

Exercise #1 (assigned 19 September, due 28 September)

Download `exercise1.dat` from the course web page, and use it to answer the following questions. Note: For this exercise, I want you to use equations and write things out and solve for things — don't just use canned computer or calculator routines. Also, please show all your work for all the parts of this assignment.

I have sampled a phenomenon. The data is presented in `exercise1.dat`.

First consider only the first two columns: $(y, \Delta y)$.

Consider only the first three measurements (first three rows). What is the error on the mean? What is the mean of the errors? Now consider only the first ten measurements, and answer the same two questions. What if you consider only the first 50 rows? What if you consider all 100 rows? From these four cases, do the error on the mean and the mean of the error behave as you expected? Why or why not?

Careful: there is a subtlety here about the mean of the errors. What is the sign of the errors, and what does the mean of the error really mean, conceptually?

For the same sample sets (first 3,10,50,100 rows), what are the mean, median, and mode? How did you find these (especially the mode)?

Now consider all the columns: $(y, \Delta y, z, \Delta z)$.

The total error, generally, is the RSS combination of the error on the mean and the mean of the errors. Ideally, one of these would be small, and you could ignore it, but in general you need to include both in your total error calculations.

Let $x = f(y, z) = y + 2z$. For the first (1,3,10,50,100) rows, what is $\bar{x} \pm \overline{\Delta x}$?

Now let $x = f(y, z) = yz^2$. For the same five cases (first 1,3,10,50,100 rows), what is $\bar{x} \pm \overline{\Delta x}$?

Careful: For both of these functions $f(y, z)$ there are a lot of things to keep track of. Make sure you describe clearly what you have done, and why, and show all your work.