521 M7410 –Adjustment and Analysis of Spatial Information

Spring Semester 2025

Homework No. 1

handed out Thursday, September 18, 2025
due Thursday, September 25, 2025, 14:20 **Name:** _____

Review of Statistical Concepts & Linear Algebra

1. Write a Matlab code that generates 30 random points $\{x_i, y_i, z_i\}$ (i=1~30) with mean coordinates (M_x, M_y, M_z)=(200.00, 100.00, 500.00) and standard deviations (σ_x, σ_y, σ_z)=(± 0.2, ±0.3, ±0.1).

   a. Plot these values in a 3-D figure.
   b. Compute their mean and standard deviation values.
   c. Mark the range of 1xσ (stddev) in the same figure as in 1a.
   d. Repeat 1a & 1b, but now with 3000, 30000, 300000 and 3000000 random values. Plot their mean values and standard deviations as functions of sample sizes.

2. Prove that the rotation matrix given in the Photogrammetry text book (Mikhail et al., 2001, p.91, Eq. 4-18b) is an orthogonal matrix.

3. Please simulate a level network with more than 10 points. Plot the configuration of this network on a figure and denote the elevation of each point. Next, compute the elevation differences between them. Finally, add $\pm 7\,mm/\sqrt{km}$ random errors to these elevation differences. List the results in a table with 5 columns (BS_Pt, FS_Pt, elevation difference (True), elevation difference (with error), true error). Save the results to an ASCII file with sufficient significant digits.

Your (individual) final report should contain (use A4 papers):

- this page as the cover sheet
- source code(s) and outputs; do not forget to add your name and lots of comment cards to the source listing (% .....)
- input and output files from program [input/output values used and calculated], if any
- plots, including captions on axes, title, your name, LB#/HM#, course title, date (if any)
- derivation and description of formulas used, accompanied by figures where applicable
- evidence of computational accuracy
- discussion of results