

## 8.3 Empirical Models

### Maple 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 *Maple* for Module 8.3 on "Empirical Models." Complete all code development in *Maple*.

### 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** Give the command in an appropriate software system to return the equation in  $x$  for the least-squares line that fits the list of points,  $lst$ , and passes through the origin.

### Non-Linear One-Term Model

**Quick Review Question 3** Suppose  $xLst$  and  $yLst$  are lists of  $x$  and  $y$  values, respectively.

- Suppose we wish to assign to  $pts$  the list of ordered pairs of corresponding  $x$  and  $y$  values but not to display the result. Give name of the function to generate a list of ordered pairs with values from  $xLst$  and  $yLst$ .
- Select the symbols that surround the argument(s) of this function.

A. $()$	B. $\{ \}$	C. $[ ]$	D. $< >$
E. $" "$	F. $' '$	G. nothing	
- Select the symbols that surround the pair  $xLst, yLst$  to return a list of the list of  $x$  values followed by the list of  $y$  values.

A. $()$	B. $\{ \}$	C. $[ ]$	D. $< >$
E. $" "$	F. $' '$	G. nothing	
- Select the symbol so that the result of the command to obtain the list of ordered pairs is not displayed.

A. $.$	B. $,$	C. $;$	D. $?$
E. $!$	F. $:$	G. nothing	
- Give the entire command to assign to  $pts$  the list of points with  $x$ -values from  $xLst$  and  $y$ -values from  $yLst$ .
- Suppose instead of constructing a list of ordered pairs from lists  $xLst$  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 command 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 to display *lp* from Part h and *lne* from Part i on the same graph.

### 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. `with(CurveFitting):`  
`LeastSquares(lst, x, curve = a*x);`  
 or  
`CurveFitting[LeastSquares](lst, x, curve = a*x);`
3.
  - a. *Tranpose* in package *ListTools*
  - b. A. `()`
  - c. C. `[]`
  - d. F. `:`
  - e. `pts := ListTools[Transpose]([tlst, rlst]);`
  - f. `pts := readdata("DanWoodEm.dat", 2);`
  - g. *listplot* from package *plots*
  - h. `lp := plots[listplot](pts, labels = [" x ", " y "],  
style = point);`
  - i. `lne := plots[listplot]([[1.309, 2.138], [1.68, 5.66]],  
style = line);`
  - j. `plots[display](lp, lne);`

4. `pts := ListTools[Transpose]([xLst, yLst]);`
5. `plots[listplot](pts, labels = [" x ", " y "], style = point,  
symbolsize = 15);`