Technische Universität Berlin

Chair of Geodesy and Adjustment Theory

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Adjustment Calculation I

Winter Term 2016/17

Homework 4: Adjustment Calculation – part II

- Linear and non-linear functional models -

Surname, Given Name:	Matriculation number:	Deadline:
		20.02.2017

Test Certificate

1. Received on: _____ (Date) _____ (Signature)

☐ Approved

☐ Resubmission not later than: _____ (Date) _____ (Signature, Date)

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2. Received on: _____ (Date) _____ (Signature)

☐ Approved

☐ Finally unacknowledged

_____ (Signature, Date)

Objective

This exercise deals with the least-squares adjustment of a levelling and a direction network.

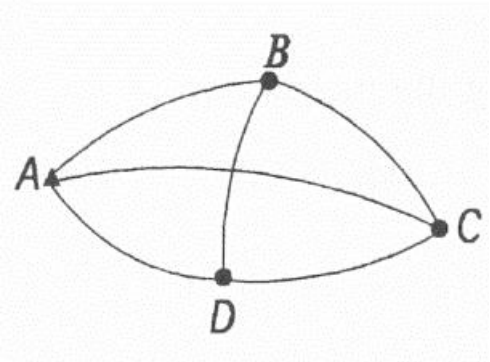

Figure 1: Levelling network

Table 2: Measured height differences and their standard deviations

From	To	Δh_i [m]	$\sigma_{\Delta h_i}$ [mm]
A	B	10.509	6
B	C	5.360	4
C	D	-8.523	5
D	A	-7.348	3
B	D	-3.167	4
A	C	15.881	12

Table 1: Points which are used as benchmarks

Point	Is Benchmark?
A	◯
B	◯
C	◯
D	◯

Task 1:

A levelling network is depicted in Figure 1 and the related measurements as well as their standard deviations are listed in Table 2. The measurements are uncorrelated.

- Perform two different adjustments for the given levelling network
    - 1. Adjustment: Use the first marked point in Table 1 as a benchmark and all others as new points
    - 2. Adjustment: Use the second marked point in Table 1 as a benchmark and all others as new points
- The error free height for each benchmark is derived from your matriculation number
    - e.g. Matr.-No.: 123456
        - 1. Adjustment (number forward): $H_1 = 123.456\ m$
        - 2. Adjustment (number backward): $H_2 = 654.321\ m$
- Set up an appropriate functional model as well as the observation equations
- Set up the stochastic model
- For the final check choose an appropriate value δ and justify your decision
- Solve the normal equation system and determine the heights for the remaining points as well as their standard deviations
- Calculate the residuals and the adjusted observations as well as their standard deviations
- Compare the adjusted unknowns, adjusted observations and residuals as well as their standard deviations of both adjustments. Present all results in one table and comment them.

Task 2:

The observed directions of the triangulation network depicted in Figure 2 are listed in Table 4. The points $1, 2, 4, 5$ and 6 are control points (error free) and their 2D coordinates are given in Table 3. Calculate the adjusted coordinates of point 3 while this time using angles as observations (derived from the observed directions).

- Set up the stochastic model for the derived angles
    - Hint: VCM from VC propagation!
- Set up an appropriate functional model as well as the observation equations
- Choose appropriate values for the break-off conditions ϵ and δ and justify your decision
- Solve the normal equation system and determine the 2D coordinates of point 3 as well as their standard deviations
- Calculate the residuals and the adjusted observations as well as their standard deviations
- Compare and comment the results from task 2 with those from exercise 12.

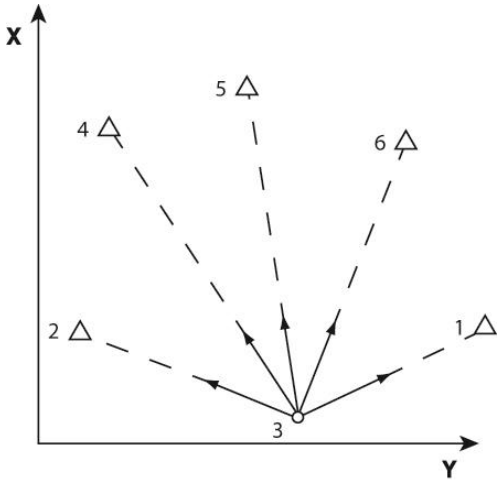

Figure 2: Triangulation network

Table 3: 2D coordinates of control stations

Point	Y [m]	X [m]
1	682.415	321.052
2	203.526	310.527
4	251.992	506.222
5	420.028	522.646
6	594.553	501.494

Table 4: Observed directions

Instrument station	Foresight station	Direction [gon]
3	1	206.9094
	2	46.5027
	4	84.6449
	5	115.5251
	6	155.5891