MATLAB assignment 7

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`. (25 points)

   (b) 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)

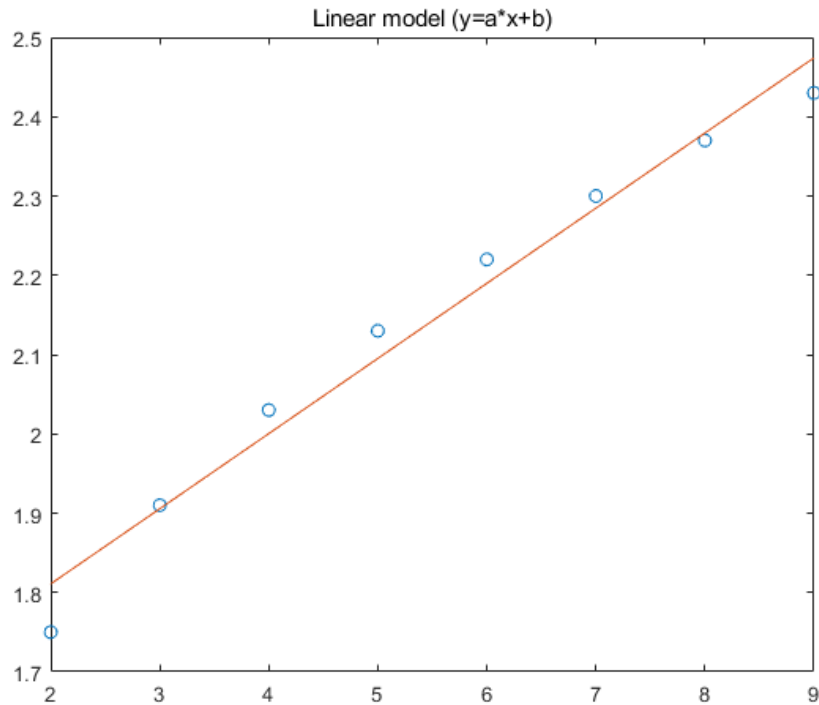 | x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
   |---|-----|-----|-----|-----|----|----|----|----|
   | y | 3.9 | 5.3 | 7.2 | 9.6 | 12 | 17 | 23 | 31 |

Figure 1: Execution result

(c) 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.

(d) Replace the `if-else if-else` command of the `LS_solver.m` with the `switch-case` command. Save this version of the file as `LS_solver_cs.m`. (25 points)

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

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.

[Who those use the built-in MATLAB command to get the least square solution **at once** will got zero points.]

2. Read the section in the *'MATLAB basic (Lee, Jeon)'* that corresponds to the this week class and practice by your self.

Submission guide

- Submit your `LS_solver.m` and `LS_solver_cs.m` files to 'Homework box for MATLAB assignment 7' on the KLMS.

- Incorrect file names and incorrect file format will cause a disadvantage in the scoring process.
[Your file should work properly as a 'function' and this means that it makes outputs **related** with given inputs. Double check if the file **works** or not, before upload.]

-      `LS_solver.m` file only: maximum (25 points)

       `LS_solver_cs.m` file only: (0 points)

       Both files: maximum (50 points)

Due date : Nov 19 (Thu) 23:59
Late submission will not be allowed.