Determining coefficients using matrix linear algebra

Purpose: to determine the coefficients of an equation so that we can model experimental data

Source code: matrixalgebra.cpp
Additional file needed: matrix_h
Example input file #1: f.txt
Additional input file #2: m.txt
Example output file: out.xls

The file matrix_h contains an external cpp file that is used to invert the matrix.
The file f.txt contains 10 columns (variables) and 15 rows (cases)
The file m.txt contains the output of the 15 cases.

Instructions:
1) Download the source code, matrix_h, and the two input files to your Desktop. Ensure that the extensions (.cpp) did not change when your computer downloaded them.

1) Compile source code to produce an application called "matalg" using the line command:

g++ matrixalgebra.cpp -lm -o matalg -Wno-deprecated

2) Run the "matalg" application by invoking the following line command:

./matalg 10 15 f.txt m.txt out.xls

The 10 refers to the number of columns and the 15 refers to the number of rows in input file #1 (f.txt in the example).

Output on the terminal screen should look like this:

$ ./matalg 18 10 f.txt m.txt out.xls

R2= 0.856795

3) Output should be an excel file that looks like this:

Coef_1	Coef_2	Coef_3	Coef_4	Coef_5	Coef_6	Coef_7	Coef_8	Coef_9	Coef_10		R2
-0.5	-0.3	1.1	1.0	-2.1	3.1	1.8	4.8	-2.7	-2.9		0.9

Shown are ten coefficients for each of the variables and the R2 of the relationship between actual and predicted outputs. For the data, there is a great fit between the experimental data and the developed model because 90% of the data fits the model.

4) Table 1 and the spreadsheet output file shows how to calculate the predicted output. The relationship for predicted outputs and actual outputs is shown in Figure 1.

Table 1. The equation to predict output using variables and multiplying them by the determined coefficient. The sum of the products is the predicted output for one case.

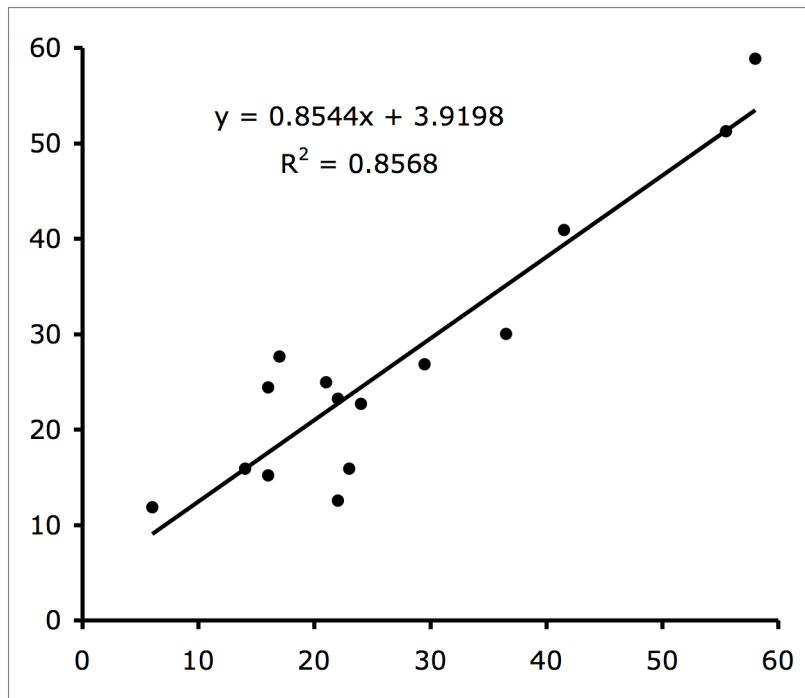| Variables	Determined coefficient	Case	Product
1	-0.493128	value	coef x value
2	-0.252397	value	coef x value
3	1.13833	value	coef x value
4	1.00789	value	coef x value
5	-2.11644	value	coef x value
6	3.13392	value	coef x value
7	1.82245	value	coef x value
8	4.7941	value	coef x value
9	-2.69151	value	coef x value
10	-2.90733	value	coef x value
		Predicted output =>	Sum of Products

$y = 0.8544x + 3.9198$

$R^2 = 0.8568$

Figure 1. Actual output (*y*-axis) versus predicted output (*x*-axis).