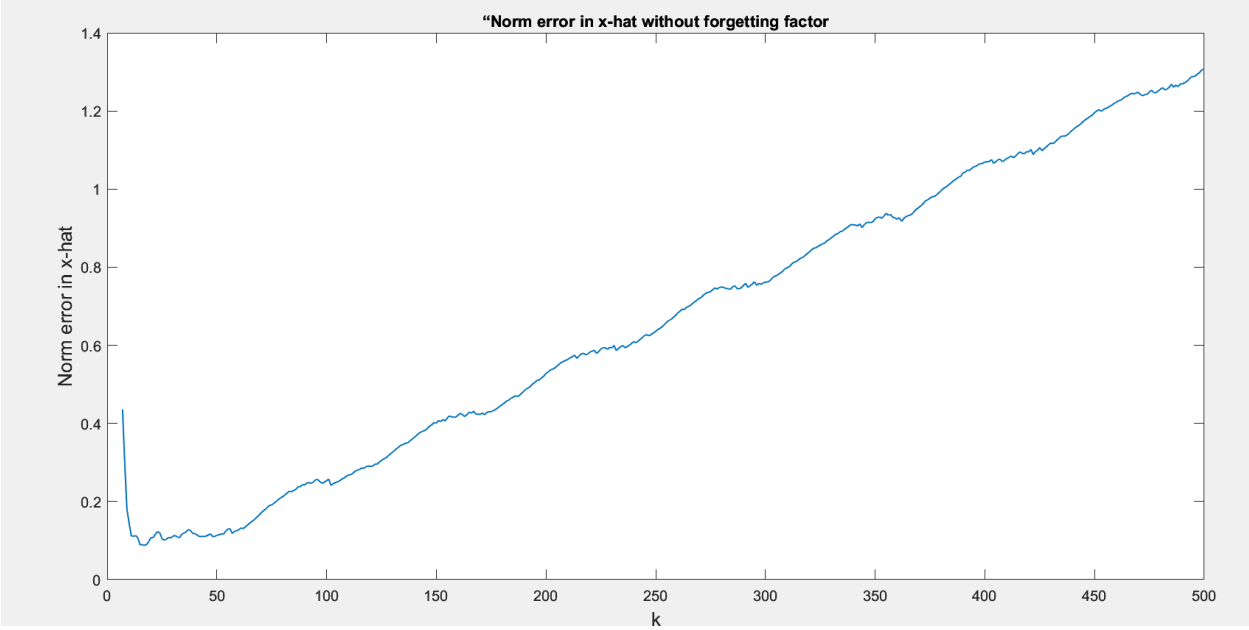

“Norm error in x-hat using Batch Process
Norm error in x-hat
k
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0
100
200
300
400
500

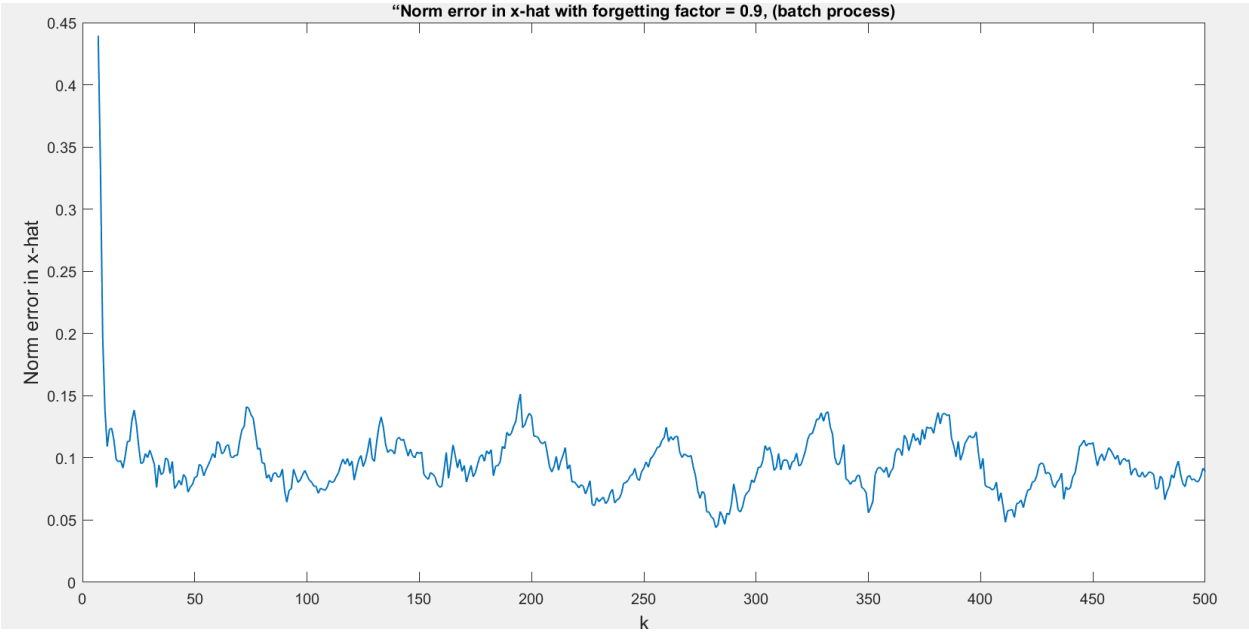

“Norm error in x-hat using RLS
Norm error in x-hat
k
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0
100
200
300
400
500

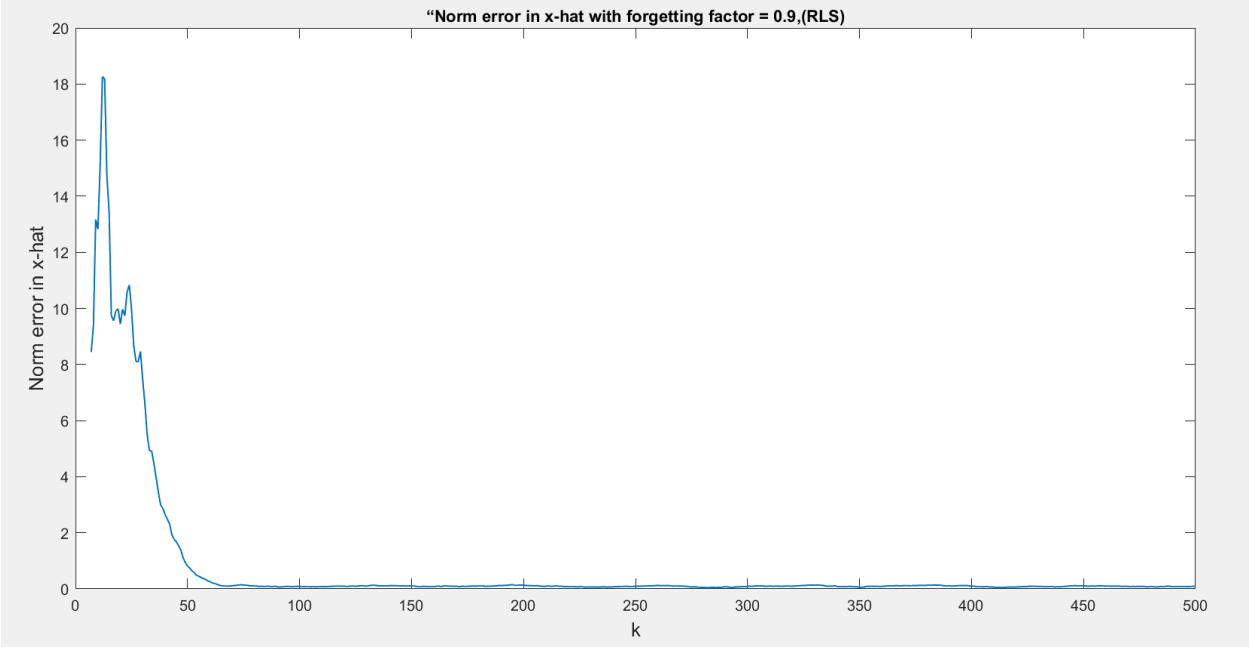


Problem 5:

N value is 7




"Norm error in x-hat with forgetting factor = 0.9, (batch process)
Norm error in x-hat
k
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0
50
100
150
200
250
300
350
400
450
500


"Norm error in x-hat with forgetting factor = 0.9,(RLS)
Norm error in x-hat
k
0
2
4
6
8
10
12
14
16
18
20
0
50
100
150
200
250
300
350
400
450
500