

Modeling Homework

Homework (25 pts): For the dataset shown on the right calculate the equations for a and b for a straight line fit using Cramer's rule ($y = c_1 + c_2x$). Assume a standard deviation of 1 for each measurement. Show your work. Compare your answer by fitting with a plotting program. Show results. Extra credit (10 pts): write a Python or C++ program that solves this problem.

X	y	σ
2	10.6	1
4	12.1	1
6	14.5	1
8	20.8	1
10	17.3	1
12	24.7	1
14	29.1	1

$$A = \begin{bmatrix} \sum_{i=1}^n \frac{1}{\sigma_i^2} & \sum_{i=1}^n \frac{x_i}{\sigma_i^2} \\ \sum_{i=1}^n \frac{x_i}{\sigma_i^2} & \sum_{i=1}^n \frac{x_i^2}{\sigma_i^2} \end{bmatrix}, \quad X = \begin{bmatrix} c_1 \\ c_2 \end{bmatrix}, \quad \text{and } B = \begin{bmatrix} \sum_{i=1}^n \frac{D_i}{\sigma_i^2} \\ \sum_{i=1}^n \frac{D_i x_i}{\sigma_i^2} \end{bmatrix}$$

$$c_1 = \frac{b_1 a_{22} - b_2 a_{12}}{a_{11} a_{22} - a_{12} a_{21}}, \quad c_2 = \frac{b_2 a_{11} - b_1 a_{21}}{a_{11} a_{22} - a_{12} a_{21}}$$