

AS-74.4191 Multivariate Regression Methods
Examination January 10, 2007 / HH

Please indicate whether you have returned the Homework Exercise, and which one of the questions below you want to substitute with it.

You can answer in Finnish or in English.

1. Discuss the difference between *information* and *noise*. Explain why the assumption *covariance carries information* often holds. How is this principle utilized in multivariate modeling?
2. Sketch in x_1/x_2 space the outlook of a Gaussian data distribution when the covariance matrix looks like:

a. $\begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$ b. $\begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$ c. $\begin{pmatrix} 1 & 0.5 \\ 0.5 & 1 \end{pmatrix}$ d. $\begin{pmatrix} 10 & 0 \\ 0 & 0 \end{pmatrix}$.

3. Assume that the output data equals the input data, so that $Y = X$. Compare the eigenvalue problems and the resulting latent basis vectors given by PCR, PLS, and CCR methods (as presented during the course).
4. The system being studied looks like

$$\begin{cases} x(k+1) = \begin{pmatrix} 0.5 & 0 \\ 0 & 0.25 \end{pmatrix} \cdot x(k) + \begin{pmatrix} 1 \\ 0 \end{pmatrix} \cdot u(k) \\ y(k) = (1 \ 0) \cdot x(k). \end{cases}$$

Show that the system realization is *balanced*. Apply appropriate model reduction.

5. What kind of system structure is assumed in *stochastic subspace identification*. When can such a structure be applied? Explain the steps that are needed in SSI.