

8.3 Empirical Models

MATLAB Quick Review Questions

Introduction to Computational Science: Modeling and Simulation for the Sciences

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This file contains system-dependent Quick Review Questions and answers in *MATLAB* for Module 8.3 on "Empirical Models." Complete all code development in *MATLAB*.

Linear Empirical Model

Quick Review Question 1 List the expressions that are linear combinations of u and v .

- A. $5u - 18v$ B. $-18v + 5u$ C. $7u$
D. $15uv$ E. $u/5 + v/3$ F. $5/u + 3/v$

Quick Review Question 2 Consider the set of points $pts = \{(0.2, 0.1), (0.4, 0.3), (0.3, 0.3), (0.3, 0.6)\}$.

- Assign to $xLst$ a vector of the x -coordinates.
- Assign to $yLst$ a vector of the y -coordinates.
- Give the command to return a vector of the coefficients for the least-squares line that best fits the set of points.
- Assign to x a sequence of numbers from 0 to 0.6 varying by 0.1, and do not display the result.
- Assign to $lineValues$ the corresponding list of y -values for the line of Part c.
- Graph the line.

Non-Linear One-Term Model

Quick Review Question 3 Suppose pts is an array of points, where the first column contains the x -coordinates and the second column contains the corresponding y -coordinates.

- Give the command to obtain the first column of pts .
- Select the operator to apply to the answer of Part a to return a row vector
A. $.$ B. $*$ C. $;$ D. $?$
E. $'$ F. $:$ G. nothing
- Give the command involving your answers from Parts a and b to assign to $xLst$ the x -coordinates of pts .
- Select the symbol so that the result of the command to obtain the vector of x -coordinates is not displayed.
A. $.$ B. $,$ C. $;$ D. $?$
E. $!$ F. $:$ G. nothing

- e. Give the command to assign to $yLst$ a row vector of y -coordinates from pts and not to display the result.
- f. Suppose instead of constructing $xLst$ and $yLst$, we wish to read the data from *DanWoodEM.dat*, where each line contains an x and then a y -value. Give the command to read this data and to assign to pts the list of data points.
- g. Give the name of the function to plot these points.
- h. Give the commands to produce a plot similar to that of Figure 8.3.5. Assign the graphics to variable lp .
- i. Give the command to display a line from the first point, (1.309, 2.138), to the last, (1.68, 5.66). Assign the graphics to variable lne .
- j. Give the command between the display of lp from Part h and the display of lne from Part i so that both appear on the same graph.
- k. Give the command after the display of lne from Part i so that these graphs do remain for a subsequent figure.

Solving for y in a One-Term Model

Quick Review Question 4 Suppose $xLst$ and $yLst$ are lists of x and y values, respectively. Give the command in an appropriate software system to assign to pts the list of ordered pairs of corresponding x and y values but not to display the result.

Quick Review Question 5 Give the command in an appropriate software system to generate the plot in Figure 8.3.13, where pts is the list of ordered pairs for the data and the points are larger.

Answers to Quick Review Question

1. The following are linear combinations of u and v :

- A. $5u - 18v = (5)u + (-18)v$
- B. $-18v + 5u = (-18)v + (5)u$
- C. $7u = (7)u + (0)v$
- D. $u/5 + v/3 = (1/5)u + (1/3)v$

2.

- a. `xLst = [0.2, 0.4, 0.3, 0.3];`
- b. `yLst = [0.1, 0.3, 0.3, 0.6];`
- c. `lineCoeffs = polyfit(xLst, yLst, 1)`
- d. `x = 0:0.1:0.6;`
- e. `lineValues = polyval(lineCoeffs, x);`
- f. `plot(x, lineValues);`

3.

- a. `pts(:, 1)`
- b. `E. '`, an apostrophe
- c. `xLst = pts(:, 1)'`
- d. `C. ;`
- e. `yLst = pts(:, 2)';`

- f.** `pts = load('DanWoodEM.dat')`
 - g.** *plot*
 - h.** `lp = plot(xLst, yLst, 'o', 'MarkerSize', 12, ...
 'MarkerFaceColor', 'k')
 xlabel('x')
 ylabel('y')`
 - i.** `lne = plot([1.309, 1.68], [2.138, 5.66]);`
 - j.** `hold on;`
- 4.** `pts = [xLst; yLst]';`
- 5.** `lp = plot(pts(:, 1)', pts(:, 2)', 'o', 'MarkerSize', 12, ...
 'MarkerFaceColor', 'k')`

Alternatively, we can use column vectors for the x - and y - coordinates, as follows:

```
lp = plot(pts(:, 1), pts(:, 2), 'o', 'MarkerSize', 12, ...  
          'MarkerFaceColor', 'k')
```