Technische Universität Berlin

Chair of Geodesy and Adjustment Theory

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Exercise 5: Propagation of observation errors - part III

- Propagation of variances and covariances -

Group:	Surname, First name:	Matriculation number:	Signature*:

* With my signature I declare that I was involved in the elaboration of this homework.

Submission until: **10.12.2023**

Objective

This exercise deals with the propagation of variances of correlated and uncorrelated observations for one or several unknown parameters.

Task 1:

The angles α_1 and α_2 as well as the distances s_1, s_2 and s_3 of the rectangle, depicted in Figure 1, were observed.

- Calculate the distance between point 2 and 4 and its standard deviation.

$$s_1 = 824,62\ m \qquad m_{s_1} = 1,2\ cm$$
$$s_2 = 1026,98\ m \qquad m_{s_2} = 1,9\ cm$$
$$s_3 = 802,00\ m \qquad m_{s_3} = 3,6\ cm$$
$$\alpha_1 = 68,3582\ gon \qquad m_{\alpha_1} = 1,5\ mgon\ (15^{cc})$$
$$\alpha_2 = 52,9212\ gon \qquad m_{\alpha_2} = 4,1\ mgon\ (41^{cc})$$

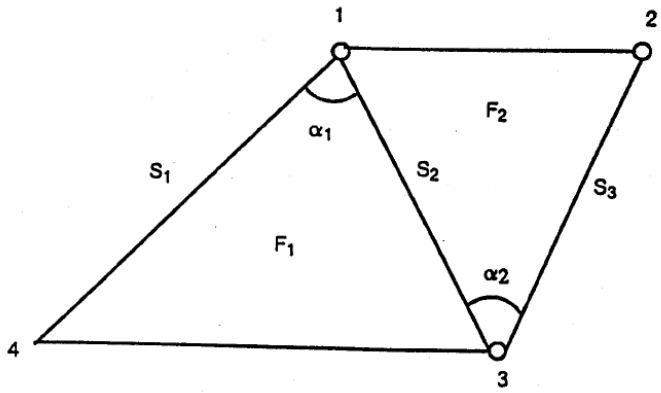

Figure 1: Observed rectangle

Task 2 (Homework):

A car is moving on a straight line in two dimensions (2D) with a constant velocity. The following quantities were observed in two individual positions, as depicted in Figure 2, with the accompanied standard deviations:

- azimuth angles $a_1 = 35.1550$ gon and $\alpha_2 = 55.1200$ gon, with $\sigma_\alpha = 0.001$ gon
- distances $s_1 = 20.005$ m and $s_2 = 30.001$ m, with $\sigma_s = 1$ mm
- time $t_1 = 9.7$ s and $t_2 = 23.1$ s, with $\sigma_t = 0.1$ s

Your tasks are:

- Estimate the velocity of the object v, as well as the standard deviation σ_v. Explain clearly all the steps you needed for the results.
- Estimate the position of the object (coordinates y_3 and x_3 in 2D) at the time $t_3 = 30$ s as well as the standard deviations σ_{y_3} and σ_{x_3}.

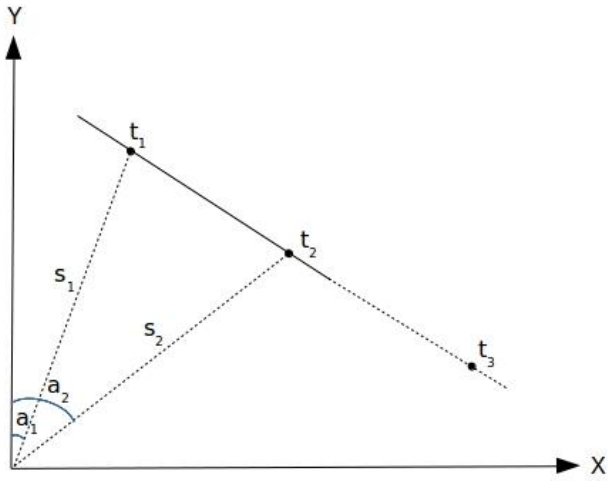

Figure 2: Movement of a car in 2D