

*Modelling*

**Ti 5416500 Statistical Analysis of Models, Examination.**

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Note to the students: The answers may be written using either English or Finnish Language. Any books (except dictionaries), lecture notes, calculators, etc. are prohibited.

1. Characterize the concepts a) statistical/empirical modelling b) mathematical/mechanistic modelling. When should each modelling approach be used?
2. Define the concepts a) variance b) covariance c) correlation coefficient
3. Give the basic aims and methods of design of experiments.
4. How can you generate random samples from a centered Gaussian distribution with the covariance matrix  $C$  ? How can you verify that, approximatively, a correct amount of the sampled points are located inside the confidence regions given by the 95% and 99% limits ?
5. The parameter  $\theta = (\theta_1, \theta_2)$  of the model  $y = \theta_1(1 - e^{-\theta_2 x})$  is estimated by measured data  $(x_i, y_i)$ ,  $i = 1, \dots, n$ . Give a MCMC procedure by which you can determine a) the distribution of  $\theta$  b) the value of  $x$  at which the response  $y$  reaches 95 % of its maximum value with 95 % certainty?