



# Kursplan

för kurs på forskarnivå

**Statistics 2.5: Bayesian Multi-level Modelling the Rethinking Way**  
**Statistics 2.5: Bayesian Multi-level Modelling the Rethinking Way**

**3.0 Högskolepoäng**  
**3.0 ECTS credits**

**Kurskod:** PS3ST25  
**Gäller från:** VT 2023  
**Institution** Psykologiska institutionen

## Förkunskapskrav och andra villkor för tillträde till kursen

The course assumes prior knowledge corresponding to Stat2, that is, McElreath's book Chs. 1-12. But even if you have not taken Stat2, it is possible to join after obtaining basic understanding of the R library rethinking and in particular the function `ulam()`. There will also be an introductory seminar reviewing the fundamentals of Stat2 needed to follow Stat2.5 .

## Lärandemål

- Understanding of the main ideas of Bayesian multilevel modeling (BMLM) and its strengths and weaknesses in relation to conventional approaches to data analysis.
- The easy way: Skills to conduct BMLM using the standardized method implemented in the R package `rstanarm`, function `stan_glmer()`.
- The middle way: Skills to conduct BMLM using the method implemented in the R-package `rethinking`, function `ulam()`.
- The hard way: Skills implementing BMLM in Stan code, using the R-package `rstan`

## Innehåll

This course (Stat2.5) is a follow up course to Statistics 2 (Stat2). Stat2 follows Richard McElreath's book "Statistical Rethinking" (2020, 2nd ed.) up to but not including the last chapters on Bayesian multilevel modeling (BMLM). In this course, we will work through some of the examples of BMLM in chapters 13 and 14, using the function `ulam()` of the `rethinking` package. In addition, we will work through some examples from other sources, including (a) a simpler way of doing BMLM, using the R-package `rstanarm`, function `stan_glmer()`, and (b) a more complicated, and more general, way involving Stan code and the R-package `rstan`.

## Course content

- Key concepts: No, partial and complete pooling, shrinkage, random intercepts, random slopes.
- Simulating hierarchical data from specified data generating model.
- BMLM the easy way: R-package `rstanarm`, function `stan_glmer()`
- BMLM the middle way: R-package `rethinking`, function `ulam()`.
- BMLM the hard way: Stan coding implemented using R-package `rstan`.
- R programming

## Examinationsformer

The course is graded Pass or Fail. Pass requires passing both of the two examination parts described below.  
1. Solving a set of exercises, some from McElreath (2020) that were not discussed during class. Selected exercises will be handed out at the start of the course. Solutions should be delivered no later than 2 months after the last seminar. If revision is needed, the revision should be

delivered no later than 3 months after the last seminar.

2. A report of analyses of data of the students own choice (real or simulated data). The analyses should follow some of the analytic approaches to multi-level modelling discussed in the course. The student will present an outline of the planned analyses at the last seminar, and should submit a report no later than 2 months after the last seminar. If revision is needed, the revision should be delivered no later than 3 months after the last seminar.

### **Arbetsform**

A series of 5 full-day seminars. The seminars will cover theoretical discussions of topics covered by sections of the literature, followed by discussions on student solutions to exercises including analysis of specific data sets. Much of the seminar discussions will concern how to address problems and illustrate phenomena using R. It is therefore a good idea to bring a laptop with R and R-studio installed to each seminar.