

Python Tool Box

It will be to everyone's advantage to prepare, if they haven't already done so, a "Tool Box" of Python programs which can be used to solve the set of generic stats problems listed below. Your eight program scripts can be designed to operate on a general set of input data, and provide useful numerical and/or graphical output. You can test each of your programs using an input data set which is located on our Canvas page, in the Python module.

1. Compute the sample mean, the sample variance, the sample standard deviation, and the error in the mean of a set of repeated measurements.

Input: File xSS.dat containing an arbitrary number of numerical values (real or integer) arranged in a single-column format.

2. Compute the weighted mean, and the error in the mean of a set of repeated measurements.

Input: File xWM.dat containing an arbitrary number of numerical values arranged in a 2-column format: (y, σ_y) .

3. Make a transformation between a measured variable and its uncertainty (y, σ_y) to a new variable

$$z = \log(y)$$

and its uncertainty σ_z .

Input: File xLD.dat containing an arbitrary number of numerical values arranged in a 2-column format: (y, σ_y) .

4. Make a linear point plot of a data set showing the uncertainties as error bars.

Input: File xLPD.dat containing an arbitrary number of numerical values arranged in a 3-column format: (x, y, σ_y) .

5. Make a semi-log point plot ($\ln y$ vs x) of a data set showing the uncertainties as error bars.

Input: File xSLPD.dat containing an arbitrary number of numerical values arranged in a 3-column format: (x, y, σ_y) .

6. Make a linear connect-the-points plot of a set of (x, y) values.

Input: File xLPP.dat containing an arbitrary number of numerical values arranged in a 2-column format: (x, y) .

7. Given a set of data with their associated uncertainties, do a linear-regression fit to a function of

the form

$$y = a \times x$$

Make a linear point plot of the data showing the uncertainties as error bars. Overlay the fitted linear function as a smooth line. (Hint: You cannot use results for a function of the form $y = a + b \times x$.)

Input: File xR1P.dat containing an arbitrary number of numerical values arranged in a 3-column format: (x, y, σ_y) .

8. Do a linear-regression fit to a function of the form

$$y = a + b \times x$$

given a set of data with their associated uncertainties. Make a linear point plot of the data showing the uncertainties as error bars. Overlay the fitted linear function as a smooth curve.

Input: File xR2P.dat containing an arbitrary number of numerical values arranged in a 3-column format: (x, y, σ_y) .