# 521 M7410 –Adjustment and Analysis of Spatial Information

# Fall Semester 2015

# Homework No. 4

handed out Thursday, October 15, 2015
due Thursday, October 29, 2015, 09:10 **Name:** _____

## Covariance Propagations

1. Given: $\boldsymbol{y} = \boldsymbol{x}_1^3 - 3\boldsymbol{x}_1\boldsymbol{x}_2 + 3\boldsymbol{x}_2^2 - 11$, $\boldsymbol{z}_1 = 3\boldsymbol{y} + \boldsymbol{y}^{-2} + 1$, $\boldsymbol{z}_2 = 3\boldsymbol{x}_1 - 2\boldsymbol{y}$, $\boldsymbol{x}_1 = \boldsymbol{x}_2 = 1$, and $\Sigma_{xx} = \begin{bmatrix} 16 & 1 \\ 1 & 4 \end{bmatrix}$.
   Ask: $\sigma_{yx_1}$, $\sigma_{yz_1}$, and $\sigma_{yz_2}$.

2. Given $\Sigma_{xx} = \begin{bmatrix} 9 & -3 \\ -3 & 16 \end{bmatrix}$:
   1) If $\boldsymbol{s} = \boldsymbol{x}_1 + 2\boldsymbol{x}_2$, find $\sigma_{\boldsymbol{s}}^2$.
   2) If you write $\boldsymbol{s} = \boldsymbol{x}_1 + \boldsymbol{x}_2 + \boldsymbol{x}_2$, find $\sigma_{\boldsymbol{s}}^2$.
   3) Justify the difference (if any) between the answers you obtained from 1) and 2).

3. Given: $y = ax_1 + bx_2 + 5$, $3a - b = 3$, $a$ and $b$ are errorless, $\sigma_{x_1} = \pm 0.8$ cm, and $\sigma_{x_2} = \pm 1.5$ cm. Find the values for $a$ and $b$ such that the uncertainty of $y$ is minimized.

**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