

Exercise 6: Adjustment Calculation - part I

- Linear adjustment problem -

Group:	Surname, First name:	Matriculation number:	Signature*:
* With my signature I declare that I was involved in the elaboration of this homework.			
Submission until: 15.12.2023			

Objective

This exercise deals with the adjustment of the parameters of a straight line which is represented by four measured points as depicted in Figure 1.

Table 1: Coordinates of the four points

Point	x [m]	y [m]
1	1.0	0.1
2	2.0	1.1
3	3.0	1.8
4	4.0	2.4

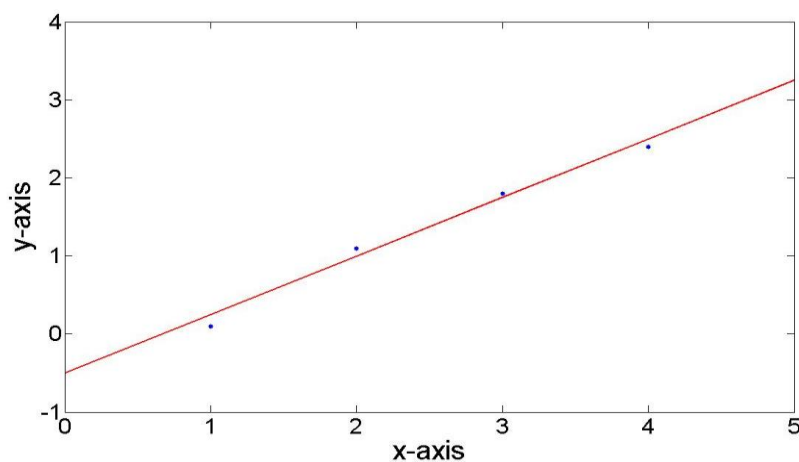


Figure 1: Four given points and adjusted straight line

Task 1:

Table 1 contains the coordinates of four points, where the x -coordinates are error free (fixed values) and the y -coordinates are measurements which are subject to random errors. The objective of this task is the determination of the unknown parameters of the straight line via least-squares adjustment **without** using matrix notation. The measurements are uncorrelated and were obtained with the same standard deviation.

1. Set up an appropriate functional model as well as the observation equations.
2. Set up the stochastic model.
3. Determine the normal equations for the target function $\sum p_i v_i^2 \rightarrow \min$.
4. Solve the normal equation system and determine the unknown parameters of the straight line.
5. Calculate the residuals.

Task 2 (Homework):

Adjust the two parameters of the straight line **without** using matrix notation.

1. The measurements are uncorrelated and were obtained with the standard deviations listed in Table 2.
2. Repeat steps 1 to 5 of Task 1 while this time using the given standard deviations for the measured y -coordinates.

Table 2: Standard deviations for the y -coordinates

Point	σ_{y_i} [cm]
1	2
2	1
3	4
4	2