MATLAB assignment 8

Introduction to Linear Algebra (Week 8) **Fall, 2019**

1. A common problem in experimental work is to find a curve $y = f(x)$ of a specified form corresponding to experimentally determined values of x and y, say

$$(x_1, y_1), (x_2, y_2), \cdots, (x_n, y_n).$$

The followings are the three important models in applications.

- ***Linear line model*** $(y = ax + b)$
- ***Exponential model*** $(y = ae^{bx})$
- ***Logarithmic model*** $(y = a + b \ln x)$

A function file `LS_solver.m` fits given experimental data to the proper mathematical model using least squares method. If you execute the following MATLAB commands:

```
>> x=[2, 3, 4, 5, 6, 7, 8, 9]; y=[1.75, 1.91, 2.03, 2.13, 2.22, 2.30, 2.37, 2.43];
>> [a, b] = LS_solver(x, y, 1)
```

Then, you may obtain the following results with the figure (See Figure 1 below):

```
Linear model
a =
    0.0948

b =
    1.6213
```

Problem.

(a) Download the function file `LS_solver_guide.m` on KLMS and complete the missing parts. Save completed file as `LS_solver.m`. (10 points)

(b) Replace the `switch-case` command of the `LS_solver.m` with the `if-else if-else` command. (5 points)

(c) Use `LS_solver.m` to fit an exponential model to the following data (Table 1), graph the curve and data points in the same figure and check that the code works.

Table 1: Data points of Problem 1-ii (exponential model)

x	0	1	2	3	4	5	6	7
y	3.9	5.3	7.2	9.6	12	17	23	31

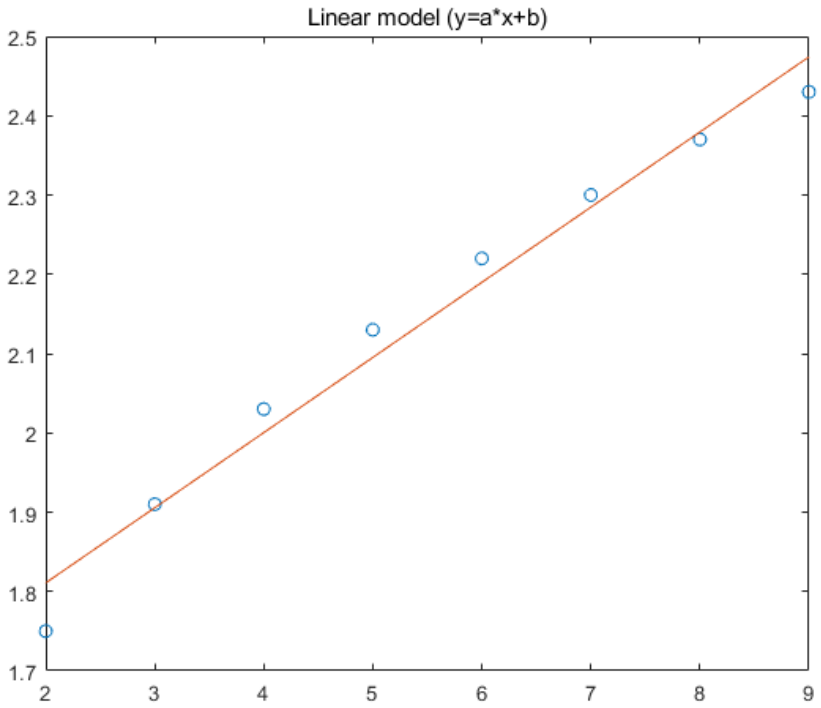

Figure 1: Execution result

Table 2: Data points of Problem 1-iii (logarithmic model)

x	2	3	4	5	6	7	8	9
y	4.07	5.30	6.21	6.79	7.32	7.91	8.23	8.51

(d) Use `LS_solver.m` to fit a logarithmic model to the following data (Table 2), graph the curve and data points in the same figure and check that the code works.

You may use the backslash operator in MATLAB (syntax : $A \setminus \mathbf{b}$ for a linear system $A\mathbf{x} = \mathbf{b}$) and refer to the T5 and T7 in Section 7.8 of the textbook.

2. Read the attachments "MATLAB_Week8.pdf" and practice by yourself.

Submission guide

- Submit your `LS_solver.m` file to *Homework box for assignment 8* on the KLMS.
  [Your file should work properly as 'function' and this means that it makes outputs **related** with given inputs. Double check the file **works** before upload your result.]

- You can submit your work after you have solved problem (a) only. In this case you will get scores for the problem (a).
- If you solved only problem (b) and just submit it, there are no points.

Due date : Nov 22 (Fri) 10:55 a.m.
Late submission will not be allowed.