Assignment 3: Curve Fitting

1. Curve Fitting Part I – Linear Fit – No Uncertainties on the Data

Begin with the ROOT macro that has been uploaded to Scholar called graph\_fitting.C (Linear Curve Fitting Example)

Modify this program to fit the following data using a linear least-squares fitting algorithm. Rather than using a generating function to create the fit data, you can either read the data below in from a file, or initialize the data arrays directly within the ROOT macro. There are no uncertainties on the data points themselves. You should calculate the fit parameters, as well as the uncertainties on the fit parameters.

X Y

1 1.6711

2 2.00994

3 2.26241

4 2.18851

5 2.33006

6 2.42660

7 2.48424

8 2.63729

9 2.77163

10 2.89610

11 2.89083

12 3.08081

13 3.05305

14 3.24079

15 3.36212

2. Curve Fitting Part II – Linear Fit – Uncertainties on the Data

Using the data from part I, assign an uncertainty, Δy, to each data point. Start with having equal uncertainties on each data point. Modify the program from part I to take into account the uncertainties. You should find that the fit parameters will not change in value, but the uncertainties on the fit parameters will now be somewhat larger.

Next, assign non-equal uncertainties. Now, you should find that both the fit parameters and the uncertainties on the fit parameters should change should both change.

1. Curve Fitting Part III – Higher Order Fits

Modify the code that you wrote for part II to fit the data with a second order polynomial. Include uncertainties on the data points, as well.

1. Curve Fitting Part IV – Non-Polynomial Fits

Begin with the ROOT macro that has been uploaded to Scholar called graph\_fitting\_nonlinear.C (Non-linear Curve Fitting Example).

Modify this program to fit the following data:

X Y

.038 0.050

.194 0.127

.425 0.094

.626 0.2122

1.253 0.2729

2.500 0.2665

3.740 0.3317

The fitting function should be of the form:



Determine both A and B, as well as the uncertainties on A and B.

1. Curve Fitting Part V – Non-Polynomial Fit to Atmospheric Data

Go to the following site and retrieve data on the density of air as a function of altitude:

http://www.engineeringtoolbox.com/standard-atmosphere-d\_604.html

Make sure to use the second table, in SI units. Note also that the density is specified in unit of 0.1 kg/m3 so you will need to divide these numbers by 10 to get true SI units.

Modify the program from part IV to fit the density data as a function of altitude using a function of the form:

Determine the parameters A, B, and C, as well as the uncertainties on these parameters.