**Curve Fitting: A Linear Curve Fit**

We learned how to fit data to a variety of functions using the Trendline chart feature and Microsoft Excel worksheet functions such as SLOPE, LINEST and LOGEST. We also saw how to linearize functions to enable these methods to be applicable. However, certain experiments may need alternative methods.

When we perform a linear least squares fit, we establish which values of *m* and *b* in the equation *y* = *mx* + *b* best fit the experimental data. By "best fit" we mean gives the smallest value to the quantity *~(yi* - *Y'i)2* where *Yi* and *y'i* are the experimental and the predicted values, respectively. Suppose our data was to be fitted to a non-linear function having the parameters *a, band c.* A least squares fit would similarly find which values of parameters minimized the sum of the squares of the difference between the experimental and the predicted values. This sounds very much like something Solver could do. We will test this hypothesis in Exercise 12 by fitting the data in Figure 1021 to a linear function and comparing Solver's results with those obtained with the earlier methods. We will then use Solver to fit the non-linear data in Figure.

A Linear Curve Fit

Our purpose is to compare the results obtained by fitting the data to a linear function using Solver with those from the SLOPE and INTERCEPT functions.

1. Start a worksheet by entering the text shown in the cells of Figure 10.22. Name the cells B2:B3 with the names in column A. Enter the values 1 and 0 in B2 and B3, respectively. These are our starting values for the fit.
2. Enter the x and yvalues in A6:A41 and B6:B41 respectively.
3. The slope intercept formula in C6 used to compute the predicted value is =m\*A6+b. In D6 compute the square of the residual using =(B6-C6)^2. Copy these down to row C41 and D41.
4. In B4 enter =SUM(D6:D41) to compute the sum of the squares of the residuals this quantity is sometimes referred to as SSR.
5. Invoke Solver with B4 as the target cell and B2:B3 as the cells to be changed. Since there is no way that Solver can adjust the slope and intercept to lower the SSR value to less than 1 x 10-5 there is no point in asking Solver to make the target cell zero. Instead, ask Solver it to minimize the target cell.

It is left as an exercise for the reader to use the SLOPE and INTERCEPT (or LINEST) functions to get values to compare with Solver's *m* and *b* values. The comparison is shown in Figure 10.24. While the values are so similar as to be identical for most practical purposes, you may wonder which set of values is better. The data used in this exercise came from the Norris database provided by the National Institute of Science and Technology (NIST) on its web site (http://www.nist.gov).This also provides the certified values for the fit which are shown in Figure 10.24. The work function results are in slightly better agreement with the NIST values.

|  |  |  |
| --- | --- | --- |
|  | Slope  | Intercept  |
| Solver  | 1.00211680038825  | -0.262323072920204  |
| Formulas  | 1.00211681802045  | -0.262323073774041  |
| NIST  | 1.00211681802045  | -0.262323073774029  |

**Figure 10.24**