Course 02418: Statistical modelling: Theory and practice

Course Material: Bingham and Fry: Regression. Linear Models in Statistics. Springer.

The course consists of weekly session of 4 hours for 13 weeks. Lectures are given for 2 hours followed by 2 hours hands-on exercises. 2 mandatory cases are given during the course. Evaluation based on cases and oral exam. The table below outlines the course contents

Week	**Topic**	**Responsible**
1	Introduction: Introductory examples, application, types of outcomes, types of covariates, introduction to building regression models, linear regression and ANOVA, the statistical software R	KKA Chap 1 + 2 (additional R material)
2	Multiple regression, the linear predictor. Sum of squares decomposition, analysis of variation, conditioning and regression	KKA Chap 3+4
3	Estimation, hypothesis testing , model checking and transformation.	LEC Chap 6 +7
4	Models with one covariate: simple linear regression. Interpretation of effects for categorical and quantitative covariates. Analysis of covariance	KKA Chap 5
5	Case I: Multiple regression: model building and interpretation using R.	PBB, MK, LEC, GG, HM, KKA
6	Stochastic simulation and re-sampling based statistical analysis: Simple Simulation, Bootstrap methods, MCMC methods	GG
7	Maximum likelihood estimation. Approximate uncertainty via likelihood methods, error propagation, delta rules. Likelihood based hypothesis testing and confidence intervals.	LEC
8	Theory of the General Linear models. Decomposition of R^n via linear sub spaces – relation to models/hypothesis testing. Relation between likelihood ratio based testing and F testing	PBB
9	Introduction to Bayes statistics. The Bayesian framework. Bayesian inference, .Bayesian prediction. Flat priors, improper priors and noninformative priors	GG
10	Genereal linear modelling and introduction to Design of Experiments (DOE). The principles of randomization, blocking and randomization. Determination of statistical	MK

	power. Introduction to fractional factorial designs	Chap 9
11	Case II: Model building: from purpose to conclusion.	PBB, MK, LEC, GG, HM, KKA
12	Introduction to Time Series Analysis. Describing and modelling autocorrelation. Developing regression based models for forcasting.	MK Chap 9
13	Introduction to analysis of survival time outcome. The Kaplan Meier curve, logrank test and introduction to Cox Proportional Hazards regression. Survival analysis using R.	KKA