

INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

EP219 Data analysis and interpretation

Assignment 4

Dated : 16 - 10 - 2017

Correct the errors for the temperature data in assignment 1 if you have not already done so. (Your error on the average temperature in a given year should reflect the uncertainty in the average temperature for that year. Give an expression for this error.) Now let us try to find various curves that fit the data.

1. **Straight line fit** Assuming $T = my + c$ fits the average temperature (T) vs year (y), find the best fit values of m and c by minimizing χ^2 . Clearly write down your expression for χ^2 . Explain what variables χ^2 is a function of. Find the χ^2 per degree of freedom for your best fit line. Plot your best fit line on top of the error bar plot.
2. **Quadratic fit** Assuming $T = ay^2 + by + c$ fits the average temperature (T) vs year (y), find the best fit values of a, b and c by minimizing χ^2 . Clearly write down your expression for χ^2 . Explain what variables χ^2 is a function of. Find the χ^2 per degree of freedom for your best fit curve. Plot your best fit curve on top of the error bar plot.

Now consider your straight line fit,

1. Sketch contours of χ^2 as a function of m and c .
2. Fixing c to its best-fit value, show the 1-D distribution of χ^2 as a function of m . Repeat this by fixing m to its best-fit value and show the 1-D distribution of χ^2 as a function of c .

Notes: (as before try to follow these guidelines)

- Make sure python 2.7/2.8 is installed. We will prefer this to python 3 for this course.
- Make sure to label all your plots, axes etc. Install latex so that you can use latex symbols in the plot legends.
- Try to experiment with histogram bins, axes range, colors, linestyle, plot markers, displaying multiple plots on the same image, saving plots to pdfs etc.

- Comment your code with detailed comments! Uncommented code will receive no credit.
- Try to follow best programming practices in python. <https://gist.github.com/sloria/7001839>